

Journal of
Industrial Engineering

March 1959



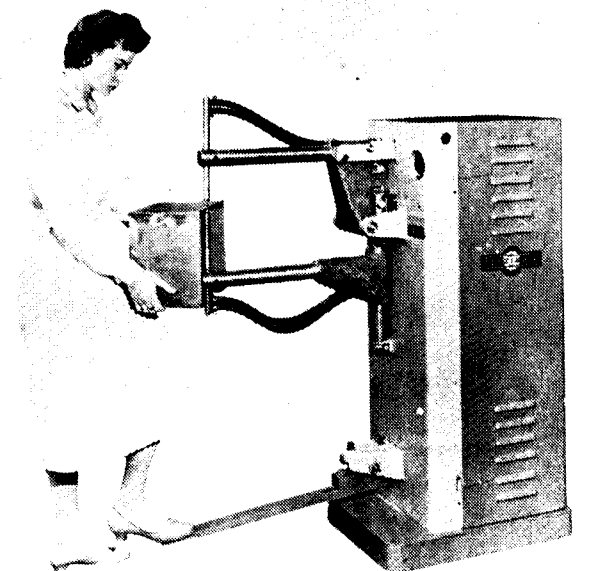
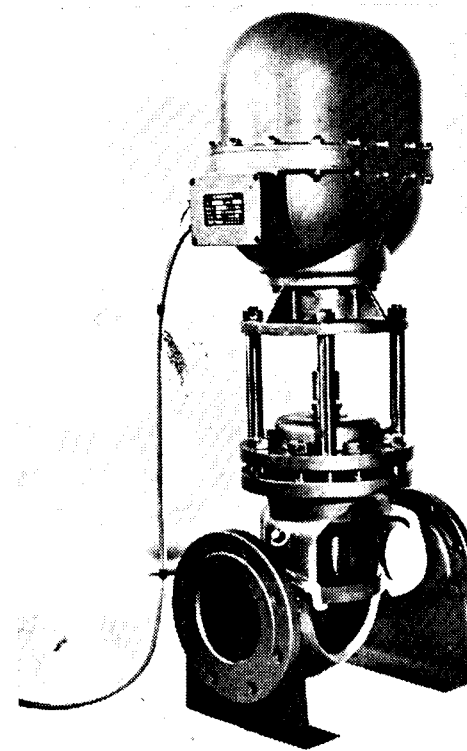
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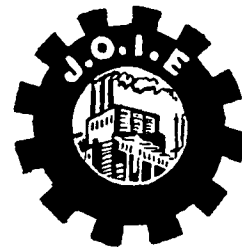
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TRACTORS FOR INDIA — JAPAN SIGNS AGREEMENT

A loan agreement was signed in Tokyo on 30-3-59 between the Indian Embassy and the Japanese Export-Import Bank under which the latter will make available approximately 374 million yen (nearly Rs. 49 lakhs) out of the Japanese credit granted for India to the Komatsu Manufacturing Company for the supply of a sizable quantity of earth moving equipment to the Indian Rehabilitation Ministry.

India will be paying for the equipment, consisting of 54 tractors, of two different types and two motor graders out of last year's 50 million dollars worth of yen credit.

EDITORIAL NOTICE

Technical Contributions

Technical contributions are invited from Works Managers, Production Engineers, Technical & Industrial Consultants on all subjects of interest to Industrialists & Manufacturing Organisations.

Articles should be elaborate supported by illustrations, wherever available, and should be of a high order. Only original photograph prints should be sent and drawings should be on drawing paper or cloth in India ink. Ferroprints are not accepted.

Summary of technical papers read before professional Institutions or at meetings of Engineers are also accepted if they are of sufficient interest to the Industrial Engineers.

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Manuscripts should be typewritten, double spaced, on one side of the paper only with sufficient margin on either side, with the sheets numbered in order. The name of the author and his full address should appear on the first sheet of the writeup.

Unused manuscripts will not be returned unless return postage is paid. Accepted manuscripts are not returned and all photos, illustrations, drawings etc., will be retained by the Editor after publication unless there be special reasons or request for their return to the author.

Manufacturers of plants and equipments can send in writeups from their Technical Staff or Chief Engineer about any new technical features, developments, research notes and news having a bearing on their manufactures and which would be of sufficient interest to the Industries.

The Managing Editor reserves the right to delete, amend, or add any paragraph/paragraphs to the contributions.

Accepted original contributions would be paid for at our rates, if desired.

March 1959

JOURNAL OF INDUSTRIAL ENGINEERING

7

Metal Spraying

WASTE in any form is one of the bug-bears of industry and this is particularly to be avoided to-day in view of the most serious difficulty with which the engineering industries are faced owing to the paucity of raw materials.

Thousands of tons of steel in the shape of component parts like crankshafts, engine cylinders, cylinder liners, piston rods, bearings, rollers, spindles, etc., are making their way into the local junk heap because they are worn.

Steel constitutes the indispensable raw material for almost every one of the engineering industries. The foreign exchange shortage has resulted in the slashing of import of steel to the point where it threatens to defeat the very purpose of development.

In this context, it has become vitally necessary to conserve steel in all possible ways. In this sphere, metal spraying, the process under review, along with other two processes of "putting-on", viz. electro-deposition and welding, plays an enormous part. In fact, all the three methods, developed during the past 35 years or so, are now firmly established in workshop practice, and each has certain advantages and disadvantages in comparison with others.

Metal spraying, which has been widely known and used in America, Europe and England for many years, has now become a tool of such limitless application that it is the standard equipment in every type of workshop and plant in those countries.

To understand what the metal spraying or metallizing, as it is often called, is, it may be stated that by this process any metallic and non-metallic surfaces can be coated with practically any metal and alloy, and mixtures of metals and non-metals.

Metal spraying in itself, which is virtually a cold process as far as the work being treated is concerned, consists of depositing infinitesimally small particles of a suitable material on a worn surface by means of a fine metallic spray with the help of a metal spraying gun specially designed for the purpose. The coating material is melted by fuel gas and a stream of compressed air, atomizes the molten metal, and carries the particles at a high velocity in the form of a fine mist from the nozzle on to the part being sprayed. The force of impact is so great that the particles actually flatten out in the form of tiny flakes as they strike the surface.

In the early stages of development of the process, hard surfaces could not conveniently be treated because of the difficulty experienced in cutting grooves in them for the minute particles to be keyed into position. This difficulty was overcome with the help of shot blasting by means of sharp steel grit. Later on, a method of pitting in the surface by sparking from an electrode carrying a high amperage current was introduced. Small craters with overhanging edges were thus produced and these edges served to provide the required anchorage for the sprayed metal.

During the last few years the scope of the metal spraying has been broadened considerably by the adoption of a spraying material containing a high percentage of molybdenum, a characteristic of which is its ability to bond on smooth clean steel and other metals as well as the pronounced affinity of the sprayed particles for the freshly exposed surface of steel on which oxidation has proceeded to a depth of only molecular dimensions. An additional property of molybdenum which is, no doubt, important in the bonding mechanism, is its high melting point. The sprayed particles impart sufficient heat to raise the surface temperature to the melting point. Fusion between the base metal and the deposited particles takes place to a certain extent, and the deposit may be built up to any desired thickness, to provide a hard surface with good wearing properties.

Since the introduction of this material for applying a bonding layer, metal spraying has been adopted by many manufacturers and plant engineers for repairing worn machine components of an extremely wide variety. In many cases, where a thickness of only a few thousandths of an inch is required, this material is used alone, but for heavier coatings it is usually more economical to apply 0.0015 to 0.002 in. of molybdenum alloy with additional built-up with a second metallizing material, selected in accordance with the desired properties of the finished product.

The different ways in which metal spraying serves the industry to-day are: reclamation of worn parts, machine maintenance, corrosion prevention, filling cracks and cavities in castings which are not so located or of such dimensions as seriously to affect the strength of the parts, and rectification of machine shop errors.

Engine crankshafts are regularly built-up when worn excessively, as an alternative to grinding and fitting thicker bearing shells. From the cost point of view, it has been observed that in case of large crankshafts for say, tractors, the cost of metallizing is to the tune of only a fourth of the replacement parts.

Among the unsung heroes in any plant are the maintenance men to whom are delegated the many inglorious tasks that keep the wheels running. They have been made more difficult owing to rigid import restrictions. Metallising can advantageously be employed in reclaiming worn machine components, shafts, axles, spindles etc.

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The value of the process as a dependable answer to corrosion problems has been demonstrated in a wide diversity of application like ship's hulls, sewage pump shells, storage tanks, structures exposed to the atmosphere, etc.

When a part is made from an expensive material and numerous manufacturing operations have been performed, it is obviously most undesirable that it should be scrapped if, by chance, at the time of final machining it is machined a fraction smaller than what it should be, specially in cases where its rectification is possible without detriment to the subsequent performance in service, by means of metal spraying.

In the electrical industries, in connection with which this supplement is being issued, metal spraying is bursting with immense possibilities. Expensive parts like armature shafts, turbine elements, fan shaft bearing surface, generator and motor shafts, motor housing, etc., subjected to mechanical wear, can readily be restored or built up to their original sizes with metal spraying.

To take advantage of its corrosion proofing quality, the underground conduit may be coated with zinc in preference to painting. Thousands of tons of steel is used up to-day for the fabrication of transmission towers all over India. Most of these are galvanised after fabrication and galvanising only gives 0.002 to 0.003 in. coating of zinc which is not enough to ensure a long term protection to the basic metal. With metallizing there is no limit to the coating thickness that can be put on, and therefore no practical limit to the corrosion protection that can be given to a part. Other electrical plants and fittings like transformer, outdoor capacitors, etc. frequently used under corrosive conditions may also be afforded similar protection by means of metal spraying.

The many unique advantages of the metal spraying have made it the obvious choice for a wide range of applications in the industrial field and it is in the fitness of things that the Indian engineers should take advantage of this method wherever appreciable scrap losses of costly components are at present being experienced. By doing so they will prove to themselves that they are at least doing the best by themselves and for the industries employing them.

Continuous Casting Plant for Steel

On 19th April, 1958, the second SCHLOEMANN vertical continuous casting plant, designed after the Rossi-Concast system, was put into operation at Paderwerk, Gebr. Benteler, Schloß Neuhaus/Paderborn, Germany. This one-strand plant, laid out for a monthly output of 5,000 m. tons, is fed by an 17 m. ton tilting ladle to produce billets 4½ in. to 6½ in. square, and later on also 11½ in. to 2½ in. The billets are cut to lengths between 10 and 20 ft. and serve for the manufacture of precision seamless steel tubes.

Messrs. Paderwerk, Gebr. Benteler, intend to restrict the production of chilled castings to a minimum, and to produce in the continuous casting plant all initial material for the making of steel tubes.

A High Efficiency Water Tube Boiler

From our Technical Correspondent

AMONG visitors to this year's Engineering, Marine, Welding and Nuclear Energy Exhibition (to be held at Olympia, London — April 16-30) will be those interested in high efficiency steam raising equipment. Many, no doubt, will be contemplating modification or even replacement of existing boiler plant in view of the continuing rise in cost of all types of fuel.

Common requirements for any new schemes will not only be high efficiency, which is paramount, but also such considerations as ease of erection in a restricted space, minimum transport problems to the site, inexpensive maintenance and — in Great Britain — conformation with the Clean Air Act.

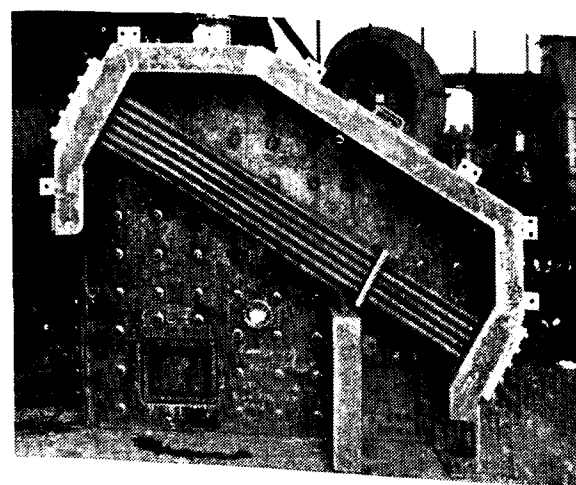
A unit which meets most modern requirements is the "Fraser"*(1) water tube boiler, which is a very high thermal efficiency type yet possesses the necessary virtue of easy site assembly in confined spaces. There is a considerable overseas demand for these boilers notably in New Zealand, Australia, India, Kenya, South Africa, the West Indies, Spain, the Belgian Congo and also China. A number of them are in operation at such South African mines as Western Reefs, New Consolidated Goldfields, Vogelstruibult Gold Mining Areas and Van Dyke Consolidated.

Although efficiency and ease of installation are of prime importance, other factors which contribute to the success of this boiler are its flexibility of output, quick steam raising capabilities ($\frac{1}{2}$ hour from cold state) easy cleaning due to a readily accessible combustion chamber, radiated heat from a refractory lined chamber which makes for rapid disintegration of fuel after stoking, a definite one way water circulation, a large steam disengaging area which gives a high steam dryness factor, straight water tubes of uniform diameter which are easily cleaned internally, altogether forming a design which eliminates seam and joint leakages resulting from expansion and contraction.

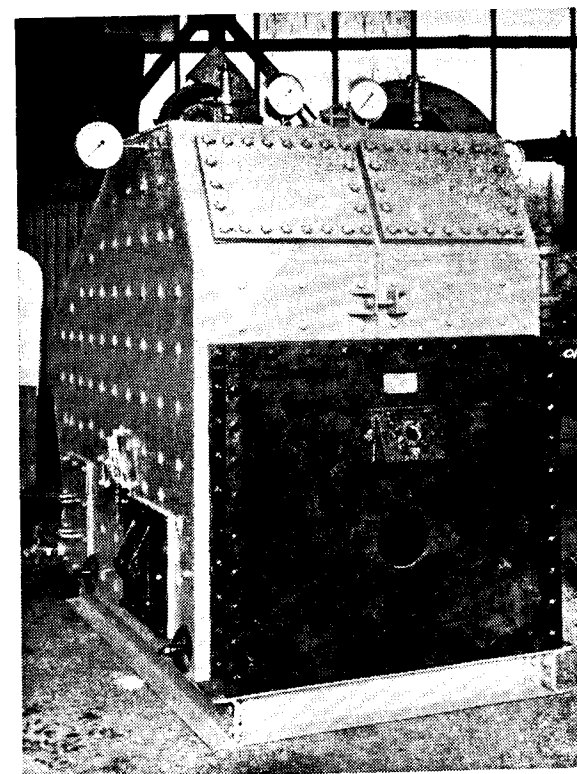
In construction the boiler consists of four separate units, namely a large combustion chamber, a tube bundle, two headers and a steam drum. The combustion chamber is of large volume and is lined with refractory brick. A steel casing surrounds the combus-

tion chamber and supports the pressure vessels. A tube bundle — a series of straight tubes terminating at each end in a header — is set directly above the combustion chamber at a steep angle, thus promoting an accelerated circulation as the water is heated and the steam bubbles rise. The headers, in which the tube bundle terminates are connected to a steam and water drum of ample capacity for the liberation of dry steam. Return water, together with any make-up water recirculates through pipes to the lower of the two headers and the tube bundle.

The wide range of duties which this type of boiler is able to perform is reflected in the figures for steam capacities of up to 15,000 pounds per hour and pressures of up to 750 pounds per square inch on the smaller capacity sizes. Impurities in raw water feed now present little difficulty in the small bore tubes which contribute to the high efficiency of the plant. Where for example, a water softening plant is not justified on grounds of expense, a special dual circulation boiler can be used which ensures that raw water is pre-heated, with consequent deposition of the chemical impurities, in a special set of tubes sited under the main tubes. This means that whilst the main tubes are sited in the hottest part of the combustion chamber, the secondary tubes utilise surplus heat to reduce impurities from say 30-40 concentrations in the raw feed down to some 2-3 concentrations in the main tubes.



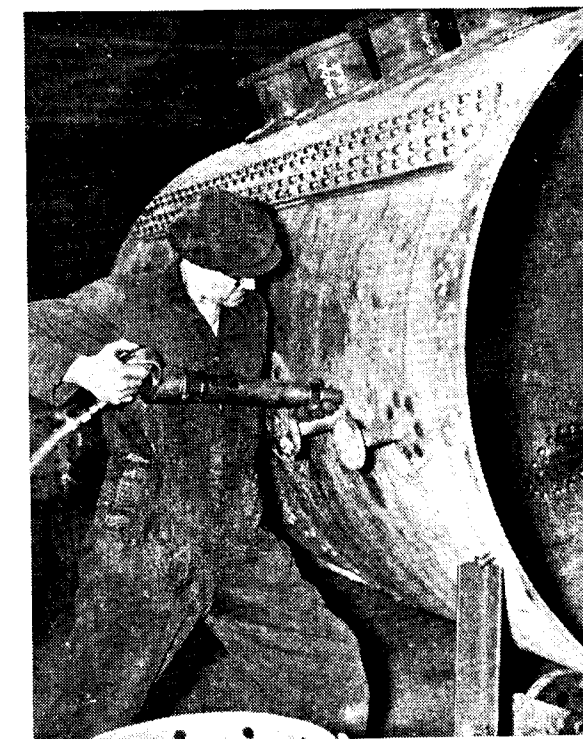
Cross-section through a Fraser Radiant Heat Water-tube Boiler.



Front view of a Fraser Radiant Heat Water-tube Boiler.

This dual system is achieved by dividing the steam and water drum into two compartments by a high baffle running along its length and forming a front and rear compartment. The front compartment is kept full to a point a little below the level of a weir in the baffle with raw feed water of the primary circuit. This water is led out of the front compartment, through the rear compartment by means of pipes, and down through two external bend tubes to the lower of the two headers and the lower tube bundle containing the large diameter tubes. From here it rises again, via the lower of two upper headers and is returned to the front compartment again to complete its circuit. The back compartment receives its feed from the condensed steam of the first circuit, which falls over the weir after being condensed by the raw water feed spray in the upper part of the steam and water drum. This feed for the secondary circuit, by virtue of being partially distilled, contains few impurities of the kind due to temporary hardness and is led out of the rear compartment to the upper tube bundle containing the small bore tubes, the steam and water being returned to the rear compartment.

As the water level in the rear compartment is maintained at a lower level than that of the front compartment, an almost continuous 'blow down' of condensed



Rivetting the steam drum of a Fraser and Fraser water tube boiler with a Consolidated Pneumatic Boyer rivetter.

steam takes place from one level to the other, accentuated at times of demand. When a demand for steam is made, the corresponding water demand is met by the rear compartment and as the water level here falls, a pump operates at increased rating until the water level has been restored.

Attention to efficient descaling of the tube bundles is important if full boiler efficiency is to be maintained. A scale thickness of $\frac{1}{8}$ inch in the tube means an increase in fuel costs of 12%, whilst even a $\frac{1}{32}$ inch thickness means a fuel bill rise of some 5%. The amount of descaling required for the primary tubes will, of course, depend largely on the type of impurities in the feed. Magnesium salts deposit a soft scale which is easily removed by washing unless overheating has taken place, when the scale becomes substantially more dense and must be removed by chipping as is the case with such deposits as those of calcium sulphate.

Special equipment is, however, available to deal with deposits and recently the *Consolidated Pneumatic Tool Company* *(2) have announced the formation of a new division to cater for the manufacture of Lagonda tube cleaning equipment. This equipment forms part of a logical sequence of compressed air tools such as riveters, impact wrenches, tube expanders, drills,

chipping caulking and scaling hammers used in the construction of water tube boilers. Their use contributes substantially to speed of site erection in the most confined spaces, whilst in overhaul and repair work, the choice available to boilermakers of precisely the right tool for a particular task, from a range of several hundred, means that boiler down time and consequent costs involved are reduced to a minimum.

At Olympia, Fraser & Fraser Ltd., will be showing their Fraser Patent Radiant Heat Water-tube Boiler, which is of the mild steel welded sectional type and can be made either for hot water, or fitted with a drum for steam. This boiler completely water-jacketed, with

a large water-walled furnace, which ensures perfect combustion of solid or liquid fuelled, making full use of radiant heat. Rapid circulation and freedom from scale (with correspondingly high heat transfer rates) are achieved by means of straight water tubes, set at a steep angle. The rear wall of the furnace consists of a water-cooled baffle with riser tubes, which provide gas passes that make full use of convected heat transfer from low temperature gases enabling an efficiency of 80% to be attained.

* Denotes an exhibitor at the Engineering, Marine, Welding and Nuclear Energy Exhibition, Olympia, London — April 16-30, 1959.

New Alloy cuts Manganese costs for Stainless Steel

Substantial savings, depending upon practice, in the production of high-manganese stainless steels are now made possible by using ferromanganese-silicon, a new alloy now available from the Alloys and Metals Department, Union Carbide International Company, Division of Union Carbide Corporation. The alloy also allows cost savings in making manganese additions to chromium-nickel stainless steels.

Ferromanganese-silicon is used both as a slag reducing agent and a source of low-carbon manganese. The cost of manganese in the alloy is considerably less than any other source of low-carbon manganese currently available. Many melters are using ferromanganese-silicon for slag reduction in place of ferrochrome-silicon, particularly in the production of 200-series stainless steel where substantial cost savings are made in meeting high-manganese specifications.

Melt shop tests show that one pound (0.45 kg.) of silicon in the new alloy reduces oxidized metals in the slag just as effectively as one pound (0.45 kg.) of silicon in ferrochrome-silicon. Although dependent upon slag conditions, high manganese recoveries can be obtained from using ferromanganese-silicon. In many large-scale commercial practices, manganese recoveries have approximated chromium recoveries obtained from a ferrochrome-silicon practice.

Ferromanganese-silicon is specially suited for use where a high manganese-to-steel ratio is desired throughout the finishing period of a type 300 stainless steel heat. Many melters believe that the high manganese-to-silicon ratio gives cleaner steel. Savings in costs are obtained in such a practice by using ferromanganese-silicon for straight alloy additions or for partial replacement of ferrochrome-silicon.

The analysis of ferromanganese-silicon is 63 to 66

per cent manganese, 28 to 32 per cent silicon, 0.10 per cent maximum carbon, 0.05 per cent maximum phosphorus, and 0.03 per cent maximum sulphur. It is available in sizes of 75 lb. by 2 in., 50 lb. by 1 1/4 in., and 3 in. by down.

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NEW SHELL AND TUBE HEAT EXCHANGERS AVAILABLE FROM "UNION CARBIDE"

Expansion of its line of Karbate brand impervious graphite shell and tube heat exchangers has been announced by Union Carbide International Company, Division of Union Carbide Corporation. Three new sizes, with 8-, 42-, and 45-inch (20.3, 106.7 and 114.3 cm.) diameter shells, bring to 16 the total of standard heat transfer units available for corrosive service.

Sizes range from 6-inch diameter to 45 inches (15.2 to 114.3 cm.), containing from 9 to 685 7/8-inch (22.23 mm) ID impervious graphite tubes. Standard tube lengths are 6, 9, 12, 14, and 16 feet (1.83, 2.74, 3.66, 4.27 and 4.88 m.). A total of 77 separate combinations of tube bundle diameter and tube length covers a range of from 17.7 to 3,585 square feet (1.64 to 332 m.²) of heat transfer surface on the outside of the tubes.

Karbate brand impervious graphite equipment is completely corrosion resistant, immune to thermal shock, free from metallic contamination, and has high thermal conductivity.

For further information, write for catalog section S-6800 to Carbon Specialties Department, Union Carbide International Company, 30 East 42nd Street, New York 17, New York, U. S. A.

Attention to detail vital in ventilating Atomic Laboratories

WHEN future historians analyze the atomic age, it is safe to predict they will credit its rapid maturity to the ingenuity of the so-called "safety engineers" as well as to the discoveries of the physicists.

For without the imagination and skill of those concentrating on precautionary measures, the scientist would have little opportunity to work in radioactive areas.

Consider just a few of the safety devices born in atomic energy laboratories:

New materials and entirely different types of construction have been developed. Highly sensitive testing instruments to detect the slightest trace of contamination have been invented. The most elaborate forms of protective clothing have been fashioned.

But over and above all such measures there has been the never-ending problem of keeping the scientists and their staffs from breathing even the most minute radioactive particles. This has called for new techniques and skills in air conditioning and ventilation.

Just how is an air conditioning system set up to avoid an accumulation of radioactive particles in the nooks and corners of the lab or, much worse, in the air?

According to engineers at Worthington Corporation (Harrison, New Jersey), which built the air conditioning systems for the three largest U. S. atomic energy installations, a ventilating pattern must be created that provides a continual flow of air from the worker, across his work and into an exhaust. The ventilating engineer must never allow air that has touched radioactive material to flow back over the worker. He must never allow radioactive particles to gather in dangerous quantities.

It sounds simple, but it is actually quite complicated.

For instance, each device used in atomic research work must have its own, individual air conditioning system. These devices include such odd-named items as a "hood" and a "cave."

The "hood" is a completely enclosed workbench used when experiments are being conducted with radioactive materials of such low intensity that they will not harm anyone coming into contact with them for short periods. It has sliding glass panels on its front through which the scientist may see his work and reach it.

Some hoods have built-in sleeved gloves in the front panel. The scientist can put his hands in the gloves and actually touch the material with which he is working during the experiment.

No rough edges or cracks are allowed on the inside walls of the "hood" and all corners are rounded off for each cleaning.

The "cave" is much larger and far more complicated. It is a miniature concrete room with thick glass windows that allow the scientist to see his work and robot hands that allow him to manipulate it. In cases where extremely radioactive materials must be used, the "cave" may have no windows at all and the scientist watches his experiment in progress on a television screen. Color and three-dimensional television are recent innovations that aid in this work.

Within the "hood" and "cave," two devices are used to insure against radioactive buildup. High velocity fans blow the contaminated air from the chamber through "pre-filters," which glean the radioactive particles from the air. The "pre-filters" are so named because the air passes through them before it reaches the exhaust ducts and final filters. They are installed at the rear of the "hood" or "cave" and—again following the rule against rough edges or cracks—are mounted flush.

The ventilation engineer in the atomic laboratory sometimes runs into the problem of condensation in the exhaust duct. In this case, Worthington installs a liquid-tight trough on the lower portion of the duct just beyond the "pre-filters" to catch the condensation, and a drain pipe, connected to a suitable waste facility, to carry it away.

In the "cave," exhaust fans are provided for each piece of equipment to be used in the experiment, i. e., robot arms, television camera, table on which the work is conducted. According to the Worthington

engineers, the ventilation specialist must keep each piece of equipment as uncontaminated as if it was in the open laboratory. This is done so the scientist can enter the "cave" immediately after an experiment to see the results of his work, make adjustments or set up new experiments.

After the air is exhausted from the protective devices, it must be cleaned again in a special highly-efficient filter system.

Finally, it is blown out a stack, the height of which is determined by meteorologists to make certain the atmosphere will dilute any minute quantities of radioactive material that might still remain.

Throughout this entire operation, the filter system plays an important role. There can be up to three sets of filters: Inlet filters, pre-filters and final filters.

The inlet filters are used to remove from the air entering the laboratory any dust that would tend to interfere with experimental work.

In each of these three operations, a filter is used

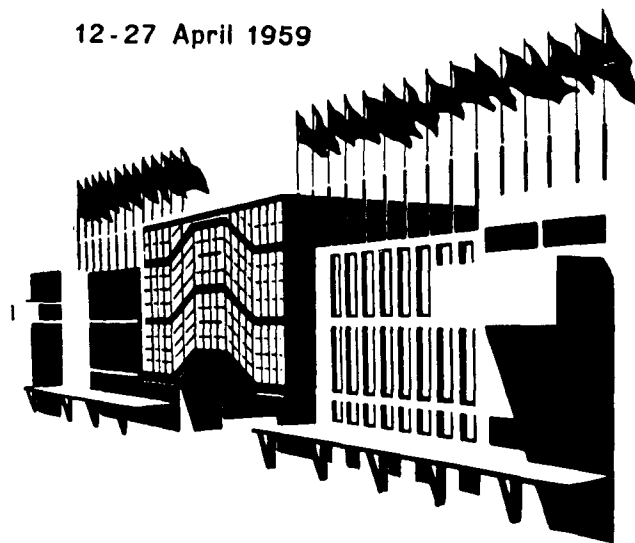
that is flame-proof yet combustible in a hot fire so it may be eventually destroyed.

The air conditioning in the atomic energy laboratory, the Worthington engineers add, must also provide regulated humidity as well as cooling and filtering. Low humidity would create an atmosphere in which static electricity could gather and possibly touch off a dangerous spark. High humidity would cause the filters to clog, thus disrupting the flow of air in the laboratory.

Finally, there must be safeguards against any sudden stoppage of the system. The Worthington engineers explained that they try always to maintain an adequate safety factor so that if any of the fans should break down, the pattern of air flow would still be maintained, even though it would be less air moving at a slower speed.

It is this type of skilful planning and unceasing care that is enabling today's nuclear scientist to bring new miracles of atomic power out of a "hood"—and a "cave".—GLOBE PRESS SERVICE

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A New Line of Paint Pumps

By an Overseas Correspondent

(Special to J.O.I.E.)

THE Spee-Flo Company has developed a number of new units during the past year. A new line of paint pumps and a new 400 series moisture extractor have been added and the line of hot spray paint equipment has been expanded.

The hot spray process has been used more and more extensively in industry during the past few years. This acceptance has been because of the ability of hot spray to give a high quality finish with a saving of time and material over conventional methods of spraying.

The basic principle of the hot spray method is the fact that much of the solvent is evaporated between the spray gun and the surface, producing a high solids film deposit. Because the material reaching the surface is room temperature or above, moisture in the air cannot condense on it so there is no problem with blushing when spraying lacquers. It permits excellent quality control and greatly reduces overspray, with the resultant saving in materials.

The simple, Underwriters' Laboratories-approved Spee-Flo heater is the basis of all their hot spray paint units. The coilless heating unit consists of an exchanger and explosion-proof, sealed heating element. It can reach full heat in three minutes and maintain full volume flow. The regular procedure of flushing the fluid lines clears the unit of all material. No special painting skills are needed to use the hot spray method. Any painter can easily adapt himself to the easier hot spray application which calls for a reduced number of passes and produces a faster and better build.

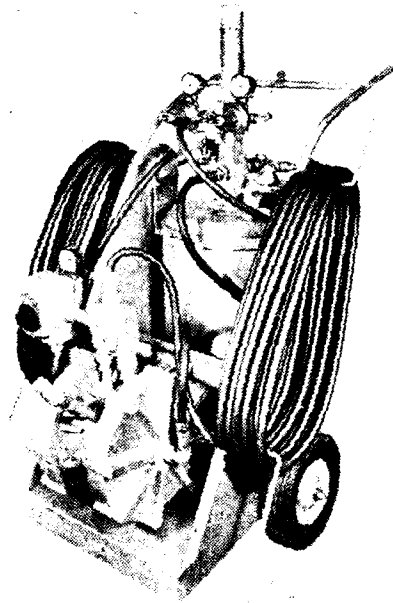
One of the current developments is a small, portable paint heater. Called the Spee-Flo 300 B2, this inexpensive heater is carried by the operator and is especially suitable for maintenance and construction painting and any work that requires compactness and portability. The light weight model is comfortable for the painter because no external heat is felt. Rated at ten gallons per hour, the unit is big enough for almost any job and is very reasonably priced.



The inexpensive and portable Spee-Flo 300 B2 gives all the advantages of hot spray and is electrically operated from a standard light circuit. The unit comes complete with hose and electric cable set.

The Spee-Flo Chieftain unit combines the Spee-Flo hot spray heater and reciprocating pump in a portable unit which carries the original five or ten gallon paint container. It is the first unit of its type especially designed for the maintenance and fabrication industries. In this field, long hose length requirements have previously limited hot spray acceptance because such heaters simply were not available. The mobile Chieftain meets these needs by providing hot spray temperatures for one or two guns and on hose lines up to 75 feet in length. Circulation from heater to gun is maintained for temperature control. The operator selects paint temperature by simply turning the Dial-a-Matic controller. The unit is equipped with a 2 KW or 3 KW heater and a pump designed to spray up to a gallon a minute.

The new Mark IV pump has been developed for the



The Spee-Flo Chieftain is equipped with a 2 KW or 3 KW heater and a pump designed to spray up to a gallon a minute. It provides hot spray temperatures for one or two guns and on hose lines up to 75 feet in length.

Circacflo hot spray heater. This advance in design combines a sealed, integral motor pump that is maintenance free. It is designed for intermittent or high production use and has no gears to wear nor close tolerances which must be maintained. The unit is available either for fixed mount or with a dolly for mobile use.

The Spee-Flo Company has added a new line of paint pumps which are of divorced design, which means that the pump in the material is completely

separated from the air motor which actuates it. The pumps are available in 10 or 55 gallon sizes for use with open head or bung type drums. They offer faster material handling, smoother regulated paint delivery and elimination of the time-consuming pressure tank shut-down for color change or material fill.



The low-priced DryAir 400 is of rugged and simple construction without screws or bolts, and automatically separates and removes oil, water and other foreign matter from the air line.

The Spee-Flo Company has also introduced the Dry-Air 400, a low-priced moisture extractor that gives clean, dry air for protection of all types of intermittently operated, air powered equipment. The unit has a rugged and simple construction without screws or bolts and automatically separates and removes oil, water and other foreign matter from the air line. It is available to fit a variety of line sizes ranging from $\frac{1}{4}$ inch with an 18 CFM maximum to $\frac{3}{4}$ inch, 120 CFM maximum.

ALLIS-CHALMERS SHIPS LARGE CONDENSER WITH TUBES INSTALLED

Containing almost 25 miles of tubes (5450 tubes, each 24 ft. long) the largest Allis Chalmers condenser shipped to date completely tubed recently left the West Allis, Wisconsin Works. Buyer of the 30,000 Sq. ft. two pass unit is the Otter Tail Power Co., Fergus Falls Minn. Previous record holder was a 27,500 sq. ft. unit sent to the City of Tacoma, Washington. Scheduled for installation at the power company's Hoot Lake Station in Fergus Falls, the

condenser will serve a 53,500-kw reheat steam turbine generator. This unit will be the second A-C condenser installed at this station. Measurements of the shell of this unit are: 24 ft. long, 14 ft. 8 in. wide and 6 ft. 8 $\frac{1}{4}$ in. high. The neck, which was shipped separately stands 8 ft. high and is 22 ft. long. It will be welded on at the installation site. The shell, complete with tubes, weighs 132,000 lb.

SUGAR & THE BYPRODUCTS OF THE INDUSTRY

By G. Ramchander, B.Sc.

Fellow, Sugar Technologists' Association
Chief Chemist, Jaypore Sugar Co. Ltd., Guntur

SUGAR and Sugarcane have both been known in our country from prehistoric times. India is the birth place for Sugarcane. In 800 B. C. Sugarcane was taken to China. Alexander introduced it to the Western Hemisphere in 300 B. C.

Sugar manufacture started in our country between 4th and 6th Century A. D. Juice was extracted from the cane by crushing it with heavy weights. The juice was then boiled and stirred until solids were formed. These solids of uneven size and shape looked like gravel and were hence called sharkara, a Sanskrit term for gravel.

China and Persia learned the art of sugar manufacture from India in the early part of the 7th Century.

The modern sugar industry with its almost pure chemical product started in our country in 1932 with the grant of protection to it to keep off foreign imports. The monumental work of Barber and T. S. Venkataraman is breeding new strains of canes, the so-called Coimbatore varieties, suitable for the country has made the sugarcane industry to stay on the field.

In 1931 there were only 31 sugar factories; while in 1954-55 there were 157 factories out of which 136 factories worked. In 1956-57 147 factories worked and in the current season 154 Units worked. Sugarcane is a tropical plant and hence the present policy of the Government is to encourage the establishment of new units in the southern parts. At present the industry is concentrated mostly in the U. P. and Bihar giving rise to a lot of competition amongst them also not to speak of the unsuitability of the region for Sugarcane growth.

Sugar is a Carbohydrate. It contains Carbon, Hydrogen and Oxygen. In the plant it is formed by the action of sunlight on the growing green part, the leaf. This product manufactured in the plant has been extracted from time immemorial and used as a sweetener in our foods.

But sugar is more than a Sweetener. It is an energy giving food. A teaspoonful given 18 Calories of

energy. Sugar is almost instantaneously absorbed into the blood stream and relieves fatigue within minutes after it is eaten. It helps the efficient functioning of every cell in the human body. The body uses sugar to burn its own fat.

When sugar is eaten between meals it controls an oversize appetite or false hunger.

Thus sugar is an important article of food. Its consumption in our country is no doubt increasing what with our tea and coffee drinking habits. In parts of our country like Bengal I may even say coastal Orissa, sugar consumption by way of our Rasagulas and the other sweets is certainly more than that of the Southerners. The production is certainly going up and last year we have had a record production of 20.26 lakhs of tons of sugar. The target for the II plan period is 22.5 lakhs of tons. It is hoped that the target would be reached in the third year of the Plan period.

But with all this our percapita consumption is woefully low when compared with that of the other countries of the world. The percapita consumption in 1949-50 of Australia is 143, of Cuba 140, of New Zealand 138, Canada 112, U. S. A. 106, U. K. 92, Egypt 30 and India 24.2.

Let me now give a short account of the way sugar is manufactured in our modern factories. The sugarcane is crushed under heavy rollers driven by power. After one or two crushings some water is added to the crushed cane. This dissolves the last traces of sugar adhering to the cells of the ruptured canes, leaving behind the fibrous portion, called bagasse which is the first byproduct of this industry.

The resulting juice may be considered as containing three ingredients:

1. Water which forms the largest.
2. Sugar which we want to recover and forms between 10 and 14 per cent of the cane weight.
3. Other ingredients which the plant has absorbed

from the soil for its growth and life activities and which we could collectively call non-sugars.

The next step is the purification of the cane juice in order to remove the non-sugars to the maximum amount before crystallising the purified white sugar for recovering it in crystal form. The carbonatation and the sulphitation are the two methods used for this purification.

In the carbonatation method, lime in a thin suspension is added to the juice and then carbondioxide gas produced by burning limestone in closed kilns is bubbled through the juice.

In the sulphitation method, lime is added in thin suspension as in the carbonatation process and sulphurdioxide gas which is produced by burning sulphur in special ovens is bubbled through the juice.

The juice is then boiled so that the non-sugars in juice coagulate. These are removed by settling and filtration. During this clarification process most of the coloring matters of the cane is also removed.

There is a fallacy in our country that bones in powder form are added during white sugar manufacture. It is not. Formerly filtration was done over bone char or burnt bone powder, which like ordinary charcoal is a good filtering medium. This was used also in the Aska Sugar Factory in the Ganjam District of our State, which was probably one of the very first factories in our country. This method of filtration over bone char is now obsolete. In its place we use either plate filters with thick and coarse filter cloth or continuous mechanical filters. Together with the lime and carbondioxide or sulphurdioxide we get brilliant and sparkling cane juice. Hence the modern factory sugar is free from bone contamination and the most orthodox amongst us need have no compunction in using sugar even during religious functions.

Filtration yields a cake called the cachaza or filter-press cake. This still contains some sugar which is a loss and a large quantity of non-sugar and some wax. The press mud forms a valuable byproduct.

The purified juice is next sent to evaporators where a portion of the water is evaporated. Final evaporation takes place in what are called the vacuum pans where actually sugar crystallises as it has no medium like water to be in a dissolved condition.

Certain of the non-sugars that still persist form a sort

of a film around the sugar crystal. They lock within them some sugar also.

The sugar crystal are separated from the mother liquor by means of centrifugal action in high speed centrifugals revolving at 1000 revolutions per minute. The slightly off colored sugar received in a first set of centrifugals is once again centrifuged in another set using a little water. The crystals from these are dried and bagged.

The non-sugar portion which goes out in the form of treacle is called molasses. It contains some sugar still locked in, about 1% on the weight of cane. This molasses forms another valuable byproduct.

BYPRODUCTS OF SUGAR INDUSTRY

Where there is a sugar factory, the development of the byproduct industries is a necessity both in the interest of economy and in the disposal of the byproduct itself.

The byproducts of the sugar manufacture, as already pointed out, are 1. Bagasse 2. Press mud and 3. Molasses.

BAGASSE

The fibrous portion of the cane after extracting the juice between the rollers is called bagasse. At present in our country, it is being used as a fuel for raising steam for running machinery and for process heating.

The fuel cost is a very big item in sugar manufacture; but for fibre that could be utilised for raising steam to run the heavy machinery used in this industry, the cost of sugar would be very high. Where alternate sources of power or fuel are cheaply available, for instance hydroelectric power or cheaper fuel, then alone could bagasse be diverted for other industries.

Bagasse could be used in the manufacture of bagasse boards and paper. The sugar contained in bagasse could be fermented into alcohol.

Activated carbon that is used for deodorising and decolorising could also be made from bagasse. Furfural that is largely used in Nylon manufacture and in the production of gramophone records could also be made out of bagasse by a digestive process. The dried residual material could be used for card board manufacture.

A bagasse resin is prepared from bagasse. This is used as a binder for laminated jute fibre, plywood or paper, for the manufacture of moulding powders, for water proofing and for making varnished and paints.

But in our country in the absence of alternate cheaper fuel, or power, these could be only of theoretical interest. However the potentialities are indicated.

When bagasse is burnt in the boilers with or without some additional firewood, the ash resulting from this burning is a source of potassic fertilizer. The percentage of this fertilizer ingredient depends upon the furnace temperature attained; for at high temperature like 800 to 1000°C. there is volatilisation resulting in loss of potash. Even then the ash could be utilised on the cane farms for even the little potash it still contains.

PRESS MUD

When cane juice is processed by heat and chemical treatment and is filtered, the resulting cake is known as Press mud, or Filter Press Cake or Cachaza. This is about 2% of the weight of cane crushed.

This cake is rich in phosphoric acid, which the sugarcane has absorbed from the soil along with other ingredients and some of which are precipitated during the purification process.

It may not be widely known that nature has endowed plants with power to secrete waxes and resins on their external surfaces with a view to protect the growing tips of buds from the ravages of ants and other insects harmful to plants. Such waxes of the sugarcane plant find their way into the cane juices during the crushing process and finally they go into the press mud as a result of the purification process. This wax could be recovered by solvent extraction. The resultant wax compares favourably when refined with the imported caruba waxes used in the manufacture of boot polishes. Such plants are working in only two factories in our country, one at Ravalgaon and the other at Vuyyuru. About 10 to 15% of wax on the dry press mud is obtained.

Dewaxed press mud is a better fertilizer as the presence of wax hinders the action of the solid micro-organisms. But even in the absence of such solvent extraction also, the press mud is found to give a highly beneficial effect on lands especially on rich fields.

MOLASSES

Molasses forms the third and the most important byproduct of the sugar industry. This is about 4% of weight of cane crushed. After the juice is purified and concentrated and after the recovery of all the crystal sugar, a sort of a dark brown highly viscous liquid remains over. This is called the final molasses, or blackstrap or simply molasses.

Molasses contains all the impurities, from a sugar man's point of view, that have passed over despite the purification process. These impurities prevent the complete crystallisation of all the sugar contained in the cane juice, so much so about 1% of the sugar contained in the sugarcane has passed over into molasses along with other non-sugars. This sugar in molasses forms the basis for the fermentation industry.

On fermentation of molasses we get ethyl alcohol and carbon-di-oxide. The former is distilled and recovered and the resulting ethyl alcohol has as many uses as the alphabet of English language. Nearly a hundred arts, crafts, and industries use alcohol in some form or other.

Low strength alcohol properly brewed, flavoured and aged is bottled for our benefit.

Higher strength alcohol, the so-called Industrial Alcohol, is used in synthetic rubber, acetate rayon and butanol manufacture. This high strength alcohol with admixture of certain chemicals forms Methylated and Denaturated spirits.

The pure alcohol called the rectified spirit is used in pharmaceutical preparations.

The highest strength of alcohol obtainable is called the absolute Alcohol. This is used in laboratories. As the so-called Power Alcohol it is mixed in varying proportions with Petrol and is used in internal combustion engines in place of plain petrol. The usual proportion is 20 gallons of Power Alcohol to 80 gallons of Petrol.

This power Alcohol-Petrol mixture is claimed to have the following advantages over plain motor spirit.

1. A better anti-knock property.
2. Ease of starting the engine in the cold.
3. A higher compression.
4. Less carbon deposition.

The power output equals that of petrol. The corrosive effects are not more than that of petrol.

But with the installation of the three Petroleum Refineries in our country, two at Bombay and one at Vizagapatnam, the future for Power Alcohol is bleak. We should only think in terms of industrial Alcohol.

Incidentally I may mention that the Petrol Consumption in our country in 1954 is about 900 million Gallons.

The second product of the alcoholic fermentation of molasses is Carbondioxide, which is produced when sugar is split into alcohol. This escapes to the atmosphere and is allowed to go to waste in most of our distilleries.

Fermentation carbondioxide is one of the purest obtainable in nature and all that is required to be done is to rid the gas of its odours. It could be cheaper as it is a byproduct of a byproduct industry. Liquified and bottled in cylinders it is the soda water gas. It is an irony that in our country with a high production of molasses, resource is had to coke for the manufacture of soda water gas.

When this gas is solidified the so-called dry ice results. This dry ice is a better aid than water ice in refrigeration industry for the preservation of fruits, vegetables, meat and fish. Large quantities of these valuable foodstuffs get split in our country due to the hot climate. These could be well preserved and a portion of our food problem solved.

I have already said that the sugar in molasses gets fermented into alcohol and carbondioxide. What is the agency that causes this transformation? It is a single celled organism called yeast which is more akin to the plant than the animal kingdom, but nevertheless has all the physiological functions of the highest orders in creation. During its life activities it secretes certain enzymes which have the power to transform the sugars into alcohol and carbondioxide. This fermentation hence takes place only when yeast is present.

When fermentation is complete, this yeast settles to the bottom and becomes another byproduct. This could be collected purified and dried.

Yeast is a very good source of proteins and vitamins of the B group the two essentials that are in

short supply in the normal Indian rice diet; being a vegetable the orthodox amongst us need have no objection for its use.

Its use will remedy many of the Vitamin B deficiency diseases, like general lassitude for work and effort, fatigue, loss of appetite and gastro-intestinal maladies, cataract, baldness, dermatitis, pellagra, insomnia, nervousness, muscular weakness, anemia and reproductive deficiency.

But with our conservative food habits we will not easily take to a precious food like this. Hence its use should be enforced at Government level. Yeast could be mixed with atta and sold. It could be incorporated in sweets and peppermints and that is what a confectionery at Vuyyuru, who have a yeast manufacturing plant, are doing.

The next byproduct available in the distillery is what is called Fusel Oil, which is a mixture of higher alcohols. During fermentation yeast acts on the albuminous matter of the molasses solution and forms principally Amyl alcohol together with smaller quantities of other higher alcohols like Isobutyl and Normal Propyl alcohol. All these together form the Fusel Oil. This is recovered during distillation. The quantity formed is about 0.05% of the sugar fermented.

Fusel Oil is used in the manufacture of explosives and also in the manufacture of essences.

After the recovery of carbondioxide, Yeast, fusel oil and finally alcohol, the molasses solution drained out is called the spent wash; it contains an important fertilizing ingredient Potash, the same as we saw under boiler ash. The sugarcane had removed this from the soil for its life process. Formation of sugar in the cane is attributed to this important ingredient. Barring the small quantity going into bagasse, the larger part of the potash taken out by the plant finds its way into molasses and finally into the spent wash when alcoholic fermentation takes place. When this spent wash is concentrated and incinerated, potash could be recovered and again applied to the fields as a fertilizer.

It is also possible to further ferment this spent wash when methane gas results together with a sludge which is rich in the fertilizer ingredients. When the potash is returned to the soil together with press mud and bagasse ash, we could have returned to Mother Earth whatever was taken out and the soil balance is

thus maintained. This is the most rational way of maintaining soil fertility.

Methane gas is combustible and could be used for domestic heating. While on the subject of fermentation I might slightly digress to point out the potentialities of using Mohwa flower, the abundant forest produce of our country in the manufacture of Alcohol, Carbondioxide and Yeast.

There are various other uses to which molasses could be put to. Though they have been commercially exploited in Western countries, they are quite in their infancy in our country. Molasses is used in the manufacture of glycerins, levulinic acid, calcium lactate and lactic acid, butyl alcohol, acetone, activated carbon and resins.

Thus we find that if all the byproducts of the sugar industry are fully exploited we may call sugar itself a byproduct.

The majority of us know sugar as a sweetener, an energy giving carbohydrate food. But sugar itself is a raw material for a number of chemicals.

Non-ionic detergents for toilet articles are made with pure sugar as the starting point; Synthesis of sugar fatty acid esters produce superior grade drying oils for use in the paint industry. With Ammonia and Hydrogen it yields in the presence of a nickel catalyst 2-Methyl Piperazine, a key starting material in resin and fibre production.

With waste pulp of beet sugar factories, a pulp feed which is claimed to be superior to cotton seed meal is also prepared.

Even here I have only indicated the potentialities to emphasize the point that we need never be afraid of overproduction of sugar. But actually we are always wanting Sugar.

Pirelli Produces Voltalir

A synthetic insulating material, called Voltalir, has been produced by Pirelli in its Bicocca laboratories outside of Milan. Insulators cable joints and terminals, capable of standing voltages as high as 400 kv, can be made of the material.

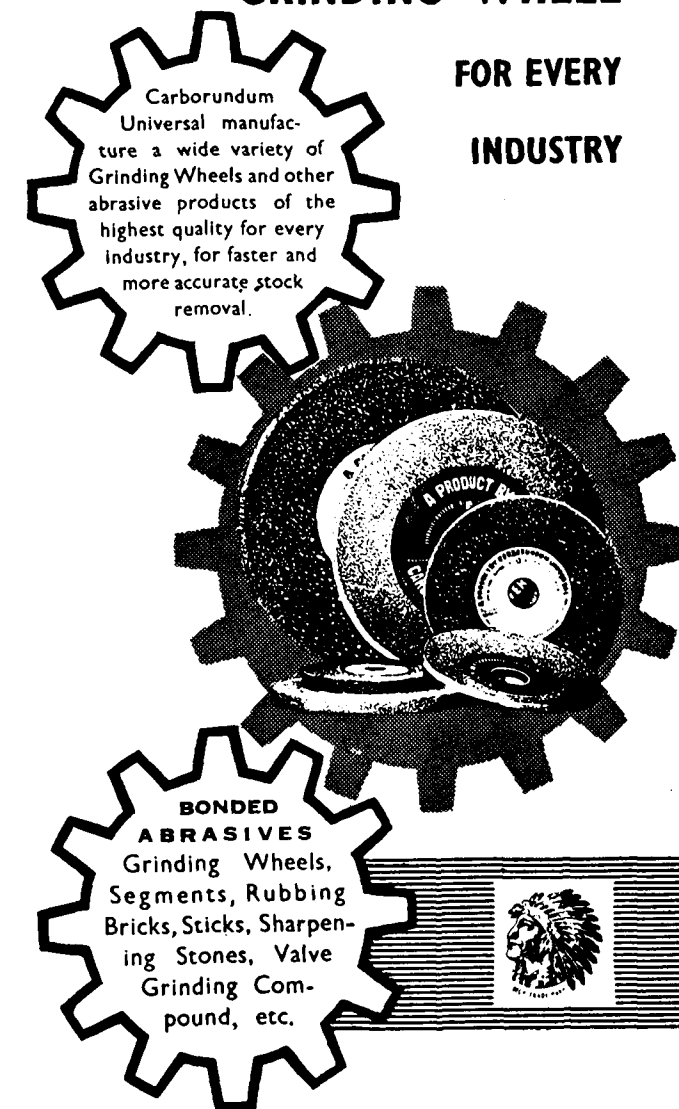
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THE SF ELECTROSTATIC PRECIPITATOR AT KAUKOPAA PULP MILL IN FINLAND

By Harry Andersson

Fläktfabriken has supplied an electrostatic precipitator installation to Enso-Gutzeit sulphate pulp mill at Kaukopaa, Finland, for reclaiming sodium sulphate from soda recovery unit flue gases. Reclaiming 7,500 metric tons of sulphate annually, this installation is one of the largest in the world and has reduced losses to a mere 1.5 kg (3.3 lb.) per ton of pulp produced. It has been in continuous operation since October 1952, and has proved entirely satisfactory. Fläktfabriken's Finnish subsidiary, AB Finska Fläktfabriken, Helsinki, has made most of the mechanical equipment.

WHEN black liquor is burned in the soda recovery unit of a sulphate pulp mill, some of the sodium sulphate is vaporized and carried away in the flue gases, where it sublimates and appears as dust. In the widely-used, spray-type recovery units, between 40 and 90 kg. (90 and 200 lb.) of sulphate per ton of pulp produced—depending on loading etc.—may be carried away in the flue gases. For a production rate of 100 metric tons of pulp per 24 hours and a price \$ 19 per ton for sodium sulphate, this represents a sum approaching \$ 50,000 annually. It is thus essential for economical operation that the sulphate dust should be recovered from the flue gases and returned to the production process.

The dust is exceedingly fine—as a rule more than 90% of the particles have sizes in the range 0.1 to 1.5 μ . The electrostatic precipitator is usually the only type of separator worth considering for dusts as fine as this, and it has achieved complete predominance in this particular application because of the relatively favourable electrical characteristics of the sulphate dust. Fläktfabriken has played an active part in the development of electrostatic precipitators for such purposes, and has already supplied precipitator installations to some 35 sulphate pulp mills with a total annual production of 1,300,000 metric tons of pulp. The value of the sodium sulphate reclaimed by these installations is about \$ 1,100,000 per year.

In October 1952 one of the largest electrostatic precipitator installations in the world for a soda recovery unit was taken into operation at Enso-Gutzeit sulphate pulp mill at Kaukopaa, Imatra, Finland. A yearly average of 7,500 metric tons of sodium sulphate

is reclaimed in this precipitator, which has operated continuously ever since it was installed and has given complete satisfaction.

ASSUMPTIONS

The electrostatic precipitator installation is designed for a flue gas flow of 216,000 cu. m/h (127,000 cfm) at 130°C (230°F), which corresponds to the normal rate of pulp production: about 300 metric tons per 24 hours. A collecting efficiency of $(96 \pm 2)\%$ is



Fig. 1. The Enso-Gutzeit Pulp Mill at Kaukopaa, Imatra, Finland. (Photo: Aarne Pietinen, Helsinki)

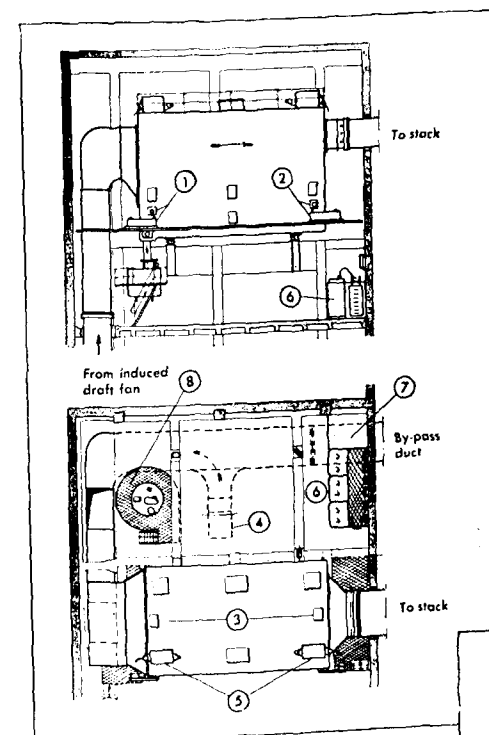


Fig. 4. The emitting and collecting electrode systems in each chamber are arranged in an inlet and an outlet group.

The numbers on the drawing indicate:

- 1 Precipitator chambers
- 2 High-tension power packs with completely enclosed high-tension circuit
- 3 High-tension disconnecter
- 4 Movable pot head for high-tension cable
- 5 High-tension cables
- 6 Inlet emitting electrode system
- 7 Outlet emitting electrode system

guaranteed. When production is pressed up to 390 metric tons per 24 hours the installation will handle 288,000 cu. m/h (170,000 cfm) at 150°C (300°F) with a collecting efficiency of $(91 \pm 3)\%$. Following usual practice for installations of this type, the gas flows are calculated for a lower carbon dioxide content than is normally attained in the operation of relatively new recovery unit.

SCOPE OF INSTALLATION

A double precipitator is employed, with two complete precipitator chambers connected in parallel and arranged side by side. This arrangement offers considerable advantages in an installation of this size, and provides a certain amount of safety in that only half the precipitator unit need be shut down if a fault occurs. The installation includes equipment for discharge of the dust and sulphate mixing, flue-gas

Fig. 2. A double precipitator is employed, with two chambers connected in parallel and arranged side by side.

The numbers on the drawing indicate:

- 1 Drive for the inlet collecting electrode rappers and the dust discharge equipment.
- 2 Drive for the outlet collecting electrode rappers.
- 3 Here the heating units are lowered.
- 4 Connection for the induced draft fan.
- 5 High-tension chambers and rappers for the emitting electrodes.
- 6 High tension power packs.
- 7 Room for fan, air filter, etc., for ventilation of the high-tension power packs.
- 8 Sulphate mixing tank.

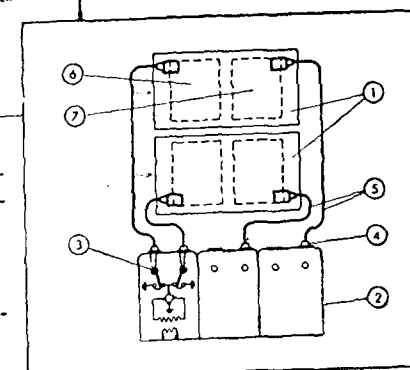


Fig. 3. The precipitator chambers measure 11.5 x 6.5 x 7 metres and are insulated with mineral wool covered with sheet aluminium.

ducts with dampers, and high-tension machinery with control equipment, Fig. 2.

PRECIPITATOR CHAMBERS

Each of the precipitator chambers, Fig. 3, has dimensions $L=11.5$, $B=6.5$ and $H=7.0$ metres ($38' \times 21' \times 23'$) and is made of reinforced concrete. The walls and bottom are heat insulated with mineral wool covered with sheet aluminium, while the roof is more heavily insulated with lightweight concrete slabs, whose surfaces have been plastered with concrete and steel-trowelled so that it may be walked upon.

The emitting and collecting electrode systems in each chamber are arranged in two groups, an inlet and an outlet group, which are completely independent of one another, both electrically and mechanically,

Fig. 4. This arrangement provides an additional reserve capacity. If a fault occurs in one group of electrodes the other group can be kept in operation, maintaining over 75% collecting efficiency in the chamber. It is also possible to operate the two groups of electrodes at different voltages, which can be adjusted to suit the different concentrations of dust in the two groups of electrodes. Advantage has naturally been taken of this possibility, and the emitting electrodes are designed so that the different parts of the chambers are operated at the most suitable combination of high voltage and low current. This has the effect of reducing the high-tension power required and thus the extent and size of the electrical equipment. In addition, the volume of the precipitator required for a given collecting efficiency is smaller than in the case of undivided electrode systems.

The collecting electrodes in each group are provided with a rapping mechanism for removal of the collected dust. The rapping frequencies can be adjusted individually to suit the operating conditions. Dust accumulates rapidly on the plates in the inlet electrode group, and the rapping frequency there should thus be fairly high. The dust losses in the precipitator are mainly due to particles shaken off the last plates in the outlet electrode group, and it is therefore important to keep the rapping frequency for this group as low as possible. The effect of varying the rapping frequencies is studied after the installation has been in operation for some time.

THE DUST DISCHARGE EQUIPMENT

In normal operation the precipitator collects dust at a rate of about 1,000 kg/h (2,000 lb. per hour) with a volume of some 10 cu.m/h (60 cfm). When the plant is being pressed to the full the corresponding figures are 1,500 kg/h (3,300 lb. per hour) and 15 cu.m/h (90 cfm). The dust is discharged continuously to the sulphate mixers by means of scraper conveyors which work along the length of the flat bottom in each chamber and scrape the dust to a screw conveyor at the end of the chamber. Since the internal width of the chambers is 6 metres it was considered best to use two parallel scraper conveyors in each chamber, with double-threaded screw conveyors carrying the dust to a discharge opening below the centre of the end wall of the chamber. The discharge equipment has proved exceptionally reliable.

THE SULPHATE MIXING EQUIPMENT

The dust discharged through the openings in the

chambers falls down through chutes into two SF₆-designed mixing tanks, one for each chamber, Fig. 5. Application has been made for a patent on the design of these mixers. Hot black liquor at about 50% dryness is fed to these mixing tanks and kept in circulation by a propeller pump so that the dust is rapidly drawn down into the liquor and thoroughly mixed with it.

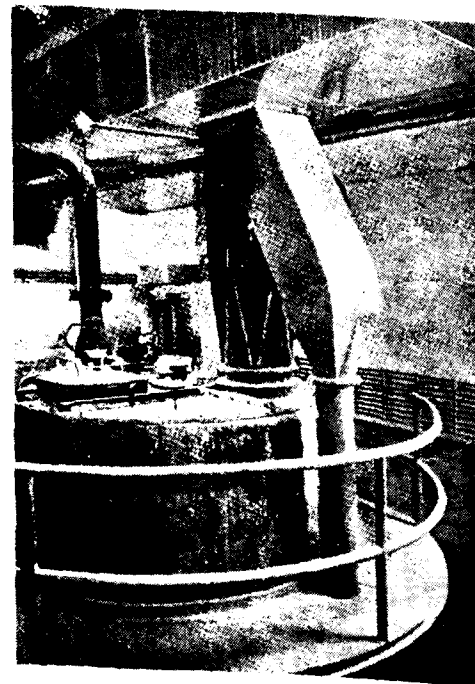


Fig. 5. Sulphate mixing tank.

The liquor leaves the mixer through overflow pipes, ready to be returned to the production process. No level regulator is required and there is very little danger of liquor overflowing. The black liquor vapour in the mixing tanks is carried away through a duct connected to the induced draft fan. The pressure in the mixers is adjusted by means of a throttle valve to give a small gas flow through the chutes from the precipitator. This prevents condensation and dust accumulation in the chutes.

HEATING UNITS

When the precipitator is cold after a shutdown it has to be heated up before it is put back in operation. The necessary heat is provided by four heating units, Fig. 6, each of which comprises a set of electric elements and a fan. Openings are provided through which the units may be lowered into the chambers when required. The fan draws in air from under the roof of the chamber, blows it through the

fore been provided with thermostatically controlled electric heating elements to maintain the porcelain at a temperature which is always well above the true dew-point of the flue gases.

THE FLUE-GAS DUCT SYSTEM

After passing through the induced draft fan the gases are led through "bell" dampers to the inlet funnels, but provision is made for by-passing the precipitator and passing the gases direct to the stack when the recovery boiler is heating up or in an emergency. The gas inlets to the precipitator are symmetrically disposed and baffles are fitted at the transition from the inlet funnels to the precipitator chambers in order to distribute the gas suitably across the precipitator. These baffles are designed so as not to require special rapping mechanisms.

The dampers are made of cast iron and are 2.5 metres (8' 2") in diameter. The sealing faces are machined, with an adjustable seat on the fixed part. The design virtually eliminates the danger of dust accumulating and provides a reliable, easily operated, flue-gas damper with excellent sealing. Louver-type outlet dampers are fitted between the precipitator and the duct to the stack.

THE HIGH-TENSION EQUIPMENT

Flaktfabriken's electrostatic precipitator installations have been built with various types of rectifiers—mechanical, selenium or electronic tube—using different kinds of automatic equipment to suit individual requirements. Mechanical rectifiers have been chosen for the Kaukopaa installation, with automatic control equipment which is described below.

The high-tension equipment comprises three 25 kVA power packs, one of which is shown in Fig. 8. Each power pack forms a complete unit, with high-tension transformer; rectifier and all the auxiliary equipment, such as fuses, motor circuit breaker and controls for the rectifier motor, assembled in one casing. The power packs also house the corresponding equipment for the auxiliary motors for the precipitator chambers. Each power pack is connected to the line by one cable, and outlets for two high-tension cables are provided on the high-tension side.

The inlet electrode groups in the two chambers are fed from the same power pack, while the outlet groups have one power pack each. If a fault should occur in one of the power packs, it can be shut down and

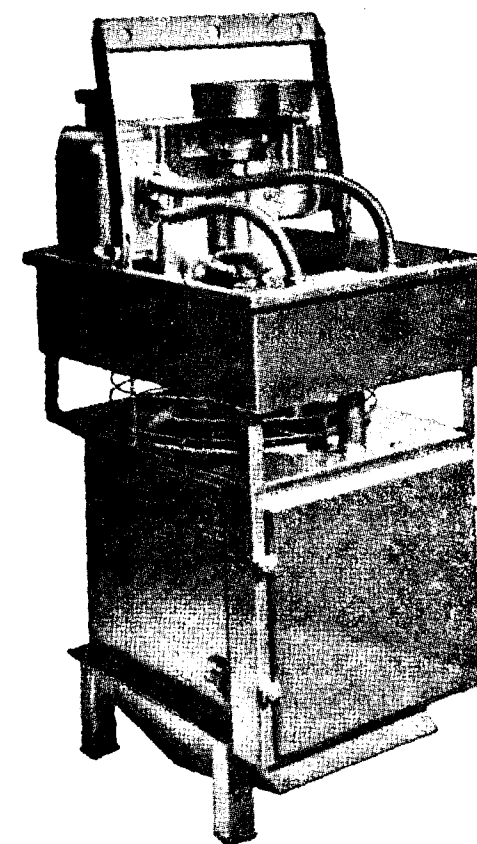


Fig. 6. Heating Unit.

heating elements, and projects a powerful jet of hot air against the bottom of the precipitator, Fig. 7. Since the precipitator chamber is heat insulated and thoroughly sealed by means of effectively tightening flue gas dampers, etc., its whole interior is evenly heated by this simple method, requiring no special hot-air circulation ducts. The precipitator is sufficiently pre-heated to prevent condensation when the hot gases are admitted.

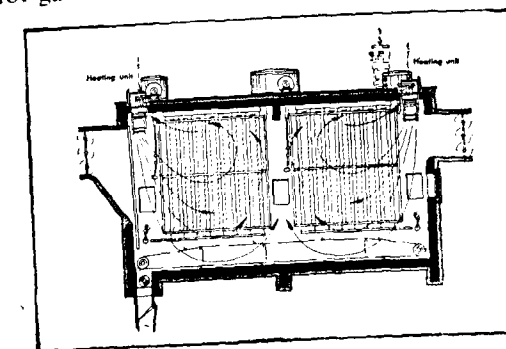


Fig. 7. The heating units direct a powerful jet of hot air against the precipitator bottom.

The high-voltage leading-through bushings are particularly sensitive to condensation and have there-

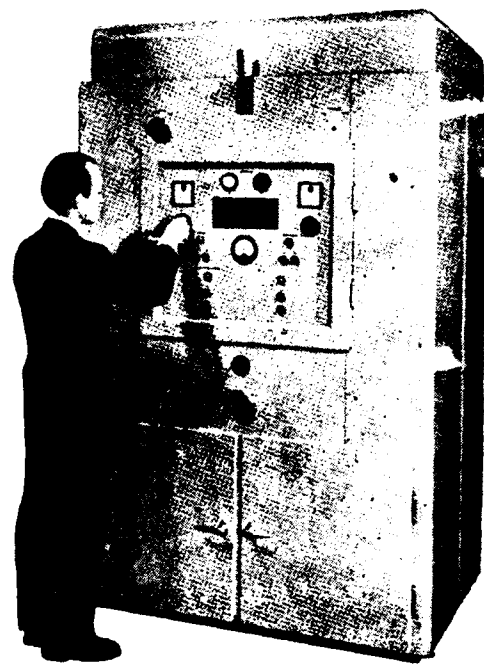


Fig. 8. One of the three high-tension power packs.

the load divided between the remaining two. The three power packs thus act as spares for one another; changing over is an easy matter and any switching requirement can be met without using special switchgear.

The rectifier arcs form ozone and nitrous gases which are toxic and corrosive in high concentrations and must therefore be removed. These gases are exhausted through a ventilation system, which is also used for cooling the transformers and rectifier motors.

AUTOMATIC CONTROL EQUIPMENT

The power packs are fitted with automatic equipment which reduces to a minimum the effect of minor disturbances in operation and eliminates the need for manual intervention except in the case of serious trouble. Provision for remote control was therefore considered unnecessary and only an instrument panel carrying voltmeters and ammeters for the three high-tension power packs and signal lamps for the precipitator auxiliary motors was placed at the front of the recovery boiler, Fig. 9.

Over-current relay

Over-current protection is provided by a time-lag

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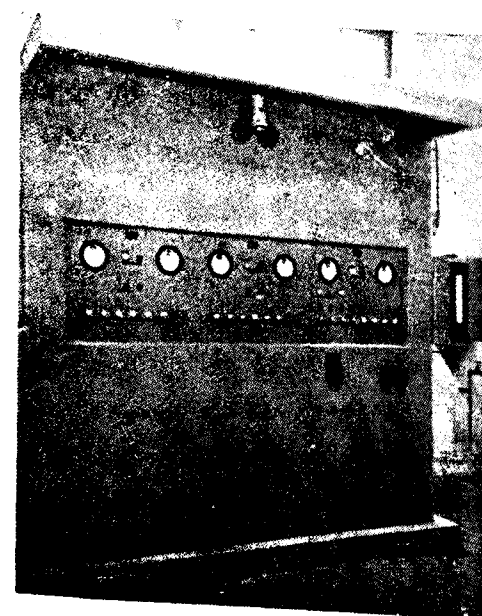


Fig. 9. Instrument panel at the front of the recovery boiler.

relay in the primary circuit of the high-tension transformer. This relay opens momentarily in the event of a true short circuit, where the over-current is very excessive. At smaller overcurrents the relay opens after a time delay which is inversely proportional to the current, and may not be tripped at all by transient disturbances such as commonly occur in precipitators. The time-lag relay protects the electrical equipment against serious faults, but prevents the precipitator from being shut down by transient current variations which can do no damage.

Reclosing relay

When the over-current relay trips, the reclosing relay closes the high-tension transformer circuit again after about 5 seconds' delay. If the fault is still present and the over-current relay trips again, a second reconnection is made, this time after about 15 seconds. If the fault still exists, and the relay trips for a third time, an alarm signal is given.

Automatic voltage regulation

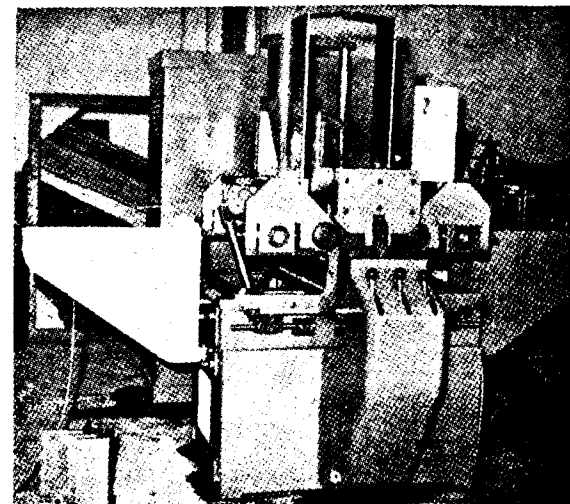
An increase in the precipitator current gives warning that flashover is imminent, with the danger of the circuit breakers opening and possibly shutting down the precipitator. In such a case the voltage can be reduced by connecting a series resistance—normally short-circuited—into the primary circuit of the high-

Sheet Metal Forming Press

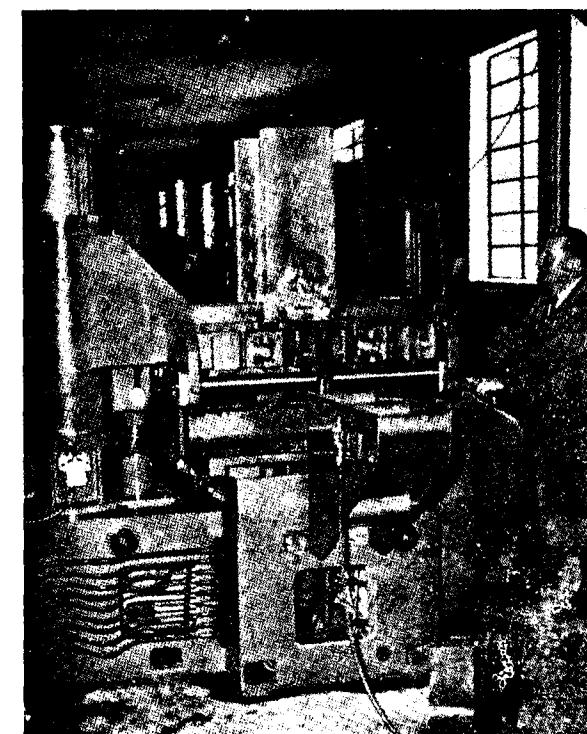
By A Special Correspondent

THE machine shown in the illustration has been specially designed for bending sheet metal shapes and appears to have considerable advantages for automobile, household goods, refrigerator, washing machine, kitchen range, metal furniture and other manufacturers that need to form metal sheets.

The accompanying sketches show some of the forms that can be produced with the machine. The special design permits the forming of bulky pieces which normally require much larger presses, excessively powerful in relation to the effort actually necessary. From the standpoint of productivity, the machine makes it possible to design pieces that can be produced at greatly reduced cost.



Overall view of the Machine.



Let us take as example the shell of a kitchen range or washing machine. By taking a large size sheet, after having performed all cutting, stamping and edge bending operations, we obtain by a single stroke of the press the finished piece and have eliminated all operations, for the assembly of a number of separate panels. The bending radii are variable up to 90 mm. (3.453") maximum. Each different radius and type of piece require a different set of tooling. In forming angle bends in the raised edges of sheet metal shapes,

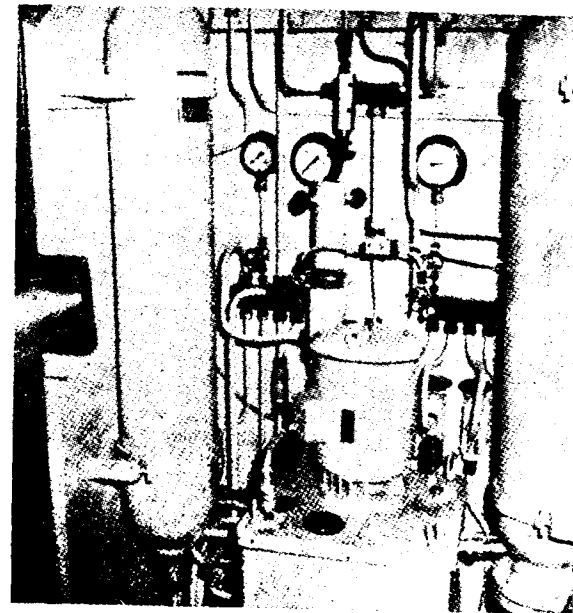
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tension transformer. The connection is made automatically by a balance relay which is sensitive to the precipitator current.

RESULTS

A comprehensive series of collecting-efficiency measurements has been made by Flaktfabriken, working in conjunction with Enso-Gutzeit. The test

procedure followed normal practice in Sweden and Finland for acceptance testing of sulphate precipitator installations. Dust analyses were carried out in Stockholm by the Swedish State Testing Institute. The results of these tests show that the precipitator installation operates at more than 98% collecting efficiency with normal loading of the recovery boiler. The average losses correspond to a mere 1.5 kg. (3.3 lb.) of sulphate per ton of pulp produced.



View of Hydraulic Equipment Controls.

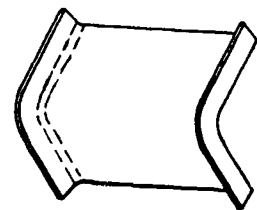


Fig. 1. —

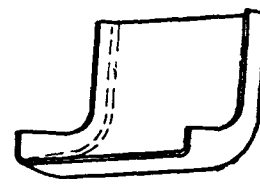


Fig. 2. —

the conditions for working the metal vary from case to case. The permissible height of the edges depends on the elasticity of the metal, the radius of the bend and the shape of the profile.

In Fig. 1 the bend is formed by stretching the metal. The thickness of the sheet is reduced slightly in the exterior layers. The edge profile does not become deformed since the tooling is designed to maintain the sheet under constant pressure during working.

In Fig. 2 the bend is formed by compression and upsetting of the metal. The thickness of the sheet increases slightly in the interior layers. As in the preceding case, the edge profile retains its shape.

Corrugated Aluminium Sheet

The Indian Standards Institution has issued an Indian Standard Specification for Corrugated Aluminium Sheet (IS: 1254-1958). The standard lays down general and specific requirements, such as profile, dimension, finish, etc. for:

(a) general purpose sheet,



The Berthiez installation in Comptoir Industriel d'Etrage et Profilage de Metaux, at Persan-Beaumont, for boring stainless-steel billets up to 18 in. in length. A production figure of 120 ft. of boring per 8 hr. shift is regularly maintained.

In all angle bending and shaping operation, the blank is always subjected to a tangential and radial thrust that produces "finished" pieces without wrinkles. The supporting guides are independently adjustable in relation to the centerline of the machine. The distance between centers of the radii of bend can also be adjusted in relation to the dimension of the blank to be processed. All movements are hydraulically operated. The electro-pump unit, pressure control system and electrical equipment are assembled together in a separate locker. The operator has available within easy reach three levers activating respectively the vertical movement of the punch slide and the raising of the right and of the left guide.

Depending on the type of blank, the machine can be utilized for the bending of one or of two radii simultaneously and makes it possible to shape a complete closed frame in two or three successive bending operations with the sheets being fed into the machine horizontally.

The simplicity of the design makes it easily possible to change the normal operating cycle to completely automatic operation so that the machine can be turned into a mass-production unit at small cost.

- (b) industrial sheet, and
- (c) building sheet

Copies of the standard, published in English and priced at Rs. 1.50 are available from the offices of the Indian Standards Institution, at New Delhi, Bombay, Calcutta and Madras.

TECHNICAL OFFER FOR THE INDUSTRIALISATION OF THE UNDER-DEVELOPED COUNTRIES AT THE LEIPZIG SPRING TRADE FAIR-1959

THE Leipzig Spring Fair 1959 held from 1st to 10th March on a total stand area of approximately 3,200,000 sq. ft. was of particular interest for those countries who are engaged in large-scale industrial development plans. At Leipzig, the leading International Trade Fair, was concentrated a considerable part of the world production of industrial equipment and engineering products of all kinds.

At the Spring Fair in Leipzig, Main emphasis lay in the technical branches where all important producers of the German Democratic Republic as well as a large number of Foreign and West German firms presented a universal and large-scale offers. Technical equipment and machinery from the Socialist countries in general and the Soviet Union in particular played a special part at the Leipzig Fair. It goes without saying that the German Democratic Republic occupied the main part of the Fair and demonstrated the high stage of technical development reached by means of many hundreds of new constructions and technical improvements. The G. D. R. at present is the largest exporter of Engineering goods on the socialist world market.

HIGHLY QUALIFIED ENGINEERING EXHIBITS

At the Leipzig Fair such exhibits play no small part which are of importance for the large scale investment programmes of the Asian and African countries. In this connection must be mentioned the firms of the German Democratic Republic who deliver large scale plants for the extraction of processing of various mineral resources. On display were particularly equipment for the coal industry and for the metallurgy. For power economy, a branch being developed in all countries building up their industry, there was a universal offer which included all subsidiary installations of steam-power stations. Equipment for Hydro-electric Power plants with a wide range of capacities were offered by the Soviet Union and Czechoslovakia.

General Engineering was represented by an international collection of exhibits in which machine tools, printing and allied machinery, textile machines

and agricultural machinery dominated. In all constructions the desire to obtain a maximum degree of productivity was evident. The competition between the exhibiting countries for high quality and reasonable prices present the buyer with excellent conditions for favourable purchases. That the engineering goods of the German Democratic Republic played a leading part on an international scale was indicated by the fact that the G. D. R. firms at the last Spring Fair not only concluded excellent transactions with the developing countries but also with such states who had reached a high state of technical development. The Soviet Union for instance, West Germany and Great Britain placed large orders for machine tools. Czechoslovakia, Soviet Union, France, Great Britain, the United States and West Germany bought considerable numbers of printing and allied machinery and textile machinery. India concluded deals in these branches too, particularly for machine tools for various purposes, which by the way were also exhibited at the recent Fair on a very large scale.

EXTENSIVE OFFER OF ELECTRO-ENGINEERING, VEHICLES AND PRECISION MACHINES

The range of goods offered at the Leipzig Fair was so varied and universal that it was difficult for a complete survey. The various trade groups are literally self-contained Fairs of their own allowing universal and carefully aimed dispositions. The electro-engineering section ranges from wireless and television sets, measuring and controlling instruments, electro-technical apparatus, cables and insulators to the most heavy exhibits of electro-engineering industry.

VEHICLES ARE OFFERED FOR ROAD, RAIL, WATER & AIR

Particular attention was paid at the Fair to the first German Jet Passenger Plane, Model "152" built in the G. D. R. at Dresden, where series production has already begun. German precision mechanics have good reputation all over the world. The largest part of the more important producers are found on



View of a section of the Machinery Pavilion in the Leipzig Fair '59.

the territory of the German Democratic Republic. The G. D. R. Supplies highly qualified office machinery which at the Leipzig Fair were also for the first time included models on an electronic basis.

The G. D. R. further supplies high grade miniature reflex cameras to many countries of the world and last but not least must be mentioned VEB Carl Zeiss JENA which is the largest precision mechanical and optical plant of the world whose wide range of products for research and industry are a hall mark of highest precision.

SMALL INDUSTRY & HANDICRAFTS ARE WELL CATERED FOR

It goes without saying that Leipzig Fair was not only a show place of Industrial Giants, High Capacity Machines, Aeroplanes, Models of Ships, Scientific Instruments but also featured equipments specially designed for small scale industrial units or for

Handicrafts production, as well as for Agriculture, at a low stage of a technical development. The offer of Agricultural equipment was characteristic of the wide range of goods on show. It meets the requirements of large scale farms in the same way as those of small farms and agricultural units who are dependent on the use of non-mechanised tools. As a matter of fact the offer of tools, at the Leipzig Fair is one of the most interesting Sections of the whole range. The programme included not only all conceivable kinds of tools, hand tools but particularly also those highly-developed mechanised tools which mostly on the basis of hard metallo ceramics make possible the astonishing productivity of modern metal and wood working. Among the exhibits for small production were found stationery power aggregates, small motors, pumps and fittings, water transport equipment for regional use, small grain mills, textile machine, simple equipment for reproduction technique and others.

TEXTILES SECTION

German Textile Machinery for manufacturing High Quality products from Cotton Waste

From Our Overseas Editor

WASTES of cotton fine spinning and other cotton waste are nowadays no wastes of low value but a very good material to be spun. In former years cotton waste brought no profit; partly they were even burnt, or at least, not used for any purpose to bring a profit. However, the latest development has shown that by suitable spinning of cotton waste a yarn can be made out of which good woven clothes, hosiery and knitted goods can be produced. By this way, possibility is given to make good use of these wastes. In many countries, mills have been installed which only work up cotton waste and render good profit. The West-German factory for textile-machinery MaK Maschinenbau Kiel Aktiengesellschaft developed a machine for a profitable spinning of cotton waste.

This factory has a total staff of abt. 4200 men. The manufacture of textile machines had been taken up in 1949 besides other products they are making since decades of years. Many designers, engineers and skilled workers of the more than 100 years old Saxony industry are employed here and an extraordinarily efficient factory could be created, which has carried out considerable deliveries in Germany and Europe, as well as in Asia, Africa and South America.

MaK Maschinenbau Kiel produces a machine set specially for the treatment of cotton waste, consisting of a special card set for cotton coarse yarns, type 604-588, together with the new type ring spinning frame, type 631, or the self-acting mule, type 641. This set has been developed together with other spinning machines for wool, hair yarn and coarse yarns, and it is a complete new design, specially considering the conditions of cotton waste treating. The advantages of these new machines are undermentioned:

THE HOPPER FEEDER

has a separate drive for the upright lattice operated

via an infinitely variable transmission. The automatic weighing scale is controlled by an electro-magnetic device and warrants exactness in weighing. The fluctuation in weight is between 1 to 2%. The variable drive permits the scale pan to be filled 1,2 to 5,7 times per minute and to meet each required output of the card set. Above the upright lattice there is a permanent magnetic strip with a high magnetic power enabling it to remove even heavier parts which have become entangled in the material mixture e. g. pieces of wire, clips, buckles, screws, nails etc. In front of the feed rollers there is a press lattice by which the material is fed in pressed against the feed rollers. This prevents any bulky fibre bundles from passing over the top of the upper feed roller.

THE SPECIAL FEEDING DEVICE

is specially designed for treating cotton waste. The task of this device is to preopen the material and to take off all coarse foreign particles in order to avoid a heavy stress on the card wires of the proper card, and to carry out a proper and adequate carding.

The feeding cylinders are driven via a safety clutch. This stops the latter through an enlarged resistance when foreign particles are entering and because of its disengaging. When the rollers have been turned back by hand, the pieces causing the trouble can be removed. From the feeding device the material is fed to the breaker card by means of a transmitter roller covered with card clothing.

BRAKER CARD

This card has the task to open the material and to parallelize the fibres by carding. For special processing cotton waste the card has 6 pairs of worker—and stripper rollers. The swift and the doffer drum have a diameter of 1250 mm. All working rollers are up to date and are made of steel. They have side flanges

and are covered with card clothing upto the outer edge of the rollers, by this way eliminating the formation of roller waste and fly waste.

The main cylinder, the doffer roller, the strippers, and the fancy are bedded in roller bearings, whilst the worker rollers are bedded in slide bearings with ball shaped bushes. The machine is completely covered with panes of plexiglass in order to enable the operator to observe these rollers during running. The wooden slide-covering reaches to the working cylinders up to a distance of 0,5 mm, by which the formation of roller waste and fly-waste is avoided. The automatic dust remover is of an improved band-type design.

The main cylinder rotates with 150 r. p. m. which corresponds to a peripheral speed of 600 metres/minute. The worker speed can be varied in a simple way by means of a new designed control gear. The fancy is infinitely variable driven and has a lead adjustable from 10 to 50% in comparison with the main cylinder. Owing to this separate fancy drive the fancy speed can be varied with respect to the swift speed without influencing the stripper speed. According to latest experience the strippers are V-belt driven which is more advantageous than the old type of drive. The doffer comb is accurately adjusted, operated by gearings in ball bearings enclosed in tight oil cases and works absolutely noiseless. It warrants an oscillating speed up to 1500 per minute.

BROAD BAND CONVEYOR

Its task is to feed the web doffed from the card to the following machine in form of a coherent band. This device consists of a band former with oscillating drums and removeable carriage, which lay the material into long fibre direction. Upright lattices convey the band to the layer which folds the band properly and therefore feeds the following card quiet uniformly.

FINISHER CARD WITH SMALL CARD

This device consists of a main finisher card of a design like the breaker card, and a small card before it with smaller dimensions. This card has also 6 pairs of workers and strippers specially for processing cotton waste. Naturally the card clothing is here of a finer kind in comparison with the breaker card in order to attain further good processing and to parallelize the material. The main drum of the small card is of 700 mm diameter, it has 3 pairs of workers

and strippers. In the small card another condensation of the folded material is effectuated. In the finisher card again a drafting takes place which intensifies the carding process, which warrants for a good quality yarn.

The finisher card and small card are also completely covered and only the small card is equipped with dust removers. The finisher card itself has none.

The control of the worker and stripper speed as well as of the fancy speed is effected just as at the breaker card. The main cylinders of the cards are driven by slip ring motors, which are generally located in pits and synchronously operated during starting and stopping. Thus even with a fully automatic machine a uniform starting and stopping of all movable pieces is granted as well as the evenness of the yarn.

CARD CLOTHING

This is specially chosen for processing cotton waste. All rollers clothed with hardened saw tooth wire have a fineness 10 to 12 turns per inch. For the card clothing small diameter wire and sector wire is used. By this choice a high number of points per surface unit is attained and herewith in turn a good processing of the material. This type of clothing also helps to diminish the formation of knops. On request the tips of the card cloth wire can be hardened.

CONDENSER

It has to secure that the web arriving from the card is divided into small bands and to round them off by the rubbing process, in order to give them the strength, which is necessary for winding-on and for further treatment. The dividing group may be delivered either of the single tape design or of the multiple tape execution. The dividing rollers are made of special steel, so as to avoid corrosions. The rubber gearing has 4 pairs of aprons which can be supplied in rubber or leather execution. The rubbing shaft and that of the eccentric are bedded in ball bearings, they are easily running and well balanced, and allow a quiet run of the condenser even at the highest feeding speed. The traverse of rubbing leathers may be adjusted from 24 to 48% very simply. Thus a perfect effect of rubbing is granted. According to the further treatment, the thread-guide may be chosen or even the bobbin frames either the one or the other movable or of the fixed type. A central

lubrication takes care for an economic and all-round lubrication. This machine, described as above, allows in continuous service a feeding of 25 to 30 metres/minute. The production must be decreased somewhat when working with bad blendings.

MAK RING SPINNING FRAME, TYPE 631

This frame is very suitable for coarse cotton yarn and its design has approved excellently. The full automatic operation is very advantageous. The adjustment of the delivery speed, spindle speed, draft and twists per meter as well as coping and the twisting tube speed is by means of infinitely variable speed gears which exclude any wrong adjustments. Each group of 4 to 6 spindles is almost sliplessly driven from a spindle drive shaft via helical gears and a tape pulley. The underwinding is effected automatically after the cops are completed. Hand regulation is naturally also provided. Below the bottom rollers there is a pneumatic exhaustor for taking up the broken threads.

Owing to the separate drive of each side of the machine the standstills for doffing, putting up tubes and cleaning are reduced, by which the efficiency and consequently the production are considerably

increased. Furthermore different counts can be spun at each side of the machine which improves its versatility.

MAK SELF-ACTING MULE 641

This mule can also be used for fine spinning of coarse cotton yarn. But with previous deliveries to Central-Asia the ring spinning frame dominated.

The self-acting mule 641 is a new machine design which is superior to the conventional types of mules in every respect. The main advantages of this mule are its high output, due to reduced backing off and reversing times, increased spindle speed and a carriage stroke of 2 meters. The positive spindle drive via helical gears avoids spindle slippage and the stepless spindle speed increase warrants a harmonic accomplishment of the spinning process and ensures a good quality of the yarn. Several spinning comparisons with conventional mules have proved this fact again and again.

The utilization of yarns, produced with the before described cotton waste spinning machines are very versatile. With these yarns high quality textile products can be made which ensure good profits.

Welding Time Reduced to One-eighth

Installation at British Automobile Factory

Automatic equipment now being used for the welding of motor vehicle axle cases at the Birmingham factory of Fisher and Ludlow Ltd. — one of the British Motor Corporation Companies — has reduced average welding time to about one-eighth of that taken by former manual methods on certain thicknesses of material. The equipment, which has been supplied by Quasi-Arc Ltd., of Staffordshire, consists of two automatic welding heads, mounted on a runway above the jigging, which are traversed at welding speeds through a split lead screw. Each end of this has its own driving motor, the traverse of the two heads therefore being independent.

Welding current is supplied to the heads from two 750 ampere direct current power packs which incorporate auxiliary direct current generators for supplying power to drive the lead screws and other controls. The axle cases consist of two pressed halves which are

placed together horizontally in the jig. Here they are held by air-operated, self-locking clamps, which correctly align the pressings and hold them tightly together during the welding operation.

The welding heads, starting at either side of the centre shaft hold of the axle case, traverse outwards, welding the two halves of the seam simultaneously. With one side of the axle case completed, the clamps of the jig are released and the case is turned over for welding the opposite side. While this is being done by the operator, the welding heads automatically return to the starting point of the seam.

The control panel is built into the main frame of the jig, and the vacuum melt circulation system is also controlled from there. In addition to a considerable increase in production since the adoption of the new installation, it is also claimed that the equipment produces consistent, high quality welding with even penetration.

NEWS ABOUT NEW PRODUCTS

NEW GEIGY PRODUCTS

GEIGY'S Circular 1298 illustrates Cuprophenyl Black BWL and Cuprophenyl Black GWL, two new colours with outstanding fastness properties for the production of blacks on cotton and filament and spun viscose rayon. In particular, their fastness to washing at 95°C (washing test c) is unique for this class of dye. In addition to their generally good fastness properties they both have outstanding fastness to light and to perspiration, and are thus of special interest for dyeing dress and sports materials, rainwear materials, knitted goods, sewing threads and all types of articles likely to be washed but not chlorinated. They are also suitable for union dyeing, and withstand synthetic resin finishes.

Their pattern card 0994a illustrates Setacyl dyes of special interest for the dyeing of polyester fibres. The colours are shown in straight dyeings produced on Terylene yarn by carrier and pressure dyeing methods, and a few combination shades are also illustrated, together with bordeaux and black shades produced with the diazotised and developed Setacyl brands. The card gives detailed directions for dyeing and after-treatment, in addition to comprehensive fastness property tables.

Geigy's new Cuprophenyl Dyestuffs Pattern Card 1200b presents a wealth of information on this range of after-coppering dyestuffs. The fastness property tables have been greatly extended and show the dyeing characteristics as well as the main properties, grouped for convenience into fastness to processing and fastness to wear. New features of particular interest to the practical dyer are assessment of light fastness in 1/25 Standard Depth and of the behaviour of the dyes in synthetic resin finishing.

The text itself has also been expanded, and in addition to dyeing instructions gives information about the various padding processes (with a table of solubility at 90 deg. 60 deg. and 40°C), pressure dyeing process and auxiliary products used in the pre-treatment, dyeing and finishing of cellulosic fibres. The card also includes graphs showing rates of exhaustion.

HELIZARIN YELLOW GREEN G

Badische have announced a further addition to the existing range of Helizarin colours, their Helizarin

Yellow Green G, which is illustrated in their card no. 7241. It is claimed to be of particular interest for the dyeing of hangings, and has good all-round fastness properties, including excellent to outstanding fastness to light and good to very good fastness to solvents. It is said to be suitable for both textile printing and pad dyeing, and like the other colours in this range, it is supplied in the form of a highly concentrated aqueous pigment paste, which is fixed on the fabric with the aid of a Helizarin binder. Sample patterns in this card illustrate the dyestuff in screen printing on cotton, matching printing on spun rayon and pad dyed on cotton. Fastness properties are included.

DIRECT DYES ON VISCOSE

I. C. I. Pattern card no. 4545 illustrates the shades of the Chlorazol and Durazol dyestuffs on filament viscose rayon piece and also provides information on the dyeing of both filament and staple viscose rayon in their various forms. It is stated that individual members of these ranges vary in chemical constitution and show wide differences in dyeing, fastness properties and solubility. Thus where no high degree of light or wet fastness is required, the Chlorazol and Chlorazol Fast are said to be satisfactory. In cases where high light fastness is the main requirement, selection from the Durazol range is recommended. Dye and fastness properties are included with the samples dyed on viscose rayon satin. Directions for dyeing are given in the introduction.

CYANAMID'S NEW PURIFYING AGENT

Cyanamid International have introduced a new textile processing agent which, it is claimed, inhibits the development of odour-causing bacteria in fabrics.

The chemical known as Aerotex Purifying Agent No. 1, is said to be most effective on cellulosic fabrics. Good durability is also claimed for it in fabrics made from blends of cellulosic and man-made fibres. The product, it is said, retains its effectiveness after many workings or dry cleanings.

Unlike other anti-odour agents, such as chlorophyl, the new chemical does not work on the principle of suppressing or neutralising offensive smells; instead, it resists the build-up of the initiating bacteria and thus prevents the development of socially unacceptable odours.

PAINTS, PLASTICS & CHEMICALS SECTION

Better Operation with Better Plant Layout

By D. B. Semeyn & R. L. Beesley

The Dow Chemical Company.

PROPER planning in a plastics fabrication plant results in smooth, economical operation and safe, pleasant working conditions. These in turn encourage high quality standards.

Plant layout deals with planning and arranging all of the physical facilities of a manufacturing operation. Application of fundamental plant layout principles to plastics fabrication plants has shown these principles can be applied in the plastics industry as successfully as they have been in other industries.

Five major topics have been selected as a base for discussion of the general principles of plant layout applied in the plastics industry. They are:—

1. Relationship of departments
2. Materials handling
3. Machine arrangement
4. Services, and
5. Safety and plant appearance.

A careful consideration of these factors is required to attain an efficient, workable layout for a new plant or a plant expansion.

RELATIONSHIP OF DEPARTMENTS

The first basic consideration in planning the layout of a manufacturing plant is the relationship of departments, with respect to material flow. In a plastic molding plant the material flows from receiving to storage, to molding room, to finished storage, to shipping. The plant should be laid out with these departments adjacent so that material will be moved a minimum distance and thereby cause minimum traffic and least disturbance.

However, there are more departments in a molding plant. A grinding and blending department for color blending of raw material or for blending it with reground material; Painting and vacuum plating

department which is usually required for custom moldings for appliances and similar applications; Hold storage for some parts which must be held while others are being molded so that they can be assembled or packaged together; Assembly department for assembly, labelling, and packaging which cannot be done at the molding machine. All these departments or work areas are production areas so they must be fitted into the flow line, but not too tightly.

Because it is most logical to combine shipping and receiving in small and medium size plants, this material flow line will assume the shape of an "O" or "U" or perhaps a "W". The material should flow smoothly through the plant from receiving to shipping with the secondary production areas in their proper place along that line but not in any way of "through" traffic.

All the molded parts should not be trucked through the paint shop when only 10% of them require painting. It can be seen that this would mean extra time in handling, possible contamination and confusion and a needless safety hazard.

It is always necessary to have several non-productive areas for maintenance, service, supervision, etc. These should be placed outside of the material flow line.

MATERIALS HANDLING

Materials handling deals with the equipment and methods of getting the material to flow efficiently and economically from one department to another.

There are many different types of equipment supplied to aid in the movement of material within a plant. Anything from a wheelbarrow to a driverless, radio-controlled power truck might be the best method in a specific application.

The following types of portable materials handling

equipment could be used in a plastics fabrication plant:

1. Four-wheel cart
2. Hydraulic low lift truck
3. Powered "Walkie" truck
4. Fork lift truck

The choice of any one of these pieces of equipment is determined by the amount of material to be handled and the availability of warehouse space.

With the more powerful or versatile equipment the same job can be done with fewer manhours, and warehouse floor area can be reduced.

Air power can be used to move granular or powdered material in several phases of plant flow, from a boxcar or truck to silos and from those silos to processing in a complete "untouched by human hands" system. Of course, this is only practicable where a large amount of single material is used. An airveyor can be used to move material from standard containers to the machine hopper, either from the floor by the machine or even from the storage area.

Conveyors are used to move finished or semi-finished parts away from the machines and through the other departments. A belt conveyor is easy to install and requires no special hooks or fixtures for parts. An overhead chain conveyor takes floor space only where it dips down at a work station; it can also turn corners easily. Since both types reduce traffic in aisles they could be narrower as a result and also safer. A conveyor could eliminate the need for a semifinished part storage area. Of course, close coordination would be necessary between production and assembly.

In the analysis of a specific job to determine which type of equipment to use, certain questions arise:

Will larger, more versatile and more expensive equipment allow the use of fewer men in the handling of material?

Will space be saved by using this equipment?

Will the wages and space saved pay for that equipment in a reasonable period of time?

Will it make the plant safer or cleaner?

Will it increase plant efficiency by moving things

quicker, by better utilisation of peoples' time, or by keeping parts cleaner?

What building changes may be necessary because of this equipment, such as increasing floor strength and door height?

The layout of the plant and of individual departments must allow for the type of material handling equipment to be used. Machine arrangement is another important consideration.

MACHINE ARRANGEMENT

Injection molding machines can be arranged in three basic patterns:

1. parallel to the aisles,
2. perpendicular to the aisle, or
3. at some lesser angle, at 45 degrees

A machine with its accessories and working space will occupy approximately the same floor area in any arrangement. Placing machines at 45 degrees offers a slight advantage in space but there will be a triangular area wasted at each end of a row of machines. A longer aisle will be required if the machines are placed parallel to it, and wider aisles will be necessary with machines at an angle to them. The choice of a pattern should be determined by its relative advantages in maintenance, supervision, material handling, appearance, and employee comfort.

If machines are placed parallel to the aisle an unobstructed view is obtained of the entire department. From one position, the supervisor is able to see all of the work areas and the operators. If the machines are placed at any angle to the aisle they hide the operators and make it necessary for the supervisor to roam the area.

With the machines parallel to the aisle, mold changes or maintenance work on one machine would not affect the operation of adjacent machines. This would also apply to delivering material or taking parts away. The highest degree of accessibility is attained. The general appearance will be pleasing, even if large and small machines are placed together. Machine widths do not vary much with size: therefore, the machines can be placed in line, perhaps under a common monorail. All will be close to the same bank of utilities and little floor space will be lost around the smaller machines.

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Machines parallel to the aisle will give several advantages in the "employee comfort" aspect. An operator will feel less confined and receive less radiant heat without a machine directly at his back. Better lighting can be planned. This arrangement would be safer since each operator will be in constant view of other employees.

Molding machine lengths vary considerably with size. If machines of different sizes are placed in the same row perpendicular to the aisle there will be waste floor space behind the smaller machines. If the original layout were planned for smaller machines, it would be difficult to add a large one later. A department arranged in this manner can appear disorderly.

With machines perpendicular to the aisle, each machine has only a small "frontage" on the aisle where materials and parts must be convenient for a truck to pick up. Wider aisles will be necessary to allow for the trucks turning radius. Maintenance work may interrupt the operation of adjacent machines.

Not only the floor space required but also the operating efficiency should be considered when planning the machine layout. Although the pattern of machines parallel to the aisle may require slightly more overall floor area, there appears to be an overbalancing number of other factors in its favour.

SERVICES

In any arrangement the molding machines will require the common utilities: air, water, electricity, etc. It is common practice to run piping overhead about ten feet above the floor, in a header bank, possibly above an aisle, with branches to each machine and work station. This old proven method has an advantage of flexibility; changes or additions can be made quite easily. It also has some disadvantages. If, for instance, it has been planned to use an overhead crane for "A" frame to assist in changing molds, this method of piping would be impossible. The headers could be located on or near a wall with branches down the wall and out to the machine, but this results in only limited accessibility to the back of the machine.

There is another place to locate these headers that solves these problems; that is, below the floor. A trench or tunnel for these utilities placed adjacent to the machines and covered with a floor plate or grating will result in the greatest accessibility to machines,

shortest branches from the headers, neatest possible appearance, and will be just as easy and safer for the maintenance pipe fitter. This trench can be made large enough for maintenance men to actually work in or just large enough for the piping. The use of a trench allows the drainage piping to be with the other headers so no special planning for this is necessary before the concrete floor is laid.

This may at first appear rather confining or inflexible. Actually it has a great degree of flexibility because machines or work stations may be placed at any point and on either side along this trench. If the plant is initially laid out with trenches and aisles alternately every 20 feet or so, there will be complete flexibility for machine changes and extensions.

Electrical power can be distributed by conduit from centrally located motor starters to the machines or by buss duct where a motor starter is "plugged in" to the covered buss bars close to the machine. The buss duct will give flexibility and economy when making changes. It is normally placed overhead, but it too can be placed in a trench with a little thought given to protect it from water.

Most small and medium sized plants will not attempt to fabricate their own dies and molds, but they should have facilities for making minor repairs or alternations on these tools. It may be necessary to have a few shop tools, such as a small lathe, a drill press, and a small milling machine to accomplish these ends. This shop should be in a separate room out of the line of flow material and adjacent to the mold storage.

Mold storage should be in or near the molding room. Vertical storage of molds saves space. Some fabricators have gone to the expense of a specially heated and humidity-controlled room to protect their molds from corrosion and to reduce tool maintenance problems.

Small molds can be handled manually on a die truck. Larger ones require either a crane, an "A" frame, or a power truck. If a power truck is used it should be able to lift high enough to place a mold in a machine between the top tie bars. An "A" frame, though the least expensive, is awkward and requires more free space around the machines for manoeuvrability. An overhead crane, on the other hand, while the most expensive initially, requires no floor space and can be manipulated easily and quickly. It can pick up only one thing at a time, therefore, a

machine may occasionally lose time because the crane is busy.

Routine maintenance work requires space in the original layout of the plant and space adjacent to the machine shop is most desirable. Maintenance equipment and supplies should be stored so they are readily available. Electric trucks will require parking space at a recharge station. The maintenance people will need benches for the disassembly and repair of machine parts and, of course, adequate space around these benches to work safely.

SAFETY AND PLANT APPEARANCE

Safety and plant appearance go hand in hand with better operation, improved employee morale, and increased plant efficiency.

Safety is essential to smooth operation. Safety should be a foremost consideration when laying out the plant and should be regarded in all phases of plant operation.

Heavy traffic aisles should be wide enough for two trucks and walking personnel.

Aisles should be straight for better visibility.

Where a blind corner is unavoidable, it should be provided with mirrors.

The plant should be well lighted; people should be able to see what they and others are doing.

Aisle borders should be marked clearly to eliminate tripping hazards.

Moving parts of machinery should be painted so bright a color that their movement is visible even from the corner of the eye.

Machines should be so placed that a person cannot be pinched by part of the machine moving close to another object.

Fast moving parts, such as V-belts and shaft couplings, should be completely covered.

Awkward pieces of equipment, like a drum tumbler, should be caged with electrical interlocks on the gates.

Handrails should be provided on catwalks, ladders, and stairways.

Incorporate electrical or mechanical interlocks to prevent energizing blenders, electrical distribution boxes, grinders, and other equipment while cleaning or servicing them. Employees may complain that it takes longer to do a job with these interlocks or that they can't see so well with a face shield while using the scrap grinder; but they will appreciate the consideration for their safety.

Good housekeeping is a must for a safe plant, and is easy if it is planned into the layout. Straight, clearly marked aisles, orderly layout of equipment, a pleasing color scheme, well located bright lighting, the apparent absence of piping, etc., will result in a neat appearing plant. This inherent neatness is incentive to keep the plant in good order.

All this has a double barrelled effect. It not only keeps employees "working employees" but it improves their morale and therefore their efficiency. People desire to work in clean, light, pleasant surroundings and they will do a better job because of these conditions, perhaps subconsciously.

THE TOTAL PLAN

After consideration has been given to the various areas they can be pieced together to determine over-all shape and size of the building. From a definite flow pattern producing areas are adjacent to eliminate unnecessary traffic and material handling; service areas are outside this flow pattern.

The plant should be laid out with both the present and future expansions in mind. How should the plant grow? What will be necessary before more machines can be added?

Fixed or immovable areas such as boiler room, restrooms, shops, etc., should be kept out of the path of expansion. It is better to group these together; in this way they are one block to work around rather than several.

Expendable areas such as the different storages which can be easily moved, should be adjacent to the fabricating areas. Construction of additional storage area at some future date would be most economical, and the old storage equipment is expensive to move, so these areas should be enlarged rather than moved.

It might seem a little cheaper to construct a new area for new machines than to revise an old area; that is, go around the storage and construct a second molding room. But wouldn't this perhaps require an additional supervisor? It should be remembered that if it appears necessary to increase the molding capacity it will also be necessary to increase storage and other department areas.

Once the size and shape of the plant and the direction of future expansion are determined, it will be possible to select a plant site. The location should first be determined considering such things as availability of labour, electrical power, water, sewage, rail siding; distance from highway, and local road limitations, including alleys. The size of the lot should allow for expansion as well as a trailer turn around, employee parking, and other "outside-of-the building" activities.

REFERENCES AND AIDS

Several books have been published about plant layout and such related subjects as materials handling, industrial buildings, and better methods. The list includes:

Practical Plant Layout by Muther, *Plant Layout and Materials Handling* by Apple, and *Plant Layout, Planning and Practice* by Malleck and Gandreau, to name a few. All are authorities in this field.

To arrive at area requirements and area relationships, it will be necessary to actually layout the plan to scale to check the machine spacing and evaluate the overall arrangement. Planning aids are available to make this an easy task. These can be moved around to test different layouts which can be easily visualized by anyone.

A two dimensional or plan view layout can be just as versatile and much more economical, but perhaps not as easily visualized. There are several firms which

supply accurate 2D transparent templates of any piece of equipment. These templates show door opening and moving part space required in addition to the floor plan of a machine. Adhesive backing allows them to be applied and reapplied to a transparent grid squared off in scale feet. When a plan is arrived at, even a tentative one, the entire assembly can be passed through a duplicating machine to obtain a permanent record.

Tapes also are available which have been printed to symbolize building walls, aisles, conveyors, building columns, and so on.

CONCLUSIONS

Although plant layout is a science in itself, an individual application involves a fabricator's own experience and personal opinions.

After the decisions have been made about each small part of the whole operation, the pieces should fit together like a checkerboard. These small decisions should be based mainly on an individual plant's experience, but other methods available should not be overlooked. If something appears practical it should be investigated further; after the cost is balanced against savings plus other advantages the answer should be self-evident.

During the planning and construction of a new plant, try to keep in mind appearance, safety, and employee comfort. Very often these things can be planned into a plant without extra cost or inconvenience.

Not long ago an architect said, "Any building, or room for that matter, that has the careful attention of an intelligent person during the planning stage will be a workable one." Tailored to the special requirements of a plastics fabricating plant, the statement might have been, "Any molding plant that has the careful attention of an experienced molder during the planning stage will operate more smoothly and efficiently."

Anglo-American Nuclear Manufacturing Link Formed

Babcock & Wilcox Co., New York is to pool its "know how" with Babcock & Wilcox Ltd, a British manufacturer of steam plants for nuclear power stations. B & W Ltd., as a member of the English Electric — Babcock & Wilcox — Taylor Woodrow atomic power consortium, is making equipment for the largest nuclear power station which is being constructed at Hinkley Point, Somerset. It designed and constructed the steam raising plant at Calder Hall and Chapel Cross. Although the British firm originated from the American Company, there has been no financial link between the two firms since 1891.

Industry Profits by Latest Developments in Detergents

ONE of the most important aspects of industrial housecleaning is the selection of a detergent to perform a particular function.

Chemists classify these functions in the following categories: Janitor-supply, specialized custom cleaning, metal process cleaning and the cleaning of components used in food processing, Globe Press Service reports.

The field of janitor-supply includes hard-surface detergents for cleaning walls, floors, etc., and detergent-sanitizers, which are used primarily in areas where disinfecting as well as cleaning must be done—i. e., rest rooms and laboratories. It is an area where plant maintenance personnel may make a decision on the type of detergent to be used once a few basic points are in mind.

Specialized custom-cleaning, on the other hand, requires particular knowledge, special equipment and the proper chemicals. This field takes in plants where a particular cleaning problem exists. It includes the dislodging of unusual deposits, such as grease in an oil refinery, and the cleaning of manufacturing equipment, tank trucks, tank trains and ships. These jobs should be examined individually and tested in the laboratory by a specialist to determine which detergent compound is best suited.

In the metalworking field, cleaning is a primary step in the finishing of various metals, just as cleaning the walls of a home is a prerequisite to painting. Alkaline cleaners have been used with a great deal of success in this field and the proper choice of detergent type may be determined through the examination of individual conditions.

In the field of food-processing, detergent sanitizers again enter the picture.

For all of these respective industrial uses, new products are being introduced constantly and improvements and refinements are being made on old products. An examination of each use individually will reveal some of the advances being made in the field.

JANITOR-SUPPLY

According to Dr. Fred Woodward of the Antara

Chemicals Division of General Aniline & Film Corporation (U. S. A), the synthetic detergent has virtually replaced soap for janitorial uses. These synthetic detergents are known as surface active agents—"surfactants." The surfactants detergents with molecules composed of one portion that is soluble in water and another that is soluble in oil. Thus, by adding surfactants to water, the water soluble portion of the molecule will extend into the water and the oil soluble portion will extend into the oil, enabling grease, grime and dirt to be literally washed away. This gives the surfactant greater cleaning power and makes it equally effective in hard water and cold. Soap does not have these qualities: hence the reasons for the switch from straight soap to a surfactant as a hard surface cleaner.

Surfactants such as those mentioned are built from either one of two basic chemicals—alkylos amide or nonylphenoxy polyoxy-ethylene ethanol, the latter given the trade name Igepals by General Aniline & Film. These are usually used in conjunction with extenders that make a little go a long way. Of the two, the alkylol amides have been found to be less effective and the Igepals are seeing greater use in industry, where the soil load is heavy.

Another change in detergents for janitorial usage, according to Dr. Woodward, is in the detergent sanitizers. Previously, a chemical serious known as quaternary ammonium chlorides was used for the combined cleaning and disinfecting job. This group, however, has been found to be effective in killing bacteria only over a narrow range.

It is being replaced by a group known as iodophors, which are combinations of iodine in the form of a soluble, activated complex—a surfactant. According to the GAF chemist, "practically every firm in the janitor supply field has developed a product based on the iodophors or is working actively towards putting such a product on the market." The basic reasons for this, Dr. Woodward says, are the iodophors' greater range of bacteria-killing powers and the increased rate of kill. This new new group will even destroy polio virus and tuberculosis spores, which remained untouched by quaternary ammonium chlorides. "In addition," he says, "the iodophors are relatively non-toxic, non-staining, insensitive to hard water and effective in cold."

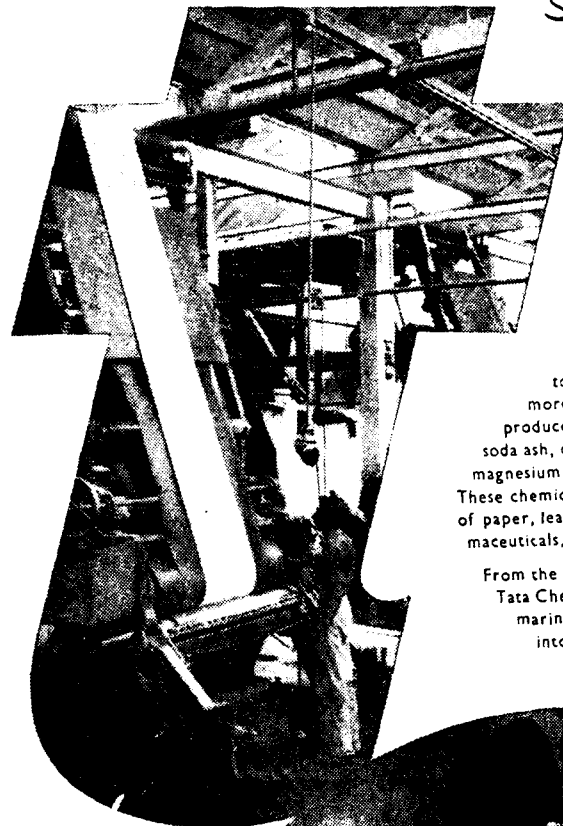
Imagine a world without
salt!



Can you imagine how poor the world would be without salt? Your food would lose its savour; there would be no paper to write on; no leather for shoes; no glass to replace the broken window panes; no medicine for the ailing.

In olden days man used common salt as an article of currency and commerce, but the scientists of today have turned it to richer and more varied uses. Out of it they produce such basic heavy chemicals as soda ash, caustic soda, bicarbonate of soda, magnesium chloride and bleaching powder. These chemicals are used in the manufacture of paper, leather, glass, soap, textiles, pharmaceuticals, and other useful commodities.

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Hawker Siddeley Group Spares no Expense on A.W.A.'s New Venture

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PRODUCTION of the Armstrong Whitworth Argosy freightercoach — due to make its first flight before the end of the year — has been so smooth that all production records for an aircraft of this class and complexity will be broken, not only in Britain but, almost certainly, anywhere in the world, including the United States.

A completely private venture, the Argosy is backed by the resources of the Hawker Siddeley Group to the extent, it is estimated, of about £10 million and, as Mr. H. M. Woodhams, managing director of Sir W. G. Armstrong Whitworth Aircraft Ltd., puts it: "No money has been spared in preparing Argosy series production".

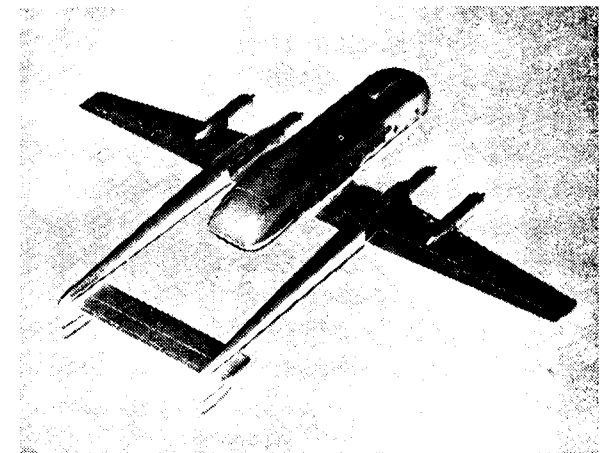
The completed Argosy series will comprise:

A. W. 650 Argosy freightercoach (4 Rolls-Royce Darts) — Pressurised fuselage for operation over medium range. Freight loaded at front and rear of fuselage via side-hinged doors which are normally power operated but may be operated by hand. There

is an inflatable seal to the flat mating surfaces. This aircraft will make it possible to reduce the overall costs per unit load handled to the lowest levels yet reached in air transport.

A. W. 651 (2 ROLLS-ROYCE TYNES)

A. W. 660 Military transport (4 Rolls-Royce Darts) — Performance similar to A. W. 650 Argosy. Fitted with



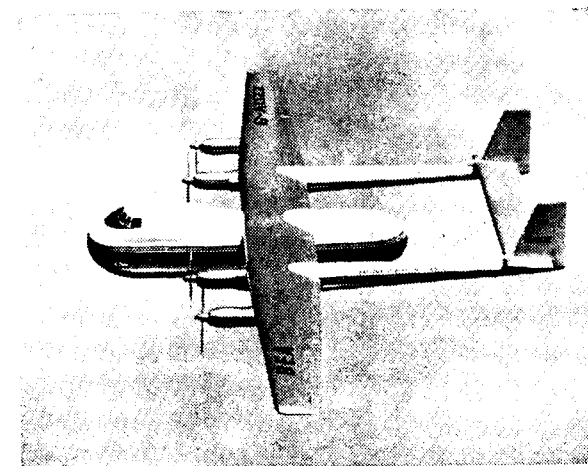
Model of the A.W. 660 Military Transport.

special beaver tail rear doors incorporating a built-in loading ramp. The floor is unobstructed and can take a variety of military vehicles and equipment. Hold designed for air-dropping supplies.

A. W. 661 (2 ROLLS-ROYCE TYNES)

A. W. 670 Air ferry (4 Rolls-Royce Darts) — Wider, unpressurised double-deck fuselage for short-haul car, freight or coach-class passengers. Six cars, side by side in pairs, and 30 'upstairs' passengers can be carried in car ferry form.

A. W. 671 Airbus (4 Rolls-Royce Darts) — Short-range transport for 126 coach-class or 116 tourist-class-passengers. On lower deck 96 seats are placed eight

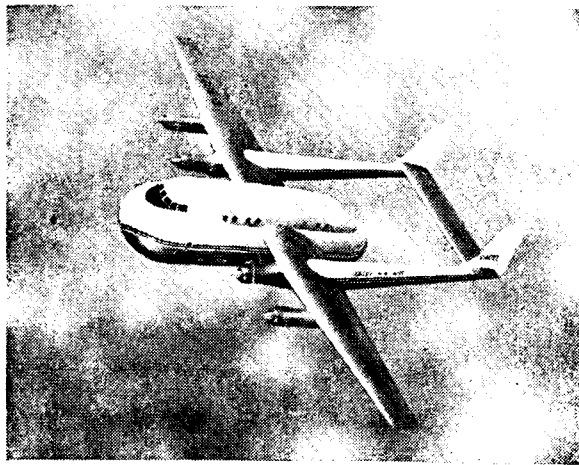


The A.W. 650 ARGOSY freightercoach aircraft.

abreast, back to back. Direct operating cost on route-lengths up to 200 miles is under 2d. per seat mile.

Armstrong Whitworth Aircraft's rapid development of this series is evidence that they are determined to go ahead and seek out fresh markets for new aeroplanes without waiting for military backing or 'insurance' orders at home.

Having made a survey of world requirements for freighter aircraft, Armstrong Whitworth designed and planned production of the new series as one operation. The decision to go ahead with the building of the Argosy was made by the Hawker Siddeley Group on September 11th, 1956. Work began immediately at the Coventry factories of Sir W. G. Armstrong Whitworth Aircraft Ltd., despite a heavy programme for the construction of the transonic Hunter fighter, the all-weather Javelin fighter, the Armstrong Whitworth Sea Hawk and airframe work on the Avro Vulcan delta bomber. Very tight production schedules have been met at each building stage, and as they are completed all production drawings are microfilmed for future use when supplying overseas customers with information.



Model of the AW 670 Car Ferry/Airbus.

Full certification for C. of A. and C. A. A. requirements should be completed by mid-1960, and the aircraft is expected to enter regular airline service later that year. Aircraft will be available to airlines for route proving and crew familiarisation from mid-1959 onwards.

Before design studies were finalised, Hawker Siddeley Regional Executives in various parts of the world and A. W. A.'s sales department made a comprehensive survey of operators' requirements.

Note was taken too of the military transport requirements of the world's air forces.

When the reports were analysed, four clear specifications emerged:

- (1) A general freighting aircraft of 82,000 lbs. (37,195 kg.) all up weight, with front and rear end loading facilities, that was of low capital cost, reliable and easy to maintain and which would operate economically over short-medium sectors with maximum payload of about 13½ short tons and cruise about 300 m. p. h. It had to be capable also of "out-back" operations from semi-prepared grass strips and had to be quickly convertible to a comfortable, pressurised air liner carrying about 75 passengers.
- (2) A military freighter of a similar specification, but able to open the rear doors in flight for supply dropping, and to have an integral loading ramp.
- (3) A car ferry for six large-size cars and 30 passengers.
- (4) An ultra short-haul "airbus" transport capable of achieving high density passenger movements at a specific direct operating cost of about 2d. per seat mile.

Specification (1) was designated the A. W. 650; specification (2) the A. W. 660 military transport; specification (3) the A. W. 670 Air Ferry; specification (4) the A. W. 671 Airbus.

The passenger airliner layout shows the Argosy as a most comfortable aeroplane with a wide, spacious, pressurised cabin in which noise level is reduced to a minimum because of the wide clearance between the propeller tips and the sides of the fuselage. An interesting feature is the new-type triple seating which can be folded away against the side of the fuselage for converting the Argosy quickly from passenger-carrying to freighting.

Air fares which compete directly with rail and boat travel are made possible with the Airbus version of the Argosy, which on route lengths of about 200 miles has a direct operating cost of under 2d. per seat mile.

Able to carry 96 passengers on the lower deck, and 30 passengers 'upstairs', the Airbus is a version

of the 670 Argosy series unpressurised Air Ferry which carries six cars on its lower deck and 30 passengers above.

Referring to the Airbus, Mr. Woodhams said: "It is on the short routes that operators find difficulty in making any profit. Our Airbus has been designed specifically for these short lengths, and on most British domestic routes it can turn a loss into a profit".

Careful consideration of general civilian uses was the deciding factor in the adoption of a twin boom configuration by A. W. A for their revolutionary new Argosy series.

Twin-booms provide for varying fuselage sizes without altering the rest of the airframe, and also make for versatility of loading and unloading freight, passengers, and military stores. Also, in the military version alternative rear-end doors may quickly be substituted.

Under a design team led by Mr. E. D. Keen, B.Sc., F.R.Ae.S., A.F.I.Ae.S., A.W.A.'s Chief Designer, production of the new Argosy series is meeting very tight building stage schedules, each of which is controlled to a target time.

Two specially erected water tanks will allow a full programme of tank testing to be carried out, and by the time of the first flight over 1,000 hours of wind tunnel running will have been carried out at Armstrong Whitworth, A. V. Roe, Armstrong Siddeley Motors and the National Physical Laboratory. Recently wind tunnel testing has taken place with a "power-on" model incorporating airscrews driven by electric motors in the fuselage. There has been also a ditching trials programme in the Saunders-Roe tank, and despite the high wing the Argosy has been developed to exhibit satisfactory ditching characteristics.

The final stage of structures testing is nearing completion with the destruction of a full fuselage specimen in a water tank at the company's Whitley factory. This fuselage, together with a 10 ft specimen, tested a year ago, has revealed much valuable data and confirmed the calculated strength of the structure. In a second water tank a complete airframe fatigue test will be carried out within the next few months. The fuselage will be mounted on the tank base, and the remainder of the airframe — wings, tailbooms and tail unit — will be attached outside the tank. Fatigue testing will go on for about eighteen months.

Detail structures tests have included stress level investigations of the fuselage under pressure and with freight floor loadings.

A 200-ton Losenhausen tension-and-compression machine has been installed at the Whitley factory to help complete the programme. Many tests have been carried out already with a 60-ton Losenhausen.

Structurally, the Argosy represents an extension of traditional practice to meet the needs of contemporary design requirements.

The fuselage has both frames and stringers attached to the skin to provide alternative load paths and as many "crack stoppers" as possible. It is, therefore, fully "fail-safe".

Extensive use has been made of Redux bonding — window reinforcements, skin doubler plates and much of the tail unit are examples.

The autoclave method of curing has been adopted, using either aluminium or rubber pressure pads, according to the components.

Conventional solid riveting with mushroom-shaped heads is used on the fuselage. Wing and tail skin is countersunk, and the rivets have machined heads.

Although the airframe structure is generally fairly orthodox so far as materials and methods of attachment are concerned, some of the structure is unique and represents the most advanced thoughts.

A new development which has become a standard procedure is the X-ray inspection of fuselage joints. This technique will be used to inspect for cracks, which otherwise would have remained hidden when performing major airframe overhauls.

There are nine main aspects in the production of the Argosy-pressings, machine-shop work, details, sub-assemblies, unit erection, fixed fittings, equipment, final assembly and complete aircraft sent to flight hangar.

Before the first flight thorough stiffness and resonance testing will be undertaken with the most modern equipment. This will enable the estimates of aeroelastic and dynamic effects of aircraft to be checked thoroughly.

All the aircraft under construction are being made on production jigs and will be fully equipped with all systems and services right from the start.

To date, six fuselages have been built—five are taking their place on the final assembly line and one is being used for water tank testing, fitted with all controls and the full-width “eggshell” front and rear doors.

Test rigs have been functioning for some time. They include hydraulics (for flaps and undercarriage), fuel flowing in a dummy wing and electrical de-icing and anti-icing.

The whole emphasis of the Argosy programme is on capacity for large-scale production.

Fabrication cycle for the first aeroplane was 22 months. In full production this will come down to 12 months.

Right from the beginning of the Argosy programme the aim has been to offer aircraft from an existing production line backed by a complete spares service. The spares organisation becomes fully operative with first flight.

With present enquiries coming into the Hawker Siddeley Aviation Division it seems as though A.W.A.'s great production capacity will definitely be needed.

MYLAR ROPE SERVES LONG PULL OF CABLES

Rope stranded from Mylar is credited with solving a problem of a long pull of conductors through conduit. The rope furnished by U. S. Plastic Rope Inc., Redwood City, California was used by R. C. Electric Co. same city. On a recent project four 500 Mcm cables weighing more than 1,200 lb. were pulled through 162-ft. length of 4-in. conduit with a Mylar rope only 3/8 in. diam. An electric winch provided the pulling

power. The conduit through which the four RHW cables had to be pulled contained one 90-deg. bend and two offsets. First 100 ft. was Orangeburg pipe and the remaining 62 ft. was galvanized. A 3/8-in. conventional 3-strand rope of Mylar was selected because of its strength. In addition it is said to have retained its handling characteristics, had no stretch, factor and did not damage the conduit

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I, T. S. Nagaraja Rao, hereby declare that the particulars given above are true to the best of my knowledge and belief.

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(Sd.) **T. S. Nagaraja Rao,**
Signature of Publisher.

Building Donald Campbell's “Bluebird”

By an Overseas Correspondent

OVER the past four years, Donald Campbell, in a series of record-breaking runs with his boat “Bluebird”, has put 80 m. p. h. on the world's water speed record. His latest official record stands at just under 250 m. p. h. On his fastest runs, he has approached 300 m. p. h.

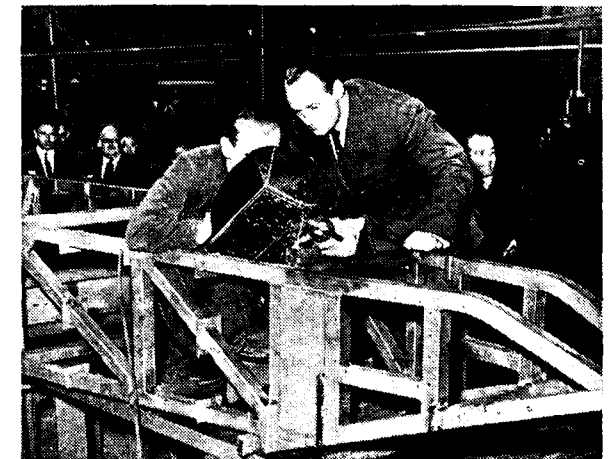
Breaking records, however, is only one part of the “Bluebird” story. Behind these high speed runs, says Mr. Campbell, there is a serious purpose—principally that of testing out new engineering theories for building and controlling high speed water craft. Indeed, “Bluebird” herself only came into being after a fascinating piece of scientific detective work by Mr. Campbell and his designers.

It was soon after John Cobb was tragically killed, when his boat “Crusader” disintegrated at something over 200 m. p. h. that the new design team set to work to build “Bluebird”. They decided that in the region of 200 m. p. h. there must be a water barrier (rather like the sound barrier faced by aircraft) which set up shock waves able to tear any conventionally designed structure to pieces. So they sent for a cine film, which showed Cobb's boat breaking up, and enlarged each individual picture in turn. From the pictures they carefully calculated the oscillations sustained by the hull immediately before it disintegrated, and therefrom the stresses on each individual frame member. It was then possible to work out the exact sequence of failures and transferred stresses leading to the break up.

This valuable information enabled the team to contrive for “Bluebird” a hull stronger than any which had ever been built. In order that it should also be lighter than all its predecessors, they worked out an ingenious design using seamless high tensile steel tubes welded together.

When completed, the hull weighed only 580 lbs.—which gave “Bluebird” a lower all-up weight than

that of any similar boat ever constructed, while still being five times stronger than Malcolm Campbell's old “Bluebird”, and three times stronger than Cobb's “Crusader”. Furthermore, it was successfully tested in the vertical plane to a factor of 27 G—perhaps twice the stress factor required for a supersonic fighter.



Mr. Donald Campbell watching a welder at work on the frame-work for “BLUEBIRD” made from square section seamless Chrome Molybdenum steel tubing at Accles & Pollock's factory.

The task of making a hull to this unique design was given to Accles & Pollock Ltd., of Oldbury, Birmingham, England, who devised a special sequence of operations to avoid distortion caused by the heat involved in welding. A chrome-molybdenum steel was chosen to British Standard Specification T. 60. The specification demanded tensile test figures of .2 per cent proof stress, 68 tons p. s. i. minimum, 78 tons p. s. i. maximum after hardening and tempering, and an ultimate tensile strength of 50 tons p. s. i. minimum. The hull, 24 ft. long, 3 ft. 8 ins. wide and 2 ft. deep, contained 275 ft. of seamless tube—mostly 2 ins. square section, 14 and 16 gauge. The total welding run was about 200 ft. in approximately 250 separate welded joints.

The technique for building these complicated

(Continued on page A.6)

Helicopters To help Lay New Oil Pipe Line

By an Aviation Correspondent

BRISTOW Helicopters Limited, Henstridge, Somerset, have placed an order with Westland Aircraft Limited for two Widgeon helicopters which they are to operate under charter to the Iranian Oil Exploration and Producing Company in Iran.

The Widgeons are being air-freighted direct to Abadan from London Airport on Sunday (December 7) and will be assembled and test flown on arrival.

Almost immediately they will start operations as personnel and equipment carriers for the IOEPC and the task force of the contractors, Constructors John Brown Limited, which is due to begin construction of a pipe line from the oil fields at Gach Saran to Kharg Island, some twenty miles off the Iranian coast.

This will be the first time that an oil company has employed helicopters in connection with pipe-laying

operations in the Middle East. Their inclusion in the task force is calculated to reduce considerably the time that would be needed for completion of the undertaking if surface transport only were used.

Bristow Helicopters Limited, is one of the leading independent British operating companies specialising in the industrial application of helicopters. For the past year they have been operating two Widgeons in the Persian Gulf under charter to the British Petroleum Company Ltd. and the Compagnie Francaise des Petroles who are jointly engaged in off-shore drilling for oil. In addition, the Company operates in the area two Westland Whirlwinds owned by the Shell Petroleum Company Ltd.

The Widgeon is a five-place helicopter which is in civil and military use in Japan, Brazil, Hong Kong, Jordan and elsewhere. It is the smallest of the four Westland types currently in production and is powered by the Alvis Leonides piston engine.

(Continued from page A.5)

built-up structures, originally developed by Accles & Pollock Ltd., for aircraft, has also been adapted to other applications, including racing car chassis, where great strength must be coupled with light weight. But few, if any, other applications can have provided such a severe testing of structure as the tremendous pounding withstood by "Bluebird's" hull during four consecutive years of high speed runs.

As Mr. Campbell himself has said, modern jet engines provide ample power for anyone to go as fast as they like; the problem is to put such engines into structures that will stay in one piece when

subjected to very severe stresses. Interviewed before his first record attempt, he described "Bluebird's" novel tubular hull as "the backbone of my whole endeavour".

This hull is indeed an outstanding example of the adaptability of the precision steel tube, but the modern tube industry serves mankind in many different ways—from hypodermic needles to fuel element cans in the heart of an atomic reactor. Some of the latest developments in this versatile art will be exhibited by Accles & Pollock Ltd. at the Engineering, Marine, Welding and Nuclear Energy Exhibition at Olympia, London (April 16—30, 1959).

MARINE ENGINEERING SECTION

MARINE BOILERS

By A Marine Engineering Correspondent
Warsaw

MANUFACTURING of marine boilers—a separate branch of the Polish Shipbuilding Industry—is carried out by one of the departments of the Stocznia Gdanska (Gdansk Shipyard). In the post-war period Stocznia Gdanska has manufactured 300 marine boilers of various types and sizes, including one hundred header boilers. Stocznia Gdanska supplies both main and auxiliary boilers for all vessels built in Polish shipyards. Recently Stocznia Gdanska has received enquiries regarding the delivery of marine boilers to China, Finland and Yugoslavia.

The present production programme does not illustrate all the possibilities in this respect. Stocznia Gdanska is able to execute any order for marine boilers.

The boilers can be built, depending on the customer's requirements, in accordance with the regulations and under the survey of the following classification societies:

- Lloyd's Register of Shipping.
- Det Norske Veritas.
- Register of USSR.
- Polish Register of Shipping.

MAIN BOILERS

Stocznia Gdanska manufactures the following types of main marine boilers:

- (a) header boilers—symbol WB.
- (b) Scotch type boilers—symbol PA.
- (c) boilers of Howden-Johnson type—HJ.

HEADER BOILERS WB

At present two kinds of header boilers are produced: WB 1 and WB 2. The characteristics of these boilers are given in Table 1.

Header Boiler WB 1

As this is destined for the mother ship of herring fishing boats it is of special construction which differs from standard boilers of this type. The water system of this boiler includes a special steam de-superheater of surface type, situated outside the boiler. This de-superheater is able to reduce the steam temperature of 14 t/h from 325°C to 220°C.

In the front wall of the boiler 4 burners of pressure type are mounted. On the sides of the combus-

TABLE 1

Characteristics	Boiler	
	WB 1	WB 2
Working pressure kG/cm ²	16	16
Output t/h	17.5	6.5
Temperature of super-heated steam (after regulator) °C	325	325
Temperature of de-super-heated steam °C	220	220
Heating surface (exhaust gases side) m ²	496.5	213
(Including water walls of the combustion chamber) m ²	15.2	—
Heating surface of steam superheater m ²	135	38.4
Heating surface of economizer m ²	110	41
Temperature of feed water (before Eco.) °C	80	80

TABLE 1 (Contd.)

Characteristics	Boiler	
	WB 1	WB 2
Temperature of heated water (after Eco) °C	110	100
Temperature of heated air °C	ab. 60	ab. 60
Efficiency of the boiler at the normal load %	84	84
Fuel	heavy oil	heavy oil
Number of burners	4	2
Type of burners	pressure	pressure
Maximum output of heavy oil for 1 burner	400	400
Total weight of the boiler.		
—without water	t ab. 100	49
—with water	t ab. 110	54
The boiler is built according to the regulations and under the survey of classification society	R. USSR PRS	NV LR R. USSR (PRS)

tion chamber there are water walls consisting of tubes $\varnothing 83 \times 5$ mm. The water wall headers are connected with the boiler drum by means of special pipings. The water tubes situated in 21 headers form the proper heating surface of the boiler. Each header consists of 1 row of water tubes $\varnothing 102 \times 5$ mm and of 21 rows of water tubes $\varnothing 44,5$ mm.

The steam superheater with 192 U-form coils ($\varnothing 32 \times 3,5$ mm) of molibden steel is situated between the fifth and the sixth rows of the water tubes. The steam de-superheater system includes a temperature regulator of the superheated steam. The surface type regulator is in the boiler drum. The economizer is situated behind the convex area of the boiler. This economizer consists of 9 sections of coils $\varnothing 32 \times 3$ mm. Air is carried to the burners by a channel lying along the back, bottom and front walls of the combustion chamber.

The boilers WB 1 are equipped with complete fittings, steam driven soot blowers and automatic feed regulators of the Hannemann system. Each boiler possesses a separate set of control and measuring devices ensuring the economic work of the boiler. If the customer wishes the boilers WB 1 can be fully or partly equipped with the automatic arrangements.

The 9,000 t. d. w. mother ship for herring fishing boats, built by Stocznia Gdanska, has two boilers WB 1 with a total capacity of 35 t/h. These boilers can also be installed in standard ship propelling plants. If the customer wishes so, Stocznia Gdanska may increase the working pressure of the boiler and temperature of superheated steam, after previous notification.

Header boiler WB 2

This boiler, is smaller than the boiler WB 1. It is adapted for work in standard ship propelling plants with working pressure up to 16 kG/cm², temperature of superheated steam for main engine up to 325°C and temperature of de-superheated steam for the auxiliary mechanisms—220°C.

The boiler WB 2 has headers connected with the drum. Each header consists of one row of water tubes $\varnothing 102 \times 5$ mm. and 16 rows of water tubes $\varnothing 44,5 \times 3,5$ mm.

The steam superheater consisting of 60 U-form coils $\varnothing 38 \times 3,5$ mm. of molibden steel, is situated between the fifth and the sixth rows of water tubes. Five partitions are mounted in the convex area of the boiler and form a three-way draught system of the boiler. In the exhaust gases channel there is a coil-type economizer (coils $\varnothing 32 \times 3$ mm). The whole combustion chamber is surrounded with a wrapper in which air is heated to the temperature of ab. 60°C and is led to two pressure burners placed in the front wall of the boiler.

The boilers WB 2 are equipped with complete fittings, steam driven soot blowers, automatic feed regulators of Hannemann type and with control measuring devices. If the customer wishes the boilers WB 2 can be fully or partly equipped with the automatic arrangements.

Thermic tests have proved the high efficiency of the boilers with their relatively small outline dimensions

and weight. Two boilers WB 2 supply 13 t/h of steam necessary for driving main engine and auxiliary mechanisms of a propelling plant with an output of 2,500 H.P

The first boilers WB 2 manufactured were installed on the steam ships "Santo Amaro" and "Santo Andre" built by Stocznia Gdanska for Brazilian owners Messrs. L. Figueiredo Companhia de Navegacao, Santos and on s/s "Latakia" and s/s "Jemen" being built for Egypt.

SCOTCH TYPE BOILERS PA

The Scotch type boilers are of three sizes and their characteristics are given in table 2.

The Scotch type boiler consists of a riveted to the with the fire boxes situated inside and welded to the furnaces and smoke tubes. The coils of the steam superheater are fitted in the smoke tubes. The headers of the superheater are fixed in the smoke box of welded construction. Above the uptake, in the exhaust gases channel, there is an air heater of tubular type.

The boilers PA2 of the series III coal-fired, have iron furnace doors, air-cooled and fixed two-partition grates, operated manually.

The boilers PA2 of the series IV and the boilers PA3 are equipped with burners of pressure type adapted for burning heavy oils.

The boilers PA are simple in design and operation. The single boilers PA2 are installed in ship steam propelling plants with an output range of 1,000 BHP. Two connected boilers are installed in steam propelling plants with an output range of 2,000 BHP.

The boilers PA2 are installed on fishing trawlers 500 t. d. w. and on sea-tugs 800 BHP built by shipyards: Stocznia Gdanska and Stocznia at Gdynia for home and foreign owners.

The boilers PA3, at the working pressure 12,5 kG/cm², produce saturated steam with temperature ab. 192°C. Two connected boilers PA3 will be installed on the 18,000 t. d. w. tankers built by Stocznia Gdanska. The boilers PA are delivered with complete fittings, soot blowers, mountings, spare part and inventory. If required the boilers PA can be additionally equipped with the control and measuring

devices and with the automatic feed regulators of "Thermofeed" type.

TABLE 2

Characteristics	Boiler		
	PA2/III	PA2/IV	PA3
Working pressure kG/cm ²	16	16	12.5
Output t/h	5.5	6	7
Temperature of superheated steam °C	320	320	—
Heating surface :			
—water side m ²	—	283	321
—exhaust gases side m ²	245	256	281
Heating surface of steam superheater m ²	97,5	110	—
Temperature of feed water °C	120	120	80
Heating surface of air heater m ²	100	100	102
Temperature of heated air °C	100	110	110
Fuel	coal	heavy oil	heavy oil
Number of burners	—	3	3
Type of burners	—	pressure	pressure
Maximum output of 1 burner kG/h	—	200	200
Grate area	6.81	—	—
Total weight of the boiler :			
—without water t	67.5	56	58.8
—with water t	98.5	87	90
The boiler is built to the regulations and under the survey of the classification society	Reg. of USSR Polish Ship's Register	Reg. of USSR Polish Ship's Register	Lloyd's Register

Principal dimensions of the boilers PA are given in table 3.

TABLE 3

Element of the boiler	Boiler		
	PA 2/III mm	PA 2/IV mm	PA 3 mm
Drum :			
—inside diameter	4820	4820	4820
—length	3450	3450	3360
Furnaces of Morison type :			
—number	3	3	3
—diameter	1125/ 1225	1125/ 1225	1125/ 1225
Smoke tubes :			
—number	362	362	548
—outside diameter	83	83	63.5
Steam superheater of Schmidt type :			
—number of coils	52	60	—
—outside diameter of tubes	22	22	—
Air heater of tubular type :			
—number of tubes	272	272	270
—outside diameter of tubes	76	76	76

BOILERS OF HOWDEN-JOHNSON TYPE HJ

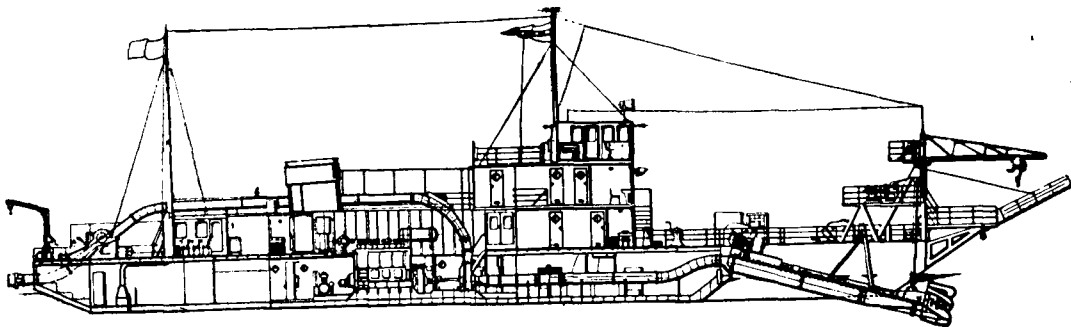
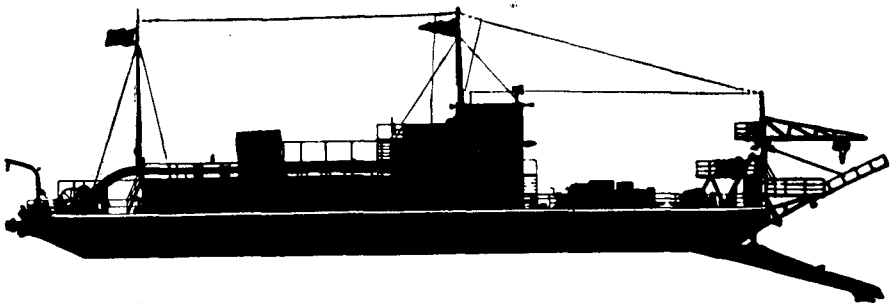
The boilers HJ of Howden-Johnson type are manufactures in several sizes. Characteristics of the boilers are given in table 4.

TABLE 4

Characteristics	Boiler				
	HJ 1	HJ 2	HJ 3/II	HJ 4/III	HJ 5
Working pressure kg/cm ²	15.5	16	16	16	16
Output t/h	3.7	6	4.5	5.5	6.5
Temperature of superheated steam °C	325	325	325	325	325

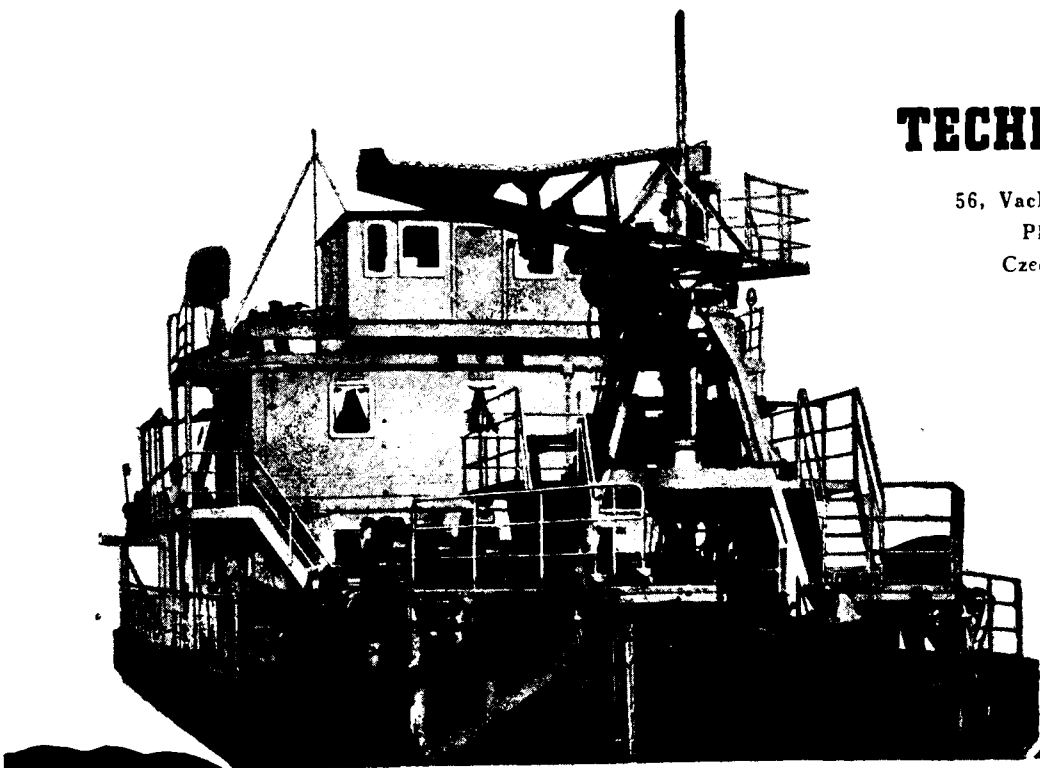
TABLE 4 (Contd.)

Characteristics	Boiler				
	HJ 1	HJ 2	HJ 3/II	HJ 4/III	HJ 5
Temperature of de-superheated steam °C	220	220	220	220	220
Heating surface : —water-side m ²	145	—	—	228	300
—exhaust gases side m ²	127	254	188	203	267
Heating surface of steam superheater m ²	28	62	50	50	52
Heating surface of air heater m ²	76	105	88	88	105
Temperature of heated air °C	100	100	100	110	110
Temperature of feed water °C	120	120	120	120	120
Fuel	coal	coal	coal	heavy oil	heavy oil
Number of burners	—	—	—	3	3
Type of burners	—	—	—	pres- sure	pres- sure
Maximum output of one burner kG/h	—	—	—	200	200
Grate area m ²	3.74	6.24	5.5	—	—
Total weight of the boiler					
—without water t	50	71	61.5	58	65
—with water t	61.5	97	80	76.5	91
The boiler is built to the regulations and under the survey of the classification society	L.R. R.USSR	R.USSR PRS	R.USSR PRS	L.R. R.USSR	R.USSR



Suction Dredgers of Czechoslovak Production

Since World War II the Czechoslovak Shipyards in Prague have delivered dozens of Suction Dredgers with capacities of 250 to 350 cubic meters/hours to other countries. The Suction Pump is driven by 4 S 350 Skoda Diesel Engine 380 H.P. The equipment serves for dredging of rivers, canals, lakes and water constructions, to a depth of 11 meters. The Dredger is controlled centrally from the Dredger Operator's table.



TECHNOEXPORT

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11, Rutland Gate,
4th Street, Madras-6

The boiler HJ consists of the riveted drum in which the furnaces and tubes are situated. In the back end plate are fixed the water tubes which, together with their casing, form the fire-box of the boiler. In this fire-box the suspended steam superheater is situated. The steam de-superheater for auxiliary mechanisms is mounted in the water area of the boiler, while the air heater is on the smoke box situated on the front end plate of the boiler.

The furnaces of the coal-fired boilers HJ are equipped with flat manually operated grates. The furnace doors made of cast iron are air-cooled. The oil-fired boilers HJ are equipped with pressure type burners.

The principal dimensions of the boilers HJ are given in table 5.

All boilers HJ are delivered with complete fittings, soot blowers, mountings, spare parts and inventory.

AUXILIARY BOILERS

Stocznia Gdanska manufactures the following types of marine auxiliary boilers:

- water-tube boilers, Clarkson type, marked with symbol "CL",
- vertical water-tube boilers, marked with symbol "VX",
- water-tube boilers, La Mont type, marked with symbol "LA".

TABLE 5

Element of the boiler	Boiler				
	HJ 1	HJ 2	HJ 3/II	HJ 4/III	HJ 5
	mm	mm	mm	mm	mm
Drum:					
—inside diameter	3581	4820	4300	4300	4820
—length	2191	2450	2220	2220	2450
Furnaces of Morison type:					
—number	2	3	3	3	3
—diameter	1000/1100	1125/1225	1000/1100	1000/1100	1125/1225

TABLE 5 (Contd.)

Element of the boiler	Boiler				
	HJ 1	HJ 2	HJ 3/II	HJ 4/III	HJ 5
	mm	mm	mm	mm	mm
Smoke tubes:					
—number	270	492	390	400	492
—outside diameter	63.5	63.5	63.5	63.5	63.5
Water tubes:					
—number	37	49	43	43	49
—outside diameter	51	51	51	51	51
Steam superheater (suspended type):					
—number of coils	26	33	33	30	33
—outside diameter of tube	25	30	30	30	30
Coil steam de-superheater:					
—type	suspended	lying	lying	lying	lying
—tube diameter	35	89	89	89	89
Tubular air heater:					
—number of tubes	—	290	212	212	290
—outside diameter	76	76	72	76	76

WATER-TUBE BOILERS "CL"

At present Stocznia Gdanska manufactures two size of the boiler "CL". The characteristics of these boilers are given in table 6

TABLE 6

Data	Boiler	
	CL 1	CL 2
Working pressure kG/cm ²	7	7
Total output t/h	1.2	2
Comprising:		
—oil firing t/h	0.6	0.8
—exhaust gases heating t/h	0.6	1.2
Total heating surface m ²	92	181

TABLE 6 (Contd.)

Data	Boiler	
	CL 1	CL 2
Comprising:		
—oil-fired side m ²	28	60.8
—exhaust-gases heated side m ²	64	120.2
Temperature of feed water °C	ab. 60	ab. 60
Fuel	diesel oil	diesel oil
Number of burners	1	1
Type of the burner	pressure, semi-automatic	
Maximum output of the burner kG/h	100	100
Total weight of the boiler:		
—without water t	16.5	27.3
—with water t	25	37.3
The boiler is built to the regulations and under the survey of the classification society	NV PRS	R.USSR PRS

The boiler "CL" consists of a drum with casing and of a furnace connected with the drum by means of bolts. The drum has two shells: inside and outside. In both shells the blind water tubes are fitted. The water tubes of the outside shell together with the shell form the boiler surface heated with the exhaust gases from main diesel engine of the propelling plant. The water tubes of the inside shell together with the shell, form the boiler surface heated with diesel oil which is burnt in the outside furnace. The drum of the boiler is covered with a casing of steel plates adequately insulated. The boilers "CL"

are delivered with complete fittings, bricks, semi-automatic oil burner, spare parts and inventory.

The boiler "CL1" is installed on the motor ship "Monte Cassino" built by Stocznia Gdynska. This boiler can be installed on motor ships propelled by main engine with an output range of 2,500 BHP.

The boilers "CL 2" are installed on the motor ships 10,000 t. d. w. of B 54 series built by Stocznia Gdanska for Polish Ocean Lines and they can also be adapted for motor ships propelled by main engine with an output range of 5,000 BHP.

WATER TUBE BOILERS TYPE "VX"

The water-tube boilers type "VX" are manufactured in several sizes.

The boilers "VX" produce saturated steam with pressure 7 kG/cm² and are installed on motor ships as auxiliary boilers. These boilers can work in conjunction with the boilers "VX".

The boilers "VX" are equipped with automatic feed regulators of "Thermofeed" type and automatic oil burners adapted for burning light and heavy fuel oils.

The boilers "VX" are delivered with complete fittings, insulation, spare parts and inventory.

WATER-TUBE BOILERS "LA"

The water-tube boilers type "LA" are designed to work in conjunction with the boilers "VX" which act as drums. The boilers "LA" consist of coils (steel tubes $\varnothing 32 \times 3$ mm) of spiral form the ends of which are fitted in the headers. These headers are connected by means of piping with the drum of the boiler "VX". The water from the drum of the boiler "VX" is conducted through the coils of the boiler "LA" by means of a special circulating pump. The coils of the boiler engines, are surrounded with a special adequately insulated casing.

MORE G-E INDUSTRIAL LOCOMOTIVES FOR TATA MILL

Working to step up local production of steel and give India a more favourable trade balance, the Tata Iron and Steel Co. has purchased six modern General Electric (U.S.A.) diesel-electric industrial haulage locomotives for use in its mills. The order was placed with the International General Electric Co., and the locomotives were constructed at G-E's Locomotive & Car Equipment Department in Erie, Pennsylvania.

This order brings to 30 the total number of G-E industrial locomotives purchased by Tata.

SHIPYARD IN CZECHOSLOVAKIA

NEW SUCTION DREDGERS

IN 1952 the Praha Shipyard began the construction of type SB 250 Suction Dredgers and by the end of this year the number of such suction dredgers produced will attain nearly 50.

Based on experience with the production and service of series SB 250 suction dredgers the construction of a new type of suction dredger bearing the designation SB 725 has been started last year. The new type SB 725 adheres principally to the well-proved conception of the SB 250, all the devices for attaining high performance and economical service, being of course, applied here.

Both types of dredgers, the SB 250 and SB 725, are operated by diesel engines. They are not self-propelled, but all their auxiliary mechanisms are fully electrified and have central control of the working operations. Their propulsion is effected by means of a system of 6 ropes fitted with working anchors. The dredgers work to a depth of 6 and 11 metres respectively. They are made with a special regard to the maintenance and reconstruction of waterways and with maximum autonomy in regard to the fuel supply bases. Their construction is carried out under strict supervision and according to the rules of The River Register of the USSR for class 'O' and enables navigation also along sea coasts.

Among the technical improvements of the SB 725 the most important are the use of supercharged diesel engines, the fitting of ship's system with the latest vertical pumps, the central control station in the engine room provided with automatic signalization of diesel engine failures, etc., increasing the range of infinitely variable speed of the winding up and braking ropes of the working anchors of the dredging arrangement, the introduction of a new system of hydraulic disintegration of dredged material during broad cut, the installation of further apparatus for perfect control of the dredging work such as for example, a special set of echographs registering continuously the bottom profile before and after the excavation, a spoil contents meter working with gamma rays, an induction speedometer for the transported mixture in the piping, a speed and length meter for winding off the working ropes, an indicator of the sinking of the dredging ladder, etc.

According to the economic analysis it is presumed that the total cost of dredging and conveying one cu. metre of solid material by means of the type SB 725 dredger will be approximately 25% lower than on using the SB 250 type.

This result, interesting mainly the organisation carrying out the dredging work, is obtained either by relative reduction of the extra costs per unit of output in comparison with the SB 250 in such items as amortization, insurance, maintenance costs and personal expenses, or by an absolute reduction of the costs per unit of output chiefly by maintaining the optimum conditions of using the installed arrangements due to perfect checking, measuring and control equipment.

A COMPARISON OF THE MAIN TECHNICAL DATA OF THE TWO DREDGERS IS GIVEN BELOW:

		SB 250	SB 725
Overall length	m	52.60	55.00
Length between perpendiculars	m	45.85	50.00
Moulded beam	m	9.00	9.20
Overall width	m	9.33	9.50
Depth	m	2.50	2.80
Height of fixed point above keel	m	9.05	9.83
Designed draught	m	1.27	1.37
Displacement at draught 1.27 and 1.37 resp.	tons	462.5	563
Crew	men	35	35
Basic output in solid material	cu.m/hour	350	725
Delivery distance and head with basic output	m	400/1	550/1
Digging depth	m	6/11	6/11
Relative output of cutting head to basic output of dredger	kW/cub.m	0.109	0.152
Diesel engine of pump			
Output/r.p.m.		380/325	800/325

Transport Pump—diameter and width of wheel	mm	1,200/240	1,400/260
Engines of power station sets:			
Output/r.p.m.		2×135/750	2×170/750
Engines of auxiliary sets:			1×60+
Output/r.p.m.		1×20/1,000	1×20/1,000
Output of the power station	kW	180	260
Independence of fuel supply	hours	300	320

One of the most important technical and financial problems in the choice of dredger type is the question of its transport from factory to destination, which in many cases practically excludes the possibility of installing the SB 250 and SB 725 suction dredgers.

For this reason the solution of easy transport brought about the elaboration of the design of a dismountable type SSB 350 suction dredger.

The design of the whole body and all arrangements of the SSB 350 dredger are subordinated to conditions of transport by rail and road so that the final assembly at its destination involves minimum costs, manpower and assembly arrangements. The whole dredger is composed of 10 main sections and of a set of auxiliary parts; the largest section has limiting dimensions 13.6 × 3.9 × 2.2, and the heaviest section weights 34 tons. The body of the vessel is assembled on water of individual, independently buoyant sections with the use of primitive assembling aids. Further assembly consists only in mutual connection of the electric wiring and water systems between sections and in the installation of supplementary deck equipment.

The main data of the SSB 350 dredger are as follows: dieselelectric suction dredger, non-propelled, with fully electrified auxiliary services and central control of all operations. It is warped by means of two ropes fitted with anchors and by a spud equipment, or alternatively, by means of five working ropes with anchors. The dredger works to a depth of 8 meters in the former case, and to 14 metres in the latter. It is fitted out for universal use even in heavy soils. Its construction is carried out under strict supervision and according to the rules of the River Register of the USSR for class 'R'.

TECHNICAL DATA OF TYPE SSB 350

Overall length	m	33.80
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Length between perpendiculars	m	26.90
Moulded width	m	7.20
Overall width	m	7.45
Depth	m	1.90
Height of fixed point above keel	m	4.10
Designed draught	m	1.20
Displacement at draught 1.20 m	tons	200
Crew	persons	17
Basic output in solid material	cub.m/hr	350
Delivery distance and head with basic output	m	400/1
Digging depth	m	8/14
Relative output of cutting head to basic output of dredger	kW/cub.m	0,315
Diesel Engine of pump—output/r.p.m.		400/1,320
Dredging pump—diameter and width of wheel		1200/240
r.p.m. of pump		325
Engine of power station set—output/r.p.m.		300/1,000
Engine of auxiliary set—output/r.p.m.		30/1,500
Output of power station	kW	220

In the case of the type SSB 350 several alternatives are considered according to the nature of the working place and the requirements of the customer regarding the basic arrangements for the exploitation of construction material (river sand), for the maintenance of water ways or for the foundation of water constructions; a further type should be with or without crew living quarters, with diesel engine drive or simply fed with electrical energy from the shore, and ultimately adapted for normal and tropical climate.

In the solution of its basic features the SSB 350 differs from the type SB 250 and SB 725 by high revolution diesel engines for attaining weight reduction, by replacement of the electric Ward Leonard regulation system of the winding up speeds of the winches by mechanical variators for the purpose of simplifying the electric installation and obtaining weight reduction, and finally by the use of spud equipment for the simplification of working arrangements and improvement of operation in heavy soils.

The attainment of working and transport ability even in the case of very hard material was the next motive of the design of the SSB 350. By tests and experience gained during operation of the SB 250 series production

in various soils a limit was set for the ratio of the output of the cutting head (cutter) to the basic output of the dredger expressed in kW/cub. m. above which successful operation of the suction dredger is guaranteed even in very heavy material such as set clays and similar soils. This limit changes with adequate chosen forms and dimensions of the mechanical cutting heads above the value of 0.25 kW/cub.m. Thus in the case of the SSB 350, the value 0.315 kW/cub.m. guarantees in any case permanent maintenance of the basic output in soils of even the heaviest categories, which until now has been reserved for heavy bucket dredgers and justifies a comparison of the operational economy of suction dredgers of this type with the operation of a bucket type dredger.

If we divide the dredging process into the basic components we obtain mutually interlinked operations consisting of disintegration of the dredged material, its transport above water surface, and finally transport to the place of discharge. The first operation of the suction dredger is carried out by the cutting head fixed on a shaft mounted in lubricated bearings and driven by a geared motor. With the bucket dredger the material is released and taken in by a row of buckets towed by a pitch chain which rotates round two pentagonal or hexagonal nuts without the possibility of lubrication in a medium containing a quantity of dredged material. The transmission rotation, between the motor and the nut is, in the case of the bucket dredger, approx. 2, 5 to 3 times higher. Assuming that the number of revolutions of the cutting head and of the working buckets per one minute is approximately equal (on the average 15 per one minute), we shall find that with the cutting head of 5 blades one blade cuts, in comparison with the bucket, only 1/5 of the material. With the suction dredger the turn off soil is carried away by the water stream, while with the bucket-type dredger it is piled immediately behind the edge of the bucket.

During the second operation—the transport of the material above the water surface—the picking up of the mixture of solid material with water is on the one hand compared with regard to the axis of the dredging pump or to that of the highest arc of the delivery piping and on the other the lifting of solid material in buckets to the fulcrum of the upper nut.

From the point of view of mechanical efficiency of the moving parts, i.e. the shaft, and cutter, compared with the tumblers, bucket chains and buckets the economy and fixed technical solution of the suction

dredger are evident as well as from the point of view of wear, incidence of breakdowns and difficulty with the exchange of worm parts, i.e. blades of the cutting head rotor and the inner sheathing of the pump, and of the transport piping as compared with the full number of buckets, pitch chains, nuts and leading surfaces of the suction dredger ladder.

The last operation, i.e. the transport of the material to the place of discharge, for example, outside the waterway, represents in the case of the bucket dredger the use of a set of prams and tugs whereas in that of the suction dredger only the use of a floating piping, which ensures continuous transport without maintenance and manoeuvring. Especially in this operation the advantage of the modern principle of hydraulic transport of large quantities of material is evident.

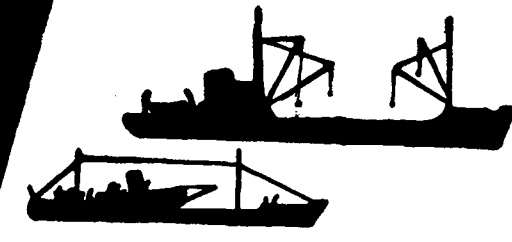
TECHNICAL DATA OF TYPE SBF 50

Overall length	m	14
Length between perpendiculars	m	10.45
Overall width	m	3.20
Height of fixed point above keel	m	3.30
Designed draught	m	0.60
Weight during transport	tons	14.70
Crew	persons	2—3
Basic output in solid material	cu.m/hr	50
Delivery distance and height at basic output	m	200/3
Digging depth	m	6
Relative output of cutting head to basic output of dredger :	kW/cu.m	0.36
Pump motor—kW/r.p.m.		40/960
KW/r.p.m. of pump		960
Total input of dredger	kW	63

The result of an analysis of the individual operations gives an idea as to how multiple reduction of costs per unit of gained and transported material is obtained in comparison with bucket dredgers.

It is also important to point out the basic simplification of the process of exploiting construction material (gravel sand) by the use of suction dredgers in comparison with further operations connected with the transport of material from the bucket dredger to the shore. The shore piping connected with the floating piping of the suction dredger replaces in this case the elevator and the mechanical conveyors discharging the prams. The mechanical screening of material is then replaced by hydraulic sorting connected with separation

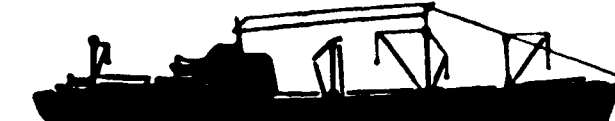
SHIPYARDS IN POLAND
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 Stocznia Gdynska — Gdynia
 Stocznia Szczecinska — Szczecin



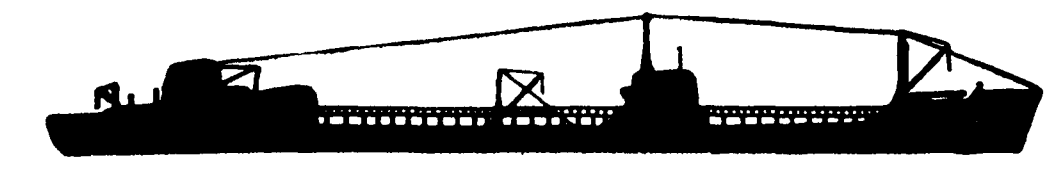


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of water. The transporting water ensures in this case the very important component of washing and separating the construction material from undesirable fine particles.

An addition to the production programme of the suction dredger series of the Prague shipyard is the type SBF 50 designed for smaller output. The dredger is fully electrified; the power is carried from the shore network or from a transportable diesel generator. All working operations are hydraulically controlled from a central, covered place. The dredger works to a depth of 6 metres, and is warped by means of 5 working ropes with anchors.

OUTDOOR TYPE THREE-PHASE DISTRIBUTION TRANSFORMERS

The Indian Standards Institution has published an Indian Standard Specification for Outdoor Type Three-Phase Distribution Transformers upto and including 100 kVA 11 kV (IS: 1180—1958). This standard covers oil-immersed, self-cooled, three-phase, double wound, outdoor type distribution transformers, with Class A insulation of capacities up to and including 100 kVA, for use on systems with nominal voltages upto and including 11 kV and a frequency of 50 cycles per second.

For some years a project for formulation of an Indian Standard covering the range of transformers produced in the country has been under consideration. Purchase and manufacture of transformers in this country has in the past been guided, in part, by the practice and standards followed abroad, particularly in the United Kingdom and the United States of America. Changing trends in the design and testing of transformers, resulting from research conducted and experience gained during and since the last war, have necessitated revision of the standards of these and other countries. The Institution has been following the progress of these revisions as well as the work of Technical Committee No. 14 (Transformers of the International Electrotechnical Commission in the formulation of its 'Publication 76' Recommendations for Power Transformers. There is, however, no unanimity yet in international opinion on certain fundamental points, particularly in the higher voltage ranges of transformers, and opinion in India too has not yet crystallized on some of the issues involved. In view of this, the preparation of an Indian Standard covering the entire range of transformers produced in the country had to be deferred.

With its wide range of working speeds and suitable choice of principal machinery outputs the technical equipment of the SBF 50 fulfills also the exacting requirements of maximum economy of the working process.

The series of suction dredgers is not completed by this type and soon it will be further extended by units of smaller output in the range of 20 cub.m/hr. and 150 cub.m/hr. as well as with some modifications of the above mentioned types SSB 350 and SB 725, with self-propulsion, so that it will be possible to cover all requirements regarding the construction of suction dredgers with an output of 20 cub. m to 800 cub. m/per hour.

In the meantime, with the progress of the many power projects in the country, the demand for distribution transformers has been increasing rapidly. A very large proportion of the present demand for transformers has been found to be in the distribution range up to 100 kVA 11 kV. An urgent need was, therefore, felt for evolving a national standard which would unify the requirements of various indentors in the country for this limited range of transformers which, in many cases, differed in relatively minor details. Such a standard, it is hoped, would simplify manufacture, effect appreciable economy in the cost of production, shorten delivery periods, provide interchangeability and simplify the stocking of spares and fittings. This standard has been prepared to meet this specific need.

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A two-layer rubber lineman's glove facilitates visual inspection for cracks, cuts or abrasions. The glove is made according to the manufacturer's standard dipping process with the inner layer light red or brown and the outer layer black. The two-colour glove resulted from a request by Long Island Lighting Co. to use this method of manufacturing to insure greater safety. It is designed with the same specifications as standard gloves except that the outer 0.008 in. is different colour than the inner layer. The inspector or lineman may easily locate any cut or crack deeper than 8 mils. Any cut which does not show the inner colour assures a glove still usable by a good margin of safety. Deeper cuts showing the inner colour means that the glove so damaged must be immediately replaced.

ELECTRICAL INDUSTRIES SUPPLEMENT

THE SCIACKY FOOT OPERATED SPOT WELDER AND THE SCIACKY RAPID SPOT WELDER OFFER TO INDUSTRY GENERAL PURPOSE MACHINES OF THE VERY LATEST DESIGN

By a Technical Correspondent

(Special to J.O.I.E.)

THE Sciacky Foot Operated Spot Welder is a precision machine for general fabrication, tacking, mass production and jobbing work. One of the most important features of this welder concerns the foot pedal action. As is generally known, the foot action of the traditional type of foot operated spot welder allows as much pedal movement in the closing of the electrodes as in the application of pressure; but since it is only during the application of pressure that we need an advantageous pressure ratio (approximately 10:1) obviously it is beneficial to reduce operator fatigue by employing a 1:1 ratio for the closing of the electrodes, this has been achieved in the Sciacky machine thus eliminating unnecessary pedal movement.

Further points of interest are:

All pivots employ pressure lubricated bearings.

The electrodes can be independently angled.

The bottom and top arm can be adjusted by means of single screws.

Built into the machine is a Sciacky electronic timer.

The doors are clamshell type, giving complete accessibility, to internal control.

Technical details are as follows: 15 kVa nominal, wound for connection across 2 phases of a 3 phase, 50 cycle system.

The transformer is air cooled and adequately rated. High conductivity rolled plate secondaries are sandwiched between the primary coils. The copper sections are arranged to give comparatively low current density to avoid dangerous temperature rises when continuously worked. Six heat tapings are provided and the link switch door is secured by a Yale lock to prevent interference by unauthorised persons.

Working throat depth: 18".

Hard drawn, high conductivity copper top and bottom arm of universal type machined at either end for vertical and angle electrode shanks to provide maximum work clearances. Both arms provide a limited degree of extension and retraction.

Hub brackets are manufactured from high tensile non-ferrous castings.

Electrode stroke is infinitely adjustable up to a maximum gap of 2½". A stop screw located on the pedal bracket provides instantaneous stroke adjustment without having to open covers etc. Electrode force is upto 400 lbs. obtainable from a heavy duty adjustable spring. A readily accessible spring compression wheel and locknut assist welding pressure setting.

The pre-set electrode force is constantly applied as the weld initiation limit switch must be actuated to commence the welding sequence.

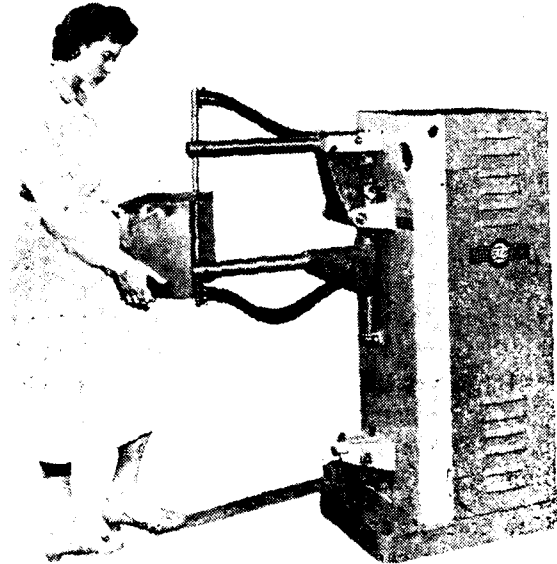
The foot pedal is radially adjustable and the normal height above the floor level (irrespective of electrode stroke or pressure set) is less than 9". These features provide a comfortable working position involving less manual effort than is usual with this type of machine. Electrodes are water cooled and machined with a ⅝" diameter B. S. S. 807 taper.

Primary current control is by heavy duty electromagnetic contactor mounted directly beneath the welding transformer.

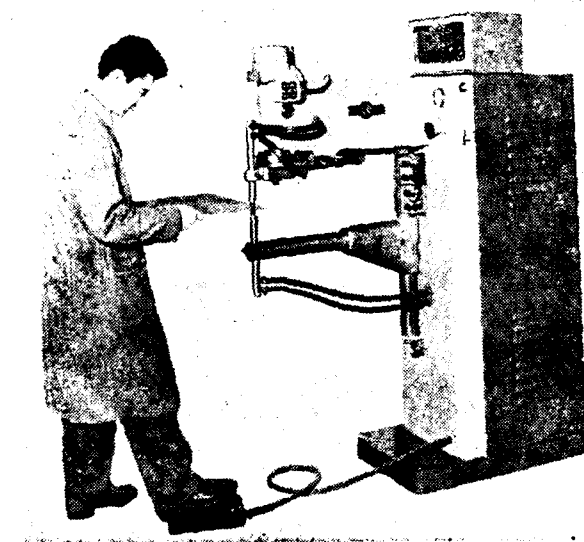
The control circuit is operated by a Sciacky electronic Thyatron timer giving weld times from 3—150 cycles.

Setting dials are visible and adjustable from work station. A weld "on-off" tumbler switch is located on timer fascia.

for operation by unskilled labour. Like the foot operated spot welder, this is very much a recently introduced machine giving in the advantage of the incorporation of the very latest in design:



A view of the Spot Welder.



A view of the foot operated Spot Welders.

Courtesy: SCIAKY ELECTRIC WELDING MACHINES LTD., SLOUGH

Welding capacity: 14+14 s. w. g. mild steel sheet and great unequal thicknesses, e. g. mild steel wire 3/16" + 18 s. w. g. up to .250" + .250" dia.

The Sciaky Rapid range of machines are fully automatic general purpose spot and stitch welder designed

High speed integral air valve and cylinder unit.

Moisture resistant, low friction cylinder seals.

Maximum bottom arm and electrode shank clearances

Hinged wing panels permitting internal access from three sides.

Single-bolt clamping of bottom arm for quick adjustment.

Stitch welding speeds up to 250 fully controlled spot welds per minute.

Sciaky electronic circuitry ensures weld consistency.

Electrode force meets with B. S. I. requirements. "Squeeze", "Weld" and "dwell" timers apply electrode force before, during and after the welding period.

The electronic chassis and individual timers, pneumatic valve gear, etc., are interchangeable between all models which are at present 15, 25, and 50 kVa.

Weld Timing Control: the fully interlocked control circuit is operated by a Sciaky four-channel electronic thyatron unit. It provides variable timing for the "squeeze" period before initiation of welding current, actual "weld" time, "hold" period when the electrodes remain closed to give extra forging action, and "off" time which governs the repeat spot or stitch welding speed. This comprehensive programme control gives the following time ranges — "squeeze", "hold" and "off" 2 — 75 cycles, "Weld" period 2 — 150 cycles. Indicator lights show when panel is switched on and valves are ready. All components are mounted on a common chassis detachable from the machine by a plug and socket. The steel cabinet is dustproof and flexibly mounted.

Machine Operation Sequence: The Machine is set in motion by a two position electrical footswitch which enables the operator if necessary to bring the electrodes together without welding current, for spot location. Normally both positions are made simultaneously, welding pressure is applied

and at conclusion of the "squeeze" period when the correct force is established the welding cycle commences. The electrode force is retained for a fractional time after welding and the electrode then re-sets to the rest position. The footswitch can be released at any time during the sequence, which will be completed automatically. Repeat spot or stitch welding are carried out by adjustment to a tumbler switch, when the top electrode will reciprocate so long as the footswitch is depressed.

Hydraulic Jack Straightens Leaning Poles

A hydraulic truck jack, attached to a length of steel pipe, straightens leaning poles quickly and safely for Indiana & Michigan Electric Co. Scrap metal may be utilized in building the inexpensive tool. The pole jack is constructed from a 7-ft. section of an old 3½-in. derrick leg with a 4×3½" angle iron welded to the foot

end. A 5×7-in. channel iron with stops is welded to the other end to hold the jack. The bracket which fits against the pole is made by welding a 2-in. pipe about 1 in. long onto a saw-tooth metal plate mounted at a 45-degree angle. Either the truck floor or the ground may be used to support the jack. Using a truck as a back-up support simplifies the job where terrain permits. Formerly it was often necessary to push a leaning pole with the truck when the pole could be approached from only one side. On rough terrain or when the truck engine failed, this was dangerous because of whipping of live conductors.

* * * * *

METER SOCKET CHANGE SAVES 100 DOLLARS

Expense of metering residences wired with oversize conductors can be cut by using a socket adapter developed by the Ohio Power Co. Using the adapters instead of current transformers, the company saves 100 dollars per installation. A 5×15×24-in. box was fabricated and a manufacturer produced a variation of the standard 200-amp. socket with enlarged terminals to fit the 500-Mcm wire. The present cost of the socket adapter is about 50 dollars. Because more contractors are using heavier conductors in anticipation of future loads, the oversize wire problem is arising frequently. The adapter permits the use of 200-amp. extended-range single-phase meters on wiring up to 500 Mcm. where conventional sockets stop at 4/0. It also reduces test requirements to every eight years in the mobile meter laboratory instead of every two as required for transformer connected meters.

* * * * *

"INSIDE" GATE LOCK REDUCES HAZARD

A new practice for locking gates in fences enclosing substation capacitor banks provides greater safety for Florida Power Corp's personnel. Gates are now installed with the locks on the inside. To further obstruct the unlocking of a gate, a plastic disc is placed on the lock keeper between the padlock and the operating rod. This safety practice was designed to prevent unauthorised employees from entering the fenced-in area around high-voltage capacitor banks. Entrance to the area should be through the control house. From the inside the gate can be readily opened. The clear plastic disc measures 6 in. in diameter and is ¼ in. thick. In the centre is a hole large enough to fit over the lock keeper.

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is attributed, the introduction of the 3-wire system of d.c. distribution, which is becoming more and more obsolescent. In 1886 came a radical innovation—operation by alternating current.

The rapid growth in the use of electricity for lighting, heating, power etc., is largely due to the widespread adoption of the 3-phase system of generation and distribution. This system has an added advantage in that it enables water-power sources to be harnessed for the generation of electricity and its transmission over distance which could never be economically practicable with d.c. system employing rotary machines.

ELECTRICITY AND INDUSTRY

Today millions of wheels of industry are turned by electricity. In every industry, electrical equipment is the key to modern production methods.

The question of factory lighting for instance, is one of the many ways in which electricity is playing a vital role in industry today. Higher levels of illumination, made possible by electricity, increase production. Better lighting conditions result in an improved quality of manufacture. Faults are detected in the initial stages of production and this results in a considerable monetary saving to the factory. The right lighting has a significant effect on the speed of production, reduction of accident cases and welfare aspects of the workers employed. And then is the subject of appearance; a well-lit plant conveys the impression of high quality manufacture.

Electric driving is the usual practice to-day in all factories. This practice, has, however, swung from the extreme of a single motor driving the entire factory, to the opposite extreme of an individual motor for each machine. The advantages of providing each machine with its own motor and control gear are, briefly, freedom of location, elimination of transmission losses, saving in space and cost of shafting and its maintenance, more constant speed, reliability, increased production, accessibility, improved working conditions and greater safety, cleanliness and appearance, and positions of machines can be altered or rearrangements made in a speedy and convenient manner.

Individual drive means that the motor is tailored to the tool; control is thus simplified and there is no

waste of power. The tool does the work at the highest speed because of the motor being built into the tool and directly coupled to the driven shaft. Putting the power where it is wanted, is what has been done by electricity in industry.

The latest mechanical handling methods comprising overhead cranes, lifts, conveyors, etc., depend on electricity for power. In the production line of a factory every component has a value which increases as it passes through each process. But while it is lying about idle, waiting to be moved by hand from one place to another, its cost starts to catch up with its value, until it ceases to be an asset. Components must be kept on the move and off the floor to eliminate bottlenecks and reduce to vanishing point any decline in output, and it is in this sphere that electricity plays a vital role.

The engineering industry relies to an ever-increasing extent on efficient heat-treatment processes to meet the demand for higher quality in its finished products. The importance of proper heat-treatment equipment, in this context is widely appreciated today. The application of electric furnaces for this purpose has gained ground because of the constant heat value of electricity which means that it is possible to know that the heat-treatment is precisely what is required. Not only temperatures but the operation of a complete heating unit can be controlled automatically. It can be arranged to start, run and shut down to any process requirement or time and temperature circle.

The main advantages of electric furnaces are:—

- (1) They are economical—labour charges are considerably reduced.
- (2) There is no wastage at all—the heat goes into the job.
- (3) They give the appropriate kind of heating at the right temperature for as long, or as short a time, as may be needed.
- (4) They can be controlled easily, exactly; better still automatically.
- (5) They are clean, neat and simple.
- (6) They are quick and compact—valuable floor space saved.

By A. C. Bhattacharya, A.M.I.P.E.

ELECTRICITY is wonderful. It is the manifestation of a mysterious source of power, with which man can do almost anything. At the movement of a switch he can command heat and light, move vertically in lifts or horizontally in trams and electric trains, operate machines and a number of domestic and other appliances which are considered as the essential requisites for a better living in modern times.

THE WORD 'ELECTRICITY'

Electricity was known to the ancients. They felt the electric shock of the torpedo fish which when touched by a spear paralyzes the muscles and arrests the feet. It also possesses the power of benumbing men, as well as the fishes which serve for its prey. The influence of electricity on the human body, and the electricity of the human body itself, were also known to the ancients. The name of the philosopher who first observed that amber when rubbed possesses the power of attracting or repelling light bodies is not known but Thales of Miletus (600 B. C.) is said to have described this remarkable property and both Theophrastus (321 B. C.) and Pliny (70 A. D.) mentioned about this phenomenon. Many centuries later, Dr. Gilbert of Colchester who may be considered as the founder of the science, carefully repeated the observations of the ancients and applied to them the principles of philosophical investigation. While writing on the subject, he chose as the name for the strange force, responsible for the attractions and repulsions excited by friction in amber, "electron" the Greek word for amber, and some years later the English word "electricity" was coined.

HISTORICAL SKETCH

During the eighteenth century and more precisely in 1747, Sir W. Watson announced the theory of positive and negative electricity which was afterwards elaborated by Dr. Benjamin Franklin of Philadelphia. He showed that electricity is not created by friction, but merely collected from its state of diffusion through other matter by which it is attracted. In addition to

his putting forward new theories on the nature of electric power, he established the presence of atmospheric electricity by conducting his famous experiment of sending up a kite among the clouds.

The discovery of the electric current, as a result of the experiments of Galvani in 1789, and of Volta in 1800, followed by the development of the primary cell as a source of continuous current, laid the foundation for further important discoveries culminating in the practical application of electricity to the service of men. The relation between magnetism and electricity was discovered as a result of experiments made by Oersted in 1820, in which he observed the effects of the electric current upon a magnetic needle. The electromagnet, the most ubiquitous device employed in electrical equipment to-day soon followed.

The extensive use of electricity in the modern world is considered by many to date from the discovery made in 1831 by Michael Faraday regarding the phenomenon of electromagnetic induction. Briefly, his discovery can be stated as follows. Whenever a coil of wire placed between the poles of a magnet, is rotated by mechanical means, there is an electromotive force tending to drive a current through the wires of the coil. Nothing in the whole history of science is more remarkable than the unerring sagacity which enabled Faraday to disentangle, by purely experimental means, the laws of this complicated phenomenon which led directly to the development of the D. C. dynamo, the alternator and the transformer. For this discovery alone Faraday has been aptly called "the father of electrical engineering".

These machines in turn made possible the study of the effects produced by the flow of electricity along conductors and it was ultimately found that the electric current could be converted into heat, light or movement by means of suitable apparatus.

Forty years after Faraday's discovery of the principle of electromagnetic induction, practical forms of d.c. dynamo made their appearance. To Edison

Dimensions	840×920×1310 mm.
Weight	350 kg.

Power supply, high-frequency section and field of operation of the generator are housed in a completely clad frame. The high-frequency section consists of a control stage, a prestage, and end stage. The control instruments for screened-grid and anode current as well as control lamps permit simple operation and control of the working condition of the generator. In connection with the high-frequency welding press HfSPA 400 the plant is used to weld and mould thermoplastic foils of a thickness between 0.12 and 0.8 mm. up to a welding-seam surface of 100 sq. cm. at a foil thickness of 0.4 mm.

Another welding press with smaller output is provided for operation at the same generator as for the hand-operated welding tongs HfSZ. This plant consists of a high-frequency generator HfGD 0.3 and the press HfSP 100.

Advance technical data of the HfSP 100:

Frequency	27.12 Mc/s
Transferable power max.	max. 1 kW
Press effect	max. 100 g
Drive of the press	by foot
Time of heating adjustable	0.1..12 s

The plant is also intended for the welding and moulding of thermoplastic foils of 0.12 to 0.8 mm. thickness.

The three sets described form a series of high-frequency welding plant which correspond to all demands in the working of thermoplastic foils.

Detailed information through Deutscher Innen- und Außenhandel Elektrotechnik, Berlin C 2, Liebknechts-trasse 14

You will be able to see these sets at the 1959 Leipzig Spring Fair held from 1st to 10th March, 1959.

G. E. C., reports on Development of Four Types of Apparatus

★ Six 345-kv "cascade" potential transformers have been produced for American Electric Power Service Co., Considered the largest of this type built, the pots are 17.5 ft. high. But they are said to be considerably smaller, lighter and up to 40% lower in price, than the conventional potential transformers of the same rating because of reduced materials. They are designed for 115-kv and higher. This typed EU-1175 pot will provide metering and back-up relaying for the 345-kv tie line between American Electric Power and Commonwealth Edison Systems. Installation is at the Indiana & Michigan Electric's Oliver Station near South Bend Ind. U. S. A. Individual core and coils are housed in the steel sections which are separated by porcelain insulators. Auxiliary windings are interconnected to force an equal division of the voltage. Secondary Voltage is taken off the bottom section.

★ Two 62,500-kva synchronous condensers have been manufactured for Commonwealth Edison Co., Chicago to control 345-kv transmission power. Each unit is rated at 30 psi hydrogen, 12.6-kv, 10-pole, 3-phase, 60-cycles. They are tied into each of two

345-kv lines which form an interconnection between the American Electric Power Service Co's Indiana & Michigan Electric Co., substation at New Carlisle Ind., and Commonwealth Edison Co. substation at Goodings Grove, 111.

★ A 20,500-kw, 13.8-kv gas turbine is offered for low-cost peaking service. Available for gas or distillate oil fuels, the unit is equipped with a high flow compressor and is suitable for operation at 1,600F firing temperature. It is developed from the 16,500-kw, simple-cycle, single-shaft gas turbine with combustion and turbine modification.

★ A new type motor that will run under water will be announced soon by the Medium AC Motor and Generator Department. The motor will be completely submersible by allowing internal circulation of water through the electrical and mechanical components. A special insulation system is the major factor contributing to the development of the motor. One application may be internal boiler water circulation.

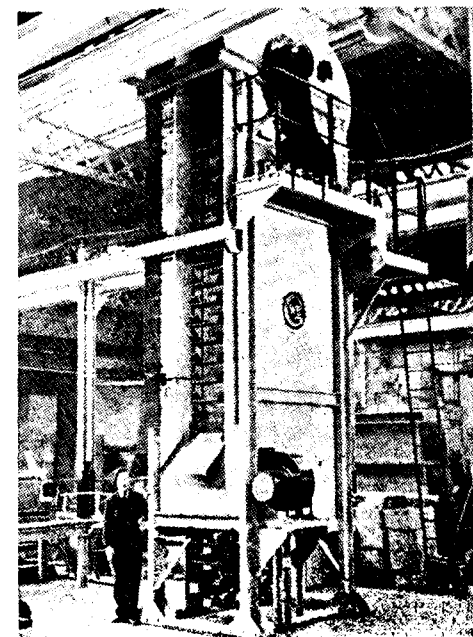


Fig. 1. A G.W.B. Vertical conveyor Furnace, with cooling chamber wall removed to show the conveyor.

Arising out of the last factor, the problem of floor space is one of the many which confront the factory engineer. Upon considering modern heat-treatment equipment, it is evident that there is a growing trend towards continuous as against batch type equipment, frequently installed in the production line. It is often the case that a continuous furnace will occupy more space than a batch type unit, and much thought has been devoted to producing designs of electric furnaces which aim primarily at reducing the required floor space to a minimum. An interesting example of space saving continuous electric heat-treatment furnace is shown in Fig. 1.

The furnace illustrated is the vertical conveyor type manufactured by G. W. B. Furnaces Ltd. This is like a horizontal pan conveyor unit set up on its end. The charge pieces are loaded into a small opening towards the bottom of the furnace, rolling into swivel mounted baskets slung between chains running over driven sprockets. With variable conveyor speed, the furnace incorporates a tilting device at the discharge point, to tip the charge into trays or on to a further conveyor for subsequent processing.

Industries today are in the midst of a vast change brought about by increasing mechanization. One of the developments in line with present day mechanization has been the use of electric portable tools occupying

an intermediate position between hand tools and power driven machines. These electric portable tools participate enough in either capacity to allow them to be used in the place of hand tools for raising output, and as a substitute for power driven machines where it is impossible to bring the work up to a stationary machine.

Every engineering workshop today that preens itself on being properly equipped and up-to-date, boasts an electric welding plant because such welding is used for a number of jobs. Almost every aspect of engineering has profited by the numerous welding techniques available now.

While welding has established itself, all manner of electrical devices have become available and been introduced into the factories, such as electromagnetic lifting gear, chucks, clutches, clock systems, large telephone systems, either manual or automatic, electro-plating, photo-printing, crack detectors, projectors for precision inspection, strain measuring by the differential-resistance method, ventilation and forced-draught fans, and winches, capstans and traversers, etc.

RECENT DEVELOPMENTS

The most noteworthy development in electrical engineering in recent times for application in industry, is represented by "Electronics". This new technique has virtually limitless possibilities for application in industry. Its application extends from a simple timer that stops and starts machines, to the complex feedback devices that regulate machines against a standard reference while they are in action, as in register control on colour printing presses. The automatic control of processes (right up to the control of a rolling or blooming mill), the examination for flaws in solid steel, electronic welding, etc., are becoming accepted way of doing things.

As a scientific term the word "electronics" is somewhat vague. The shortest definition that has so far been found for it is as follows: "Electronics is the science which deals with the behaviour of free electrons". The control of electron emission in relation to its practical utilization was first applied in radio telegraphy thus establishing its capability of transporting energy from one place to another without any material connection between the two places.

ELECTRONICS IN INDUSTRY

In its industrial application, electronics plays a somewhat different role. In this sphere, it is employed as energy converters. For example in case of high-frequency heating, the ordinary current is converted into high-frequency unit by means of an electronic machine. In industry, the principles of electronics are employed in two main directions viz: (a) as Power and as (b) Intellect.

As far as power is concerned, the achievements of electronics are as follows:—

- (i) Rectifying all powers, controlled or not controlled. Electronics converts the A. C. into D. C. in a simple and most economical way.
- (ii) Electronic switching of power, for reliability and economy. The simple replacement of a switch by an electronic tube (Thyratron, Ignitron, etc.) as is done for avoiding sparks or for better defining the switching time, is cited as an instance in point.
- (iii) High-frequency induction and dielectric heating.
- (iv) Inversion to convert direct current into alternating current.
- (v) X-rays, not only for structural research in industry, but also as radiated power for chemical, physical and biological transformations.
- (vi) Ultrasonics—using inaudible sound—waves for emulsifying in chemical industries, cleaning tiny objects, detecting flaws in metal, etc.

Electronic provides industry with intellect in various forms such as (a) observation followed by (i) an alarm only (ii) alarm plus reaction i. e. automatic intervention in the process, (iii) a refinement of an alarm in accurate measurement of the observed quantity and (iv) a refinement of rough intervention in the regulation and control; (b) mechanical book keeping with electronic means; and (c) Electronic computing machines.



Fig. 2. Measuring the plate thickness of a pressure vessel from one side only with the help of a portable instrument which works by ultrasonics.

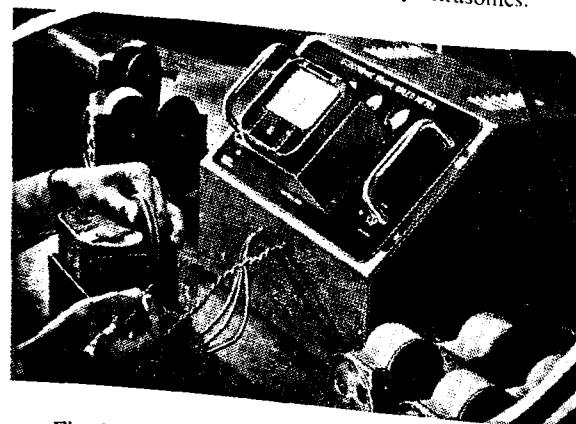


Fig. 3. Electronic speed measuring unit which is being employed to check the cine-camera driving motor.

The applications of electronic techniques in production are completely transforming many manufac-

turing processes and apart from electronic control and regulation, their field extends to weighing, batching, counting, industrial radiography, metal detection, battery charging and measurement. Some of their applications are depicted in the pictures reproduced elsewhere as Figs. 2 & 3.

Conditions to-day are such that modern scientific

methods as obtainable by electronic devices must be employed to an increasing extent in industry to achieve better results. The future of electronics, as far as it can be seen, is even more spectacular. With the enormous strides that are being made in the field of electronics, the day is not far off when we will have the age of running factories by stabbing a finger on a plastic push button.

PERFORMANCE REQUIREMENTS OF MAINS-OPERATED PUBLIC AMPLIFIERS

The Indian Standards Institution has drafted an Indian Standard Recommendation for Minimum Performance Requirements of Mains-Operated Public Address Amplifiers [Doc: ETDC 8 (26)] for wide circulation amongst the interested parties for eliciting their comments.

This standard recommends the minimum performance requirements that are to be expected of a public address amplifier designed for operation from electric mains and intended for general purposes.

This standard is one of a series of Indian Standards relating to Audio Amplifiers. The others in this series are:

IS: 1302 Methods of Measurements on Audio Amplifiers (under print)

IS: 1301 Code of Safety Requirements for Electric Mains-Operated Audio Amplifiers (under print)

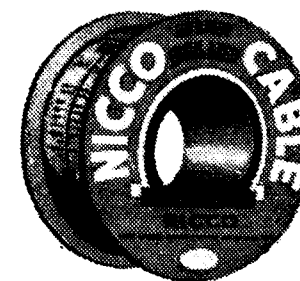
An Indian Standard Code of Practice for Installation of Amplifying Systems (under preparation).

The object of this standard is to recommend certain minimum figures of electrical performance characteristics that may be expected of moderately priced public address amplifiers.

The values given in the standard are based on data collected from tests conducted on a number of makes of such amplifiers manufactured in India and which are normally acceptable to the consumers. It is hoped that with the help of the recommendation given in this standard, the industry could have a basis for designing acceptable amplifiers, and the purchase can be assured of at least a minimum level of performance.

Copies of the draft standard are available, free on request, from the offices of the Indian Standard Institution, located at New Delhi, Bombay, Calcutta and Madras.

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STEPHEN HOUSE, DALHOUSIE Sq., CALCUTTA-1

SELECTION OF LIGHTING EQUIPMENT

By D. S. Doshi

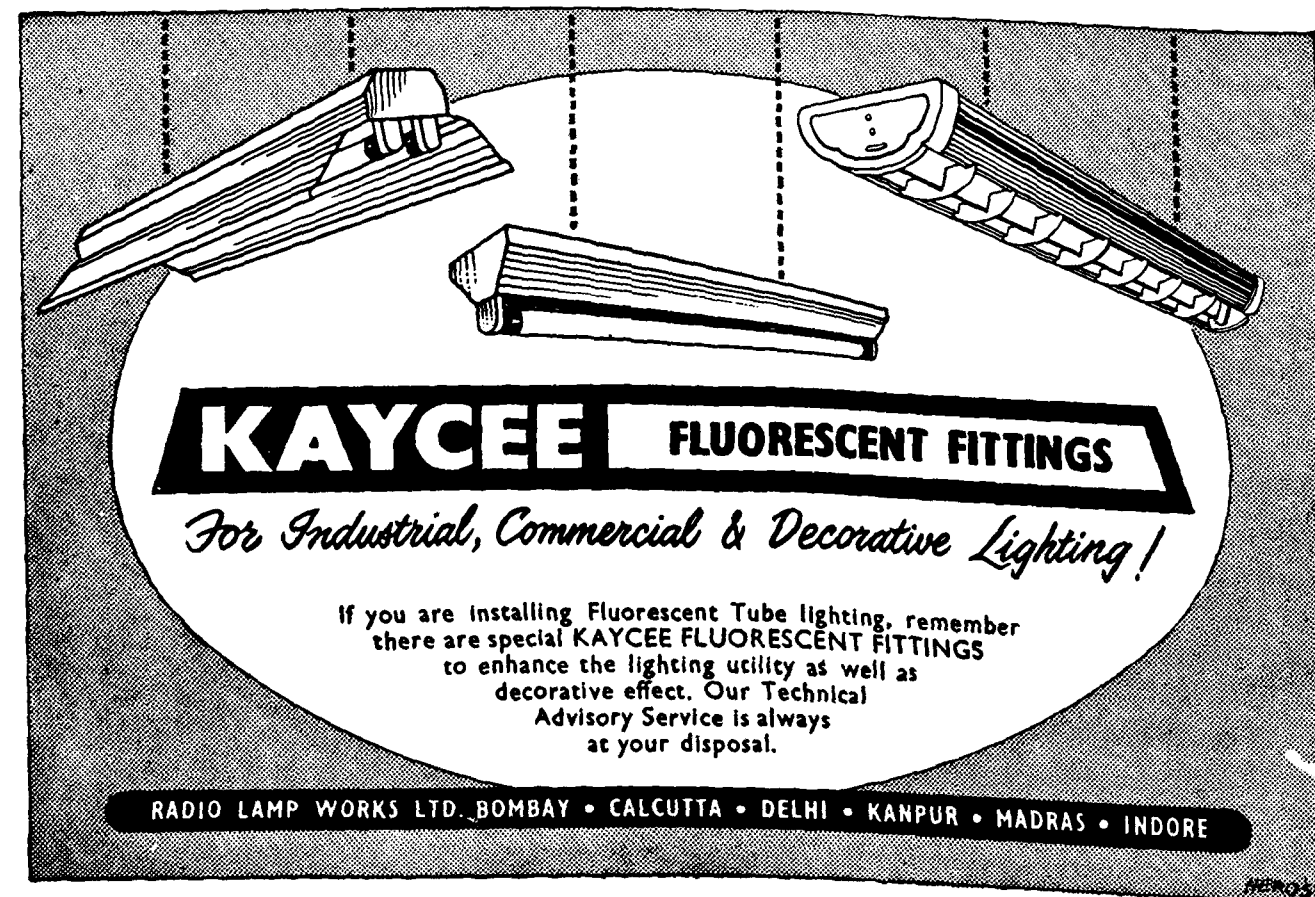
Lighting Engineer, Radio Lamp Works Ltd.

IN this country during the last decade the industrial development has accelerated very fast. With the development of all other industries, the manufacture of lighting fittings and accessories has also developed rapidly. A considerable change has also taken place in the way of thinking of our people and it has been universally recognised in this country also that planned good lighting is essential to improve the productivity and promote sales. But due to the rapid development of this industry, unfortunately many of the manufacturers have kept in mind only the quantity of production and they have not given serious thought to the quality of the fittings and accessories. Consequently the consumers have to purchase whatever is available to them either due to their ignorance of the quality products or due to temptation for going in to purchase at cheaper price.

SELECTION OF EQUIPMENT FOR INDUSTRY

It should be realised that cheaper goods are not always the most economical. In my opinion it becomes necessary for consumers to know what exactly is desirable when they make purchases of fittings and accessories—especially when huge quantities of these items are to be purchased for big projects, factories, offices, road lighting etc. With the advent of fluorescent tube lamps, it has become essential to utilise them in preference to incandescent lamps as the tubes last longer and save energy, thus resulting in saving of recurring expenditure. I shall therefore confine myself to the manufacture of fittings and accessories suitable for use with fluorescent tubes.

The reflectors and the housing for the accessories are



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For Industrial, Commercial & Decorative Lighting!

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mostly made from steel sheets. For general purpose workshops, factories, godowns etc., where no abnormal atmospheric conditions exist or chemical processes are carried out, it is economical to use stove enamelled industrial fluorescent fittings. The situations where there is high humidity and temperatures, it is preferable to use either vitreous enamelled or anodised aluminium industrial fluorescent lighting fittings. In factories where chemically corrosive fumes exist, vapour-proof fittings are essential. In the dusty atmospheres like flour mills, cement factories, glass factories etc., it will be necessary to use dust-proof fittings. In mines and where there is a possibility of explosion taking place, explosion-proof or flame-proof fittings will be necessary.

FOR OFFICES

In general offices it will be quite suitable to use the box or rail type fittings, but to avoid glare and obtain



A general office air-conditioned and lighted to obtain the effect of natural day-light.
(Bachhraj Group Office)



A Board-Room to give glare-free light of 30 ft. candle on the table. Use has been made of louvred frames in harmony with acoustic slabs.
(Bachhraj Group Office)

diffused light, it will be necessary to use these fittings with louvres or diffusers. They are known as decorative or functional fittings. In factories, where high and wide bays exist, the most efficient source of light will be the mercury vapour lamp. Unfortunately the imports of these lamps have been restricted due to foreign exchange difficulties and in India we have just made a beginning to manufacture such lamps. It will be advisable to use 80W fluorescent tubes in a fitting which can accommodate four or more such tubes.

STREETLIGHTING

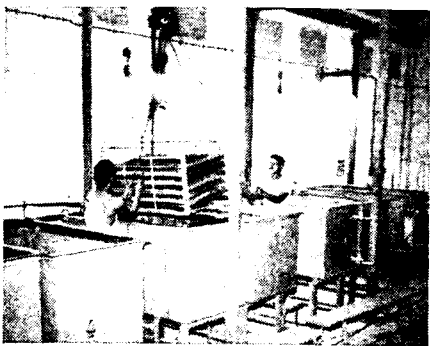
On roads till now in India, we were either using gas lamps and in villages even kerosene lanterns. With the electrification of roads it is essential to use an efficient source of light on roads as an economy in capital investment as well as maintenance is very essential. Unfortunately the mercury vapour lamps have to be kept aside for some time to come. It will therefore be advisable to use fluorescent tubes with a suitable fitting which will distribute the light on roads uniformly, will be free from insects, rain water and can withstand the climatic conditions of this country.

MATERIALS USED IN EQUIPMENT

While purchasing, it is very essential to know the material, thickness of the reflector and channels etc. It has been observed that steel reflectors should have a minimum thickness of 20 s. w. g. and aluminium reflectors that of 18 s. w. g. The steel sheets obtained are sheared, folded, drilled, welded and finally we obtain a fitting. But this fitting becomes oily, rusty etc. during the transport, processing and handling. If it is painted without any pre-treatment, the paint will not stick properly, necessary gloss will not be obtained and the reflectivity of the fitting will be low and the life of the paint will be short. As a result, the fitting will lose its purpose. It is therefore essential to pre-treat the steel sheets and before making any purchase, the customer should see to it that he gets the right quality of the fitting.

PROCESSING OF MATERIALS

The grease and oiliness etc., can be removed by treating the sheets with alkalis at high temperatures and then rinsing with hot water. The scales, rust etc., can then be removed by pickling at high temperatures and rinsing with cold water.



Lighting Fittings of steel sheet pre-treated with alkalis and acids to remove grease, oil, oxides etc. and phosphate-coated to improve the life of paint.
(Radio Lamp Works Ltd. Factory)

After the removal of all the foreign materials on the surface of the fitting, it should be granodined (coated with material which shall bind the paint thoroughly to the steel sheets) and then rinsed with hot water. To remove the final traces of granodine, the fittings should be deoxylyted. The fitting is now ready to be sprayed with paint. The reflector surface should be painted with non-yellowing paint to obtain high gloss and retaining it for longer time. The painted fittings are then baked at high temperatures in a stoving oven. The fitting is then ready.

For vitreous enamelled fittings it is very essential that right quality of steel sheets are used. During the process of enamelling, the enamelled sheets are fired at very high temperatures and then they are cooled. During this process thermal co-efficient of expansion and contraction of the steel sheets and the enamel should be same as otherwise the enamelling will not be uniform throughout. It should also be noted that vitreous enamel is a sort of glass or porcelain and cracks easily. It, therefore should have a good binding with the steel sheets. The steel sheets should then have saw-teeth like surface, so that enamel is firmly gripped to the sheets. Vitreous enamelled fittings are used in humid atmospheres. But the enamel being brittle, it is liable to break easily and then the corrosion from within will start very rapidly. It seems that anodised aluminium sheets are better in such situations. Aluminium itself is a non-corrosive material and anodising reinforces this effect.

In dusty, chemically corrosive, explosive situations, the fittings should be selected which should serve the purpose in such conditions.

For streetlighting also the material used should be

anodised aluminium as this material has the advantage of non-corrosion, lightness etc., the qualities which are essential. The streetlight fittings also should be insect-proof and weather-proof. They should be mechanically strong enough to withstand the different atmospheric and climatic conditions. The light distribution from the fitting should be such that the roads are more or less uniformly lit. It should not happen that under the lamp we get a very bright light with patches in between.

CHOKES

The fittings alone will not serve the purpose without the accessories. The most important of these accessories is the choke (inductive ballast). It is compared to the heart of human being. In the choke, it is



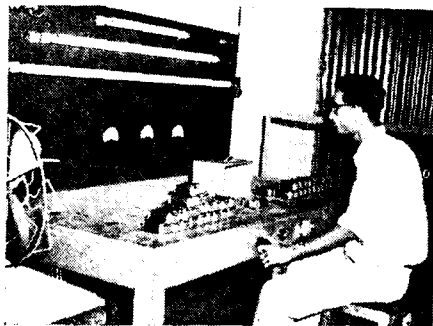
Chokes manufactured on electrically operated winding machines.
(Radio Lamp Works Ltd. Factory)

essential to see that it serves the purpose for which it is meant. The design and construction of the choke should be such that it allows the correct value of current to pass through the circuit, because it is with this current only that the tube can give its optimum light output. If this current is high, the light output of the tube may be more but the life will be shortened



High voltage Flash Test on chokes to ensure the quality of insulation.
(Radio Lamp Works Ltd. Factory)

and vice versa. The power loss in the choke should not be high because it is a loss of energy and also the temperatures are high, thus resulting in an early failure or deterioration of the entire unit. The high temperatures may bring havoc and even a fire may take place.



Individual chokes tested before casing to ensure correct current and wattage consumption at rated voltage so that optimum light output is obtained.
(Radio Lamp Works Ltd. Factory)

Recently a few of the chokes were tested by the author and he was horrified to see the results which are disclosed in the Table below. The purchaser should therefore know well what is desired by him before making purchases. He should be fully informed about the performances of the choke that are desirable. The Table may be useful as it gives the desirable performance in the last row.

STARTERS

The next important accessory is the starter. The starters of the correct design should be obtained. Some times the bi-metallic strip is not properly timed and then the tubes start blinking thus rapidly shortening the life of the tubes.

HOLDERS

The tube holders should be of correct design and should serve the purpose. It should not happen that the tube falls down thus creating nuisance and injuries.

TABLE

Make of the choke	Voltage mains	Starting current	Running current	Total power consumption	Power consumed by tube lamps	Power loss in choke	Temp. rise	REMARKS
'A'	230V	0.55A	0.35A	45W	34W	11W	69.6°C	Low starting current Difficult starting. Less light due to low running current. Temp rise beyond limit.
'B'	230V	0.85A	0.32A	38W	30W	8W	56.7°C	Very high starting current. Shortens life of filaments. Lower running current. Less light Temp. rise near limits.
'C'	230V	0.65A	0.46A	58W	44W	14W	50.2°C	High running current More light but life shortened. Perhaps designed to work 220V.
Desirable Performance	230V	0.70A	0.4A		40W ± 3W	11W	60.0°C	Compare with the figures.

avoid that sometimes the clips are used, but it has been observed by the author that some of the clips are not elastic enough and after their use for some time they lose their purpose.

APACITORS

The last important accessory, but not the least is the condenser. The condensers are primarily used for power factor improvement and in circuits where two fluorescent tubes are used, to help in avoiding the roscoscopic effect. While selecting the condensers it could be noted that they should be of correct value for the improvement of the power factor and also the temperature rise should not be very high.

CONSULTATION ON LIGHTING PROBLEMS

The intention of this article is to make the people conscious about the quality of the fittings and accessories before their purchase. Recently some of the firms in India have started the consultation departments where they offer free consultation services. These services include the preparation of illumination design for factories, offices, schools, show rooms, roads



Lighting Engineer working on a lighting scheme.
(Radio Lamp Works Ltd. Office)

etc., assistance in selection of the correct type of fittings and accessories for different purposes, collaboration with architects, civil engineers etc., at the stage of making plans, so that lighting—artificial or natural becomes an integral part of the buildings etc. These services are available without any obligation on the part of the customers and the intention is to create consciousness and conditions for good lighting in this country, so that the productivity is improved which is so essential for a rapidly developing country like ours.

SPACE AGE DEMANDS NEW TECHNOLOGY

With yesterday's "high-temperature" materials all but melting away under the intense heats of today's rocket engines, scientists are looking to new technology to produce the materials of tomorrow. Development engineers of Union Carbide Corporation find their 75-year experience in producing carbon and graphite for industry gives them a valuable start in tackling the temperature problems created by the space age.

Here at one of Union Carbide's development laboratories, a technician watches through an observation port in a flame-test chamber as a new graphite-base material is put through its paces. Positioned in a jet of exhaust gases travelling at five times the speed of sound from an oxygen-kerosene flame (note characteristic diamond-shaped supersonic nodes), the conical specimen reaches a white heat of approximately 5,000 degrees Fahrenheit (2,690 deg. Centigrade) in a matter of seconds. Conventional graphite erodes beyond tolerable limits in about eight seconds, but Union Carbide has already produced materials that hold their dimensions ten times longer, and is developing materials which will hold their dimensions on even longer cycles—well beyond the normal operating

requirements of rocket engine components. The new knowledge being gained is expected to exceed everything previously learned of the behaviour of materials at temperatures approaching that of the sun's surface, and gives promise of resulting in a whole new "family" of high-temperature materials for both industrial and military equipment of the future.

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Remote control system for unattended power stations and substations provides 105 channels of control supervision and upto 30 channels of continuous telemetry over one transmission circuit. Applicable to any transmission circuit capable of passing 15 pulses per sec. it can be used with telegraph circuits, voice grade circuits or microwave radio links. Signal system permits automatic triple code checks, insuring integrity of transmissions and preventing wrong operation or loss of data. Less than two seconds are required for any transmission. Pulse width telemetry permits continuous data gathering over same circuit as supervisory control transmissions. Manufactured by Applied Science Corp of Princeton, P. O. Box. 44, Princeton, NJ. USA.

Why a Thermoplastic Sheath on Rubber Insulated Shielded Power Cable?

By an Electrical Engineer

WHEN you buy shielded power cable you don't generally inquire, "why have a sheath at all?" But it would be a fair question, answered something like this:

You (and we) expect a nonmetallic sheath on shielded power cable to:

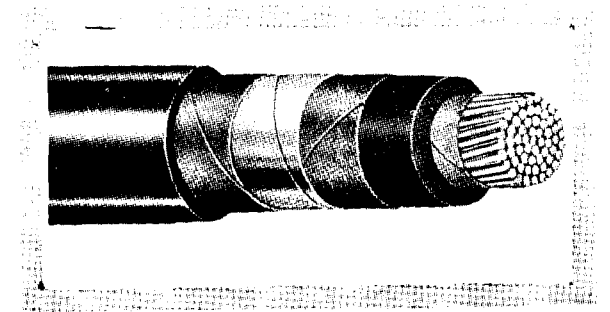
1. Protect the insulation and shield during installation.
2. Be equally satisfactory for use in ducts, buried directly in earth and aerially.
3. Resist weather and soil conditions.
4. Have adequate moisture resistance.
5. Be easy to pull, handle, install.
6. Resist burning.
7. Be flexible enough for installation at sub-zero temperatures.
8. Be durable and homogenous.

ORIGINALLY, BRAIDS AND LEAD

Early efforts to meet these requirements involved fabric braids or lead sheaths. Braided coverings were relatively inexpensive; but they rapidly oxidized and rotted. Lead was (and is) a fine protector; but it was costly, hard to handle, it corroded, and was easily damaged.

NEXT, NEOPRENE

In 1932, a few cable makers began using Neoprene instead of the conventional older materials. As a sheathing material, Neoprene offered definite advantages over lead and braids. Obviously, Neoprene solved the rotting problem with braid. And, used in place of lead, Neoprene has cut cable cost, made handling easier, and resisted damage better. It



RoZone insulated, RoSeal sheathed, shielded power cable for high-voltage application through 15 kv.

provided oil, flame and sunlight resistance when used over rubber.

NEXT PROBLEM, SHIELDING

But at certain voltage levels the electrostatic shielding formerly provided by lead sheathing was still needed. The IPCEA shielding recommendations were established and the logical solution to achieve the shielding effect was a metallic tape wrap between the insulation and the nonmetallic sheath.

THE SOLUTION

After years of research, we developed a material of which we're very proud. Its name is RoSeal and it is a thermoplastic. Applied over premium quality RoZone insulation, RoSeal is a completely satisfactory sheath for shielded cable rated up to 15 kv.

HERE'S WHAT YOU'LL GET FROM ROSEAL

1. A rugged protective covering with toughness and other good mechanical properties.
2. Resistance to attacks from any micro-organisms.
3. Resistance to weathering and soil conditions (equal to Neoprene).

4. Exceptional moisture resistance (superior to Neoprene)
5. Much easier pulling (RoSeal's friction coefficient is lower than that of any other sheathing material because of its waxy structure). Pulling lubricants not generally required.
6. Flame resistance.
7. Easy bending (superior to Neoprene) and installation at sub-zero temperatures.
8. Durability and long life (equal to Neoprene).

AND LOWER COST, TOO

This new development, RoSeal, offers you an additional benefit due to the inherent economy of RoSeal sheath as compared with Neoprene.

OTHER ADVANTAGES

In every test, you'll find that RoZone insulated,

PRODUCTION TESTING OF CORONA LEVEL ON HIGH-VOLTAGE CABLE

NONDESTRUCTIVE TESTING OF CABLE* IS A QUALITY CONTROL MEASURE WHICH PROTECTS THE ULTIMATE USER

Whether insulated with rubber or thermoplastic, high-voltage cable must be free of voids and porosity. Otherwise, there may be trouble, if the operating voltage exceeds the corona-forming voltage.

Our job was to provide a test which would insure cable performance in a corona-free condition.

Rome developed and has continuously used a corona-ionization production test procedure since 1947. It is now applied as part of standard testing for all power cable rated 4001 volts and over.

HOW IT'S DONE

The detector is a basic "filter"-type circuit. It consists of an ionization-free, high-voltage transformer with amplifier and detector circuits located in a central control area with other inspection instruments. A corona-free bus-distribution system provides accessible electrical connections to the reels of cable in the test zone.

RoSeal sheathed cable has uniformly high corona levels and electrical properties.

You'll find that RoSeal has greater resistance than Neoprene to oils and most chemicals and immeasurably better moisture resistance.

This advantage is of considerable importance in industrial applications and for direct burial in earth.

WHAT ROSEAL LOOKS LIKE?

Installation procedures for new RoZone-RoSeal are the same as for Neoprene sheathed cable. Its general appearance is the same, as are dimensions, ratings, and everything else.

You can use RoZone-RoSeal aerially, in ducts, and installed directly in earth.

SEND FOR DATA

Detailed specs and engineering data are yours for the asking.

While bridge circuits have been used for ionization detection, the filter circuit provides more advantages since it involves simpler equipment, it provides for grounded test specimens, is more sensitive, and it can record minimum values of corona level rather than the average value detected by bridge methods.

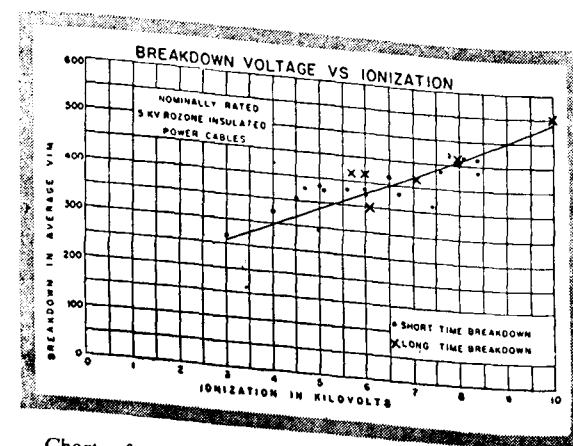


Chart of observed data on breakdown voltage vs. ionization as determined on samples of a rated 5 kv. rubber-compound-insulated conductor.

This test, used on the production line, helps determine the electrical soundness of every foot of

cable in every reel. If troublesome voids exist, the detector immediately indicates their presence. If the trouble cannot be remedied, the defective portion of the cable is discarded.

WHERE TROUBLE OCCURS

Voids may occur next to the conductor, within the insulation, or beneath the outer shield. Voids are more likely to be found between the insulation and the conductor—and this is the most vulnerable place since it is the area of maximum voltage stress. Proper cable design and correct manufacture are the best assurances for a corona-free cable.

MORE ABOUT TESTING

The corona-level tests we have been conducting for the past eight years, on all high-voltage rubber—and thermo-plastic-insulated power cables consist of measuring the corona level on full reel lengths of cable. This is done before the routine voltage and insulation resistance tests, during which unshielded cables are immersed in water which acts as the ground electrode. Shielded or lead-sheathed cables are tested dry on the floor.

QUALITY CONTROL

As a standard quality control measure, we require that the measured corona level on any high-voltage cable exceed the intended operating voltages by a predetermined value. This means that the cable should be free of any destructive ionization effects in service. And that's important, because ionization of air in voids between conductor and insulation causes the formation of small quantities of ozone and oxides of nitrogen together with a subsequent reduction in dielectric strength and a rapid physical deterioration of the insulation. With nonozone-resistant rubber

insulations you may get corona cutting (similar to sunlight checking).

Testing helps prevent all these possible performance hazards.

THE VALUE TO YOU

The real end value of Rome's corona-level testing is its contribution toward production of power cable that assures *you* years of trouble-free service. It is a quality control measure (now getting general industry acceptance) of enormous value to all users of high-voltage cable.

When you buy cable that has been corona-level tested, you derive a certain peace of mind from the knowledge that at least one frequent cause of costly troublesome service outages has been virtually eliminated. Your maintenance costs go down proportionately. And, indirectly at least, the good will of the people who depend on the power distributed over these lines is enhanced.

If you'd like to know more about Rome Power and Control Cables, a note to us will bring you catalogs specifications or engineering help.

* "The Measurement and Investigation of Ionization Level of Rubber-Insulated Cables," R.C. Graham, E.K. Duffy, W.P. Foster; Trans. AIEE Technical Paper 48-198; August 24 to 27, 1948.

"Corona-Level Testing of Cables," R.C. Graham; reprinted from Electric Light and Power, May, 1953.

"Corona-Level Measurements as Applied to Rubber and Thermoplastic Insulated Cable," R.C. Graham; program Twenty-Second Annual Conference of Doble Clients January 24 to 28, 1955.

MOISTURE RESISTANCE OF CABLE INSULATIONS

In sharp contrast to the situation only 15 to 20 years ago, moisture need no longer be considered a serious hazard to cable operation.

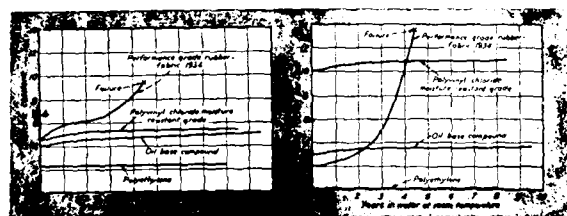
Two factors have helped materially in the relatively rapid attainment of this present degree of protection: (1) New insulating materials and compounds have been developed which possess an inherent high degree of moisture stability; (2) Short-term laboratory test methods now help to evaluate moisture resistance

correctly and thereby speed the development of the newer insulating materials.

METALLIC SHEATHS—PRO AND CON

A continuous metallic covering, such as lead sheath inherently provides complete moisture protection to the underlying insulation. But a metallic sheath is not always advisable or practicable. Hazards such as electrolysis, corrosion, vibration, plus added weight

and economic factors often nullify its usefulness. This seems to be more the rule than the exception.



These graphs show some long-time 1000-cycle test results on typical insulations. Time consumed retards development of new types. The text explains limitations of accelerated tests and how interpretation is affected by application.

Because of these problems presented by metallic sheaths, attention turned to the study of the ability of the conductor insulation itself and nonmetallic coverings to withstand water and moisture. These studies involved the theories of mechanics of moisture attack, effects of environmental conditions, methods of test, and evaluation of insulating materials and coverings with particular relationship to actual performance and experience.

THEORIES

The mechanics of water absorption have been comprehensively investigated. While there is a lack of agreement in terms of actual operation, it is generally agreed that there are at least two physical methods by which water might affect insulation: by actual "absorption" and "diffusion."

"Absorption" is a direct layer effect in which the successive outer layers of the insulation gradually become water-soaked. Tests for increased weight or electrostatic capacitance of the dielectric reflect changes by absorption.

"Diffusion"—more difficult to measure—takes place when water permeates the insulation and establishes irregular conducting paths of water from the conductor to the outer surface. Its study involves additional parameters such as pressure and rate. A weight test would not disclose "diffusion" but some sensitive electrical quantity such as insulation power factor or resistivity might be related to it.

The effect of moisture upon cable characteristics can probably be best explained in terms of its electrical action which provides a direct determination. The

insulating properties of a dielectric are adversely affected by the conducting properties of the water.

The determining feature for any insulation operating under an alternating current stress is its electrical stability. For as soon as its insulation becomes erratic under a particular set of circuit conditions, a cable's usefulness to that circuit is ended. For a power cable, complete electrical instability is reached when dielectric losses become excessive enough to permit actual thermal failure. For a communication cable, this point is reached when attenuation constants increase so much that an acceptable level or quality of signalling cannot be maintained.

In cable insulation it is not so much a question of "how much" water, as "where" it is. The ultimate criterion in the penetration of water through cable insulation, therefore, is its effect upon the electrical stability of the cable—all other effects being of secondary importance. The longer the electrical properties of an insulation remain relatively constant in the presence of water, the better is the true moisture resistance of that insulation.

Long-term unaccelerated moisture tests have been fundamental and helpful in adding to the knowledge of moisture absorption. But a minimum of two years' immersion period has usually been necessary to establish whether or not an insulation was truly electrically stable—and many such tests have been continued on many types of insulations for 5-year periods and longer. Something of a more practical nature was obviously needed and several short-term test methods, based upon electrical measurements were devised and found to give a relatively truthful index of moisture resistance.

TEST METHODS

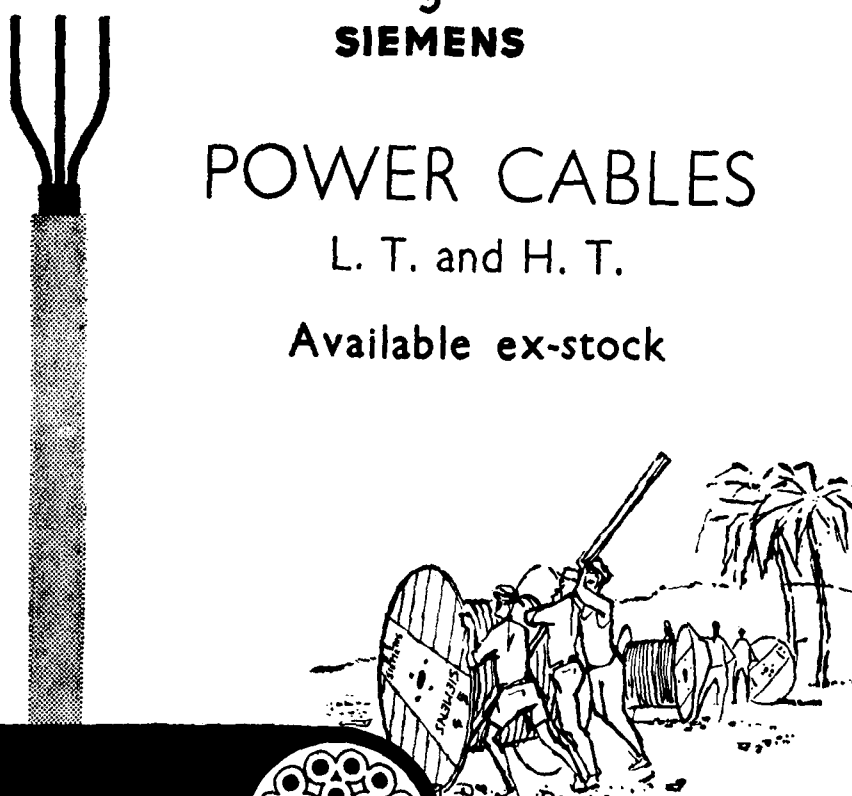
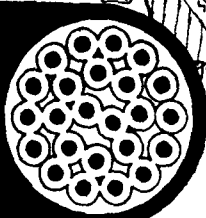
One such short-term test control is the temperature of the water bath. This has been found to have a substantial accelerating influence, although certain caution is needed in establishing a maximum test temperature that will not alter results because of chemical or physical changes. For most materials and purposes, a bath temperature of 50°C. has been found satisfactory. Further, the effects of thickness of insulation are reflected in the rate of change of electrical properties. Relatively thin walls (preferably not less than 1/32") will disclose the effects of water much sooner than heavier walls which may require several months immersion to indicate a correct trend of measurements.



POWER CABLES

L. T. and H. T.

Available ex-stock

SIEMENS-SCHUCKERTWERKE AG
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SISTA'S-SE-10

In performing electrical measurements, an increase in the applied test voltage will generally cause a truthful "acceleration." For example, measurements of power factor and capacitance at 60-cycle voltages up to 80 volts per mil of insulation thickness provide a reliable means of testing insulated conductors intended for 60-cycle power service applications.

An electrical test which consists of measurements of 60-cycle capacitance and power factor at 40 and 80 volts per mil on cable specimens immersed in water at 50°C. is now the only moisture test recommended by IPCEA for power and control cables. It is sometimes called the Stability Test. Details and limits for this and other tests are set forth in the recent IPCEA wire and cable specifications, Appendix N—Method EM-60.

Highlights in development of pvc compounds for wire and cable

1932. Experimental work began.
1935. First commercial production, principally for signal and instrument wiring.
1938. Underwriters' approval in appliance lead wires.
- 1930-40. Underwriters' approval as Type T wire for rewiring jobs.
- WORLD WAR II YEARS.** Military applications: communications, power, electronics, signaling and others (including aircraft and shipboard);
- Code recognition for use as Type T wire for new installations:

PROGRESS REPORT ON POLYVINYL CHLORIDE INSULATIONS

Since 1932, when researchers started investigating polyvinyl chloride compounds for wire and cable, it has become one of the most popular insulating materials available. In fact, over 100 million pounds were used by the wire and cable industry in 1954 alone!

To bring you up to date on polyvinyl chloride wire coatings and Rome Cable's product—Rome Synthinol® in particular, is the purpose of this brief report.

IN CONCLUSION

The various possible effects of moisture on insulation involve a careful analysis of the end use before choosing materials and design. But it is certain, at least, that specification of lead sheathed cable designs is no longer mandatory for wet locations. And there is no question that we are headed for still better moisture-resistant insulations—and better tools aiding our understanding of the problem of moisture.

For further study of this subject reference is made to a paper entitled, "What Moisture Resistance Means in Cable Insulation" by R. C. Graham, Chief Engineer, Rome Cable Corporation, which we will gladly send on request.

- Underwriters' approval (1943) and NEC recognition as Type TW for wiring in wet locations.
- 1946-48. New applications and approvals: machine tool wiring, switchboard wiring, street lighting cable, cords, control cable, and many others.
1951. Acceptance by IMSA for police and fire alarm cable NEC recognition as TW wire through 2000 MCM; Underwriters' approval of Rome Synthinol 901 for 105°C. appliance wiring and, in
- 1954, approximately 100 million pounds of polyvinyl chloride compounds were used by the wire and cable industry.

WHAT ARE POLYVINYL CHLORIDE COMPOUNDS?

These compounds consist of polyvinyl chloride (or a co-polymer of polyvinyl chloride and polyvinyl acetate) thermoplastic resin mixed with plasticizers for flexibility, fillers for strength, pigments for color, and stabilizers for resistance to age and oxidation. The combined properties of these ingredients determine the properties of the compound. The compounds are thermoplastic in that they do not

require vulcanization. They are generally applied to wire by the extrusion process.

Polyvinyl chloride compounds produced by Rome Cable bear the registered trade name Rome Synthinol®.

CHARACTERISTICS OF ROME SYNTHINOL

Rome Synthinol has earned its popularity because of these desirable characteristics:

- Economy*—low in cost; and because of its small diameters, handling and installation costs are minimized.
- Simplicity*—no outer braids required
- Flame Resistance*—inherently resists burning
- High Dielectric Strength*—higher than most rubber compounds
- Moisture Resistance*—superior to many rubber compounds.
- Appearance*—bright, shiny colors
- Weather Resistance*—unaffected by long exposure to sunlight and weather
- Versatility*—suited to many low-voltage insulation and jacket applications—indoors or out, in conduit or duct, in water, or in the ground.

SPECIAL COMPOUNDS

Because polyvinyl chloride insulation and jackets derive their properties from the materials they contain, it is possible—through proper ingredient selection—to "engineer" compounds for specific end uses. Here are some of the special applications:

- Cold*—special compounds are available for low-temperature applications—down to 40°C. and lower
- Heat*—special compounds are available for high-ambient conditions—up to 105°C.
- Deformation*—special compounds, or special cable design, can reduce this effect
- Moisture*—most polyvinyl chloride compounds have very good moisture resistance. But careful selection is advised if dc potentials are involved in wet locations.

Polyvinyl chloride insulation should not be used where heavy and/or frequent current overloads are involved (such as in network cable). And because of relatively higher dielectric losses, it is not generally recommended for the higher primary distribution voltages.

SPECIFICATIONS

The various polyvinyl chloride wire and cable industry specifications in use today are: Underwriters' Specifications; ASTM D734; IPCEA Appendix I for insulation, Appendix J for sheath; Federal Specification JC-129; IMSA Specification No. 20.

There are also, of course, many individual customer specifications applicable for specific end uses.

TYPICAL APPLICATIONS

Rome Synthinol and other polyvinyl chloride materials are suited for these wire and cable applications:

- Type TW building wire
- Nonmetallic sheathed cable
- Type UF underground feeder cable
- Machine tool wire
- Station control cable
- Series street lighting cable
- Multiple street lighting cable
- Multiple conductor instrument wiring
- Fire alarm and traffic signal cable
- Over-all jackets
- Fixture wires
- Radio hook-up wire
- Appliance wires

FURTHER DEVELOPMENTS

From its active and pioneering part in the development of polyvinyl chloride compounds, Rome Cable's experience is reflected in Rome Synthinol Cables. Special Rome Synthinol Compounds are available for many unusual applications.

A notable example is Rome Synthinol 901, the first high temperature polyvinyl compound to receive appliance wire listing for 150°C. and later approved for use on TW moisture-resistant building wire. Because of other outstanding properties—increased resistance to oils, solvents, and chemicals—Synthinol 901 has proved itself as a preferred insulation material for chemical, petroleum, and other industrial wiring where high temperatures and environmental hazards are a continuous problem.

If you have a wire and cable problem for which a polyvinyl chloride compound might provide the answer, our experience is at your service.

March 1959

TYPICAL PROPERTIES OF POLYETHYLENE (not specification values)

PHYSICAL AND MECHANICAL				CHEMICAL		ELECTRICAL			
PROPERTY	UNITS	TEST METHOD	VALUE	PROPERTY	RELATIVE RESISTANCE	PROPERTY	UNITS	TEST METHOD	VALUE
Tensile Strength	Lb./sq. in.	D412—51T	1600—2000	Acetic Acid	Good	Power Factor		D150—47T	
Ultimate Elongation	%	D412—51T	350—600	Chromic Acid	Fair	@ 60 cycles			0.0003
Heat Resistance Temperature	°C.	D746—51T	-60 to -95	Hydrochloric Acid	Good	@ 10 ⁴ cycles			0.0003
Flex (25°C.)	Lb./sq. in.	D747—50	20000—25000	Nitric Acid	Good	@ 5 x 10 ⁷ cycles			0.00044
Compressive Strength	Lb./sq. in.	D695	4000	Sulfuric Acid	Excellent	@ 3 x 10 ⁹ cycles			0.00035
Hardness, Shore		D676—49T	C81, D48			Dielectric Constant		D150—47T	2.3
Softening Point	°C.	ASTM	95	Alkalies	Good	60 Cycle Dielectric Strength	Volts/Mil.	D149—44	1050
Melting Point	°C.		115—125			Impulse Strength	Volts/Mil.		1800—2500
Thermal Conductivity	BTU/hr./sq. ft./°F./in.		1.75	Ethyl Alcohol Solvent	Good	Arc Resistance	Sec.	D495—48T	30
Flt Index	dg./min.	D1238—52T	0.95 to 1.6	Aromatic Hydrocarbon Solvent	Not Recommended	Volume Resistivity	Sec.	D257—49T	> 10 ¹⁷
Specific Gravity		D792—50	0.92	Chlorinated Solvents	Not Recommended	Surface Resistivity	Ohm-CM.	D257—49T	> 2x10 ¹⁴
				Ethylene Glycol, Gasoline, Oils	Good	Ozone Resistance		D470	No Effects
				Kerosene	Fair				
				Soaps	Excellent				

PROGRESS REPORT ON POLYETHYLENE

ITS ORIGIN

In 1940, the first samples of polyethylene resin (manufactured in England) appeared in this country. Now, only fifteen years later, it has become one of industry's most popular plastics. And there is every indication that it will be one of the most plentiful, as well as economical plastics. Rome Cable is proud to have played a most active pioneering role in this development and application of polyethylene—under the trade name of RoLene.

WHAT IT IS

Polyethylene, a pure hydrocarbon thermoplastic resin, is produced from the polymerization of ethylene gas. It is applied to wires and cables by the extrusion process and only a very minor quantity of compounding ingredients are added—an antioxidant or heat stabilizer, plus pigment for weather protection.

WHY POLYETHYLENE?

Polyethylene, because of several unique properties, is ideally suited for many wire and cable applications. Electrically, it is in itself the best dielectric material that can yet be utilized as cable insulation. Of all the nonmetallic materials it has the highest resistance to moisture and, in addition, possesses outstanding mechanical resistance to extreme cold temperatures. It is highly resistant to most chemicals and oils—even more so than the conventional polyvinyl chloride, and various rubber compounds used on wire and cable. It also excels most of these materials on abrasion resistance.

Polyethylene, when properly pigmented, is inherently resistant to weathering and sunlight. Conventional polyethylene supports combustion or flame but by proper compounding (as in the case of Rome cable's RoSeal) can be rendered flame retardant. Being a

thermoplastic, conventional polyethylene softens readily at about 225°F., but exhibits no plastic flow at temperatures up to 190°F. Since it is essentially a pure hydrocarbon it possesses excellent resistance to aging and oxidation. It is, of course, obvious that such properties, plus its low cost, admirably qualify polyethylene for a host of wire and cable uses.

The history of polyethylene as applied to wire and cable products is indeed significant. During World War II years practically the entire supply of the material was allocated to special insulated coaxial cables for radar, radio, and important military communication circuits because of its superior dielectric properties. Since the war, many commercial applications have been explored with equal success. These include weatherproof wire, street lighting cables, control, supervisory and telemetering cables, telephone cables, service cables and power distribution cables up through 15 kv rating. One of the increasingly popular uses of polyethylene has been as a jacket or sheathing material on telephone and power cables and as a protective covering for lead sheaths. Rome Cable was among the first to introduce polyethylene on such wire and cable products as weather-proof wire, triplex service drop, ornamental pole and bracket, REA telephone cable, station control cable, tree wire, neon sign cable, 5 and 15 kv power cables, as well as RoSeal, a flame-retardant cable sheath. Naturally a wealth of experience has been gained with these applications.

ITS APPLICATIONS

Industry specifications pertaining to polyethylene have been established in recent years. For example, ASTM Specification D 1248 describes the materials for use on wires and cables and various IPCEA Appendices describe actual constructions for power and control applications. ASA is now preparing a specification for polyethylene covered weatherproof wire. Polyethylene also complies with Military Specification MIL-D-3054.

Polyethylene has many interesting and valuable applications in electric utility operations today. Several of our modern generating plants utilize literally millions of feet of polyethylene insulated control cables that provide reduced dimensions, added moisture protection—particularly on dc circuits in wet locations—and maximum dielectric properties. For overhead distribution, polyethylene is now regularly used as weatherproof wire covering, and as insulation

on triplex service drop cables mainly because of its superior physical characteristics, resistance to weather and oxidation, and reduced weight. Applications to street lighting circuits are numerous, underground or overhead series and multiple circuits, as well as from the pole or bracket to the fixture itself. Most of the new communication, telemetering, or supervisory circuits also utilize polyethylene insulation. The foregoing applications have gradually proven themselves during the last ten years so that polyethylene has become, or is becoming, the preferred material for these uses.

Industry, particularly certain chemical processing plants, has been advantageously using polyethylene insulated 5 and 15 kv power feeder cables for several years. A summary report on these applications is presented in "Kabelitems," Number 79, available from the Bakelite Company, 30 East 42nd Street, New York 17, New York.

In addition to the technical merits of polyethylene probably the greatest impetus to its rapid acceptance has been in the economy accrued therefrom. In the product types described above, polyethylene construction is substantially equal in cost to alternate designs using other materials, and in most cases, considerably less than the conventional alternate wire and cable products. The available supply of polyethylene seems assured since there are now at least ten known producers of the raw material.

To operating people as well as the cable installer the ease of handling polyethylene has definite advantages. Polyethylene cables are generally lighter in weight and smaller in diameter than alternate designs. It has a hard, smooth, waxy and clean surface so that it is easily handled. It can even be installed at sub-zero temperatures because of polyethylene's excellent resistance to cold.

ITS FUTURE

Variations and improvements in polyethylene are being continually announced. For example, some new polyethylenes have already been announced that have a higher melting point and improved resistance to mechanical abuse and abrasion. Future commercial applications of these materials seem assured and it has been estimated that approximately 85,000,000 pounds of polyethylene will be used in wire and cable during the year 1960.

OVERHEAD CABLES FOR DISTRIBUTION

Up until the last decade practically all overhead distribution involved some form of open-wire construction. Probably the most advantageous factor justifying this procedure has been economy plus an acceptable experience record. Like everything else, times are changing so that it is no longer axiomatic that open-wire circuits must continue to be used for overhead power distribution. Therefore, a brief story behind some of the modern cable designs for these applications may be of interest.

The need for cable is unquestioned. Overcrowded poles, severe tree conditions, storms, public relations, regulation problem and appearance are some of the contributing reasons for this need. The cable industry in recognition of this need has developed suitable cable products for almost every overhead distribution job and the Rome Cable Corporation has played a most active role in this progressive development. Cable costs have been so reduced by careful design and uses of new materials that installed economies now closely approach open-wire construction in many instances. Today's distribution engineer would be remiss if he did not at least consider an appropriate type of cable for his new or replacement overhead distribution circuits. Rome Cable is prepared to supply all of these products and associated engineering services.

PRIMARIES

There is a definite trend towards aerial cable in the 5 kv to 15 kv range but it is difficult to conclude whether this trend is more in factory-assembled or the field-assembled variety, since there are merits for each.

In the 5 kv range the cost of cable compared to open-wire construction may not be too attractive when evaluated on the installed cost per mile of line, averaging approximately twice as much. In the 15 kv range this picture improves somewhat. However, if this comparison is based upon final installed cost per KVA this differential between cable and open wire is considerably narrowed. Naturally, there must be other determining reasons for using cable, such as improved appearance, resistance to storms, less tree trimming, better voltage regulation and greater reliability.

Preference for cable design in the 5 kv rating utilizes

ozone-resistant rubber insulation (such as Rome Cable RoZone) with a suitable nonmetallic sheath (such as Rome Cable RoPrene or RoSeal)... unshielded and relatively easy to hot tap, particularly when the cable incorporates the "reverse-lay" feature. Economic preference for cable designs for the higher primary voltages, utilizes the same grade of insulation on each conductor covered with a bronze tape which serves as a combined shield and armor but makes "hot tapping" difficult and hazardous. These and other cables may be supplied with insulated copper or aluminum power conductors all properly bound to the correct Copperweld messenger as described in the new IPCEA-NEMA specifications for aerial cable or an equivalent type. Installation procedures for factory-assembled or field-spun cables are described in the technical literature as well as manufacturers' catalogs.

SECONDARIES

Until quite recently there has been relatively little activity or interest in using cable for overhead secondaries but several utilities have been investigating and experimenting with either field—or factory-assembled cables for this application. Joint pole construction, elimination of crossarms, reduction of hardware, ease of installation, improved appearance, storm resistance, improved regulation and less tree trimming are some of the features to be realized, provided final installed cost is not prohibitive.

It is here that aluminum, at least for the phase conductors, seems to offer definite economic and technical advantages since the lighter weight is a most useful feature for line construction. With the advent of the now popular Triplex construction for service drops the idea of a similar factory-assembled cable for secondaries has certain merits. For single-phase secondaries, this cable generally consists of two #2/0 AWG aluminum conductors (usually #1/0 or neutral messenger) spiralled around a suitable

When this cable is used on conventional 150-foot pole spacings the service taps can be made at or near each pole with special fixtures now available. However, it is obvious that greater savings are possible with increased pole spacings and "flying" midspan service taps made where possible or convenient. Prefabricated devices to accomplish these taps have been developed. Thus, the combination of Triplex

secondaries and services offer a new and advantageous construction idea at modest cost.

When secondary sizes larger than #2/0 AWG are required, either spinning or a cable construction similar to primary aerial cable is suggested.

SERVICES

The use of open-wire service drops is rapidly disappearing particularly in new construction and housing developments. Service drop cable, Type SD, utilizing concentric neutral has been too costly to merit universal acceptance unless some special feature such as reduced theft possibility was desired. Nine years ago the Rome Cable Corporation introduced the now popular neutral or self-supported Triplex type of service drop cable. This design received almost instant acceptance and has proven highly satisfactory. The power conductors, insulated with polyethylene or Neoprene, are spiralled around a neutral messenger in accordance with IPCEA recommendations.

Aluminum unquestionably offers economic and technical advantages for the power conductors and has

CABLE IDENTIFICATION

Nearly all electrical cables must carry identification for such various reasons as to establish identity of manufacturer, age, circuit choice and temperature rating. Of these, the important identity to most users is to readily permit proper circuit or phase selection as well as source of manufacture. The methods employed to gain these objectives must result in quick and clear intelligible information conveyed in a medium which is reasonably permanent and economical to achieve.

CIRCUIT IDENTIFICATION

The subject of circuit identification in cables is somewhat complex. Its purpose is obvious—to identify a particular circuit, phase, polarity or other end use towards easier installation and maintenance. The most conservative approach eliminates all requirements for circuit identity within the cable so that each and every circuit must be electrically "rung out" or checked by the installer. However, the most popular approach requires some particular form of identity, of which there are many. Industry standards for a particular type of circuit identity have been established by many groups including IPCEA,

become the general choice of metal for this particular application. A popular neutral messenger has been a reduced size ACSR but the idea of hard-drawn copper has been gaining favor, particularly where there is planning towards Triplex secondaries with Copperweld messengers in order to provide copper-to-copper contacts on the exposed neutrals. Consideration of this "combination" design is suggested.

For further information on Triplex services or secondaries we suggest you obtain Rome Cable Bulletins RS-5 and MST-1.

TREE WIRE

This discussion would not be complete without some reference to so-called Tree Wire installed on insulators for overhead construction. For primaries and unusually important secondary circuits this product would cost considerably less than insulated cable and somewhat more than weatherproof wire. Where extensive tree trimming is a problem or too costly the use of the newer low-cost special thermoplastic Tree Wire designs might be considered. Here, again, Rome Cable is ready with the information and the product.

NEMA, NEC, ASA, IMSA, Underwriters' Laboratories and many others.

Insofar as control cable is concerned the original NEMA color sequence arrangement has become so well established that any newer methods simply represent an alternate interpretation of the original system as outlined in IPCEA Table XXX. This provides for 127 different color combinations by the employment of solid base colors and either one or two stripes or tracers of a contrasting color. This procedure as originally established was intended for fabric braid coverings where it was a simple matter to insert colored tracer threads in one or more carriers of the woven braid. To apply the identical procedure to modern jacket coverings over the insulated conductors such as Neoprene and polyvinyl chloride where braids are not employed presents certain problems. Hence, the development of a new identification method (IPCEA Method 3) now used by the Rome Cable Corporation for these types of multi-conductor control cables where a contrasting, permanent surface printing is applied over a single black or neutral base color. The first six primary colors are printed 1-black, 2-white, 3-red, 4-green, 5-orange,

6-blue. For more than six conductors the tracer color is printed directly following the base color such as 7-white-black, 8-red-black, etc. To be readily distinguishable the printing appears on opposite sides of each conductor at regular frequent intervals. This low-cost method is strongly recommended for these types of cables since it expedites production, eliminates problems of color matching and fading, eliminates errors due to color blindness which is fairly prevalent, and provides a positive method of identification for the life of the cable. Other identification possibilities involving colored spirally or longitudinally applied stripes over colored jackets are also used and are described in IPCEA Methods 1 and 2.

Power cable identification is simplified since here we are only concerned with a maximum of three or possibly four phase identities which may be accomplished in a number of ways. On unshielded non-metallic sheathed cables a preferred system utilizes permanently molded longitudinal ribs on the sheath surface. The same procedure may well be used on shielded cables although appropriately printed semi-conducting tapes under the metallic shielding tape has been generally accepted. On lead sheathed cables a colored tape directly under the lead sheath accomplishes the job. On certain multiconductor signal, telephone, telemetering, instrumentation and communication cables a simple method of circuit identification is frequently employed which consists of one colored conductor or pair in each layer of the multi-layer assembly of conductors. This colored circuit serves as a reference point from which the remaining circuits may be located by counting in a given direction in each layer.

MANUFACTURER AND MISCELLANEOUS IDENTIFICATION

A relatively simple time-proven system is used by most cable manufacturers to identify their product as

STATISTICAL QUALITY CONTROL IN WIRE AND CABLE MANUFACTURE

WHAT IS S. Q. C. ?

Statistical Quality Control is the application of statistical principles to a coordinated program of inspection procedures from raw materials through the manufacturing process and final inspection.

HOW DOES IT WORK ?

Quality Control by statistical methods is basically

an aid in reordering or replacing cable. Manufacturers of Underwriters' labeled products such as building wires and cords are assigned specific colored marker threads to be incorporated in their products and most manufacturers usually extend the use of these same colored threads in other cable products where practicable. This identification consists of colored combinations of small threads. For example, Rome Cable Corporation uses one yellow and one blue thread. These threads may be incorporated in appropriate locations within the cable design, such as in or over the stranded conductor, in the interstices of a multi-conductor assembly or under the outer sheath. Other methods of manufacturer identity are frequently used such as stamping on solid conductors, printed marker tapes, or surface printing in some acceptable manner such as the permanently molded name used on all Rome-60 portable cables. In some cases even the customer name and other information may be included where practicable and added cost is not prohibitive.

A printed marker tape incorporated within the cable assembly is the easiest approach to this situation which may be further embellished with unit length markings as well as date of manufacture. A rather novel method to accomplish this was developed by Rome Cable engineers (U. S. Patent 2,705,735) which comprises recording on a magnetizable wire a record of information relating to the cable and combining this wire in a suitable location within the cable construction.

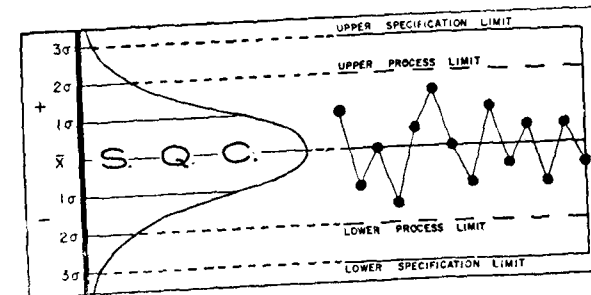
The foregoing represents only a condensed review of the highlights on this little publicized subject. Most problems, of which there are many, can be solved by following appropriate standards and some of the ideas mentioned above. Here again, Rome Cable's experience might be of real value to you, so why not discuss your particular cable identification problem with us ?

the application of the mathematical laws of probability to replace guess work, personal bias, haphazard inspection methods, etc., in the manufacturing process.

WHY DOES IT WORK ?

No two things are exactly alike. This is the first fact that must be recognized in understanding

Statistical Quality Control. The piece-to-piece variation of any characteristic of machine-made product falls into a definite pattern. This pattern,



which is formed from the measurement of many pieces, is bell-shaped and is called a normal curve. The normal curve is illustrated at the top of this page. The following proportions may be expected between the limits shown.

Limits	Per cent Within
$X \pm 1.00$	= 68.3%
$X \pm 2.00$	= 95.5%
$X \pm 3.00$	= 99.7%

For any manufacturing process, this pattern will be repeated over and over again as long as the same chance causes or influences are at work. From this fact comes the ability to predict future process limits for many characteristics such as tensile strength of insulations, insulation resistance, insulation wall thickness, and even conductor resistance.

WHERE CAN S. Q. C. BE USED ?

Practically anywhere in the manufacturing process Statistical Quality Control techniques, originally developed by Dr. Walter A. Shewhart, proved their value shortly before and during World War II when applications were made in the Ordnance Department. Since that time, the scope of the Statistical Quality Control function has constantly widened.

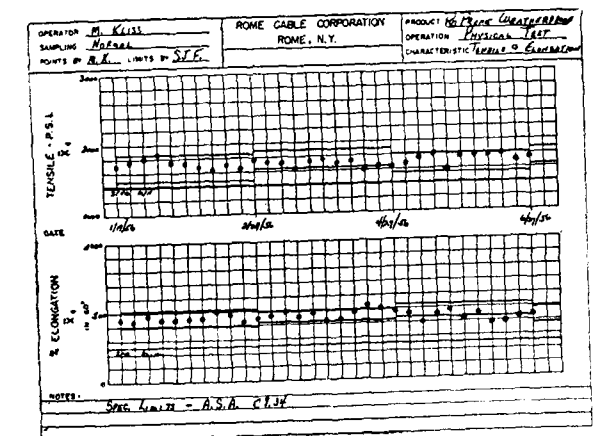
The principles and methods of S. Q. C. provide engineering, production, and inspection with a systematic approach for gathering and maintaining information on quality characteristics. This permits decisions to be based on facts rather than intuition or memory.

Rome Cable Corporation has pioneered in the

development and application of S. Q. C. techniques in the manufacture of wire and cable.

AN ILLUSTRATION

At Rome Cable Corporation, we have learned to apply many Statistical Quality Control methods to advantage. For example, "Control Charts" are maintained covering physical test results on all insulating and jacketing compounds. These charts provide the engineer, inspector, and others with a complete historical record for each type of compound.



The illustration will give you an idea as to their ability to present essential information in a usable, easy-to-read manner. The chart shown is used to record routine tensile strength and elongation data of the RoPrene covering used on Weatherproof line wire. Although space prohibits discussing other applications of Statistical Quality Control at work at Rome Cable Corporation, many successful applications have been made and more are being developed.*

IN CONCLUSION

Statistical Quality Control is proving to be a major contributing factor in increasing manufacturing efficiency and product reliability. It is effecting considerable savings in manufacturing costs, through defect prevention, rework reduction, and more efficient utilization of inspection. For our customers, this means maximum quality at lowest cost without sacrificing performance or reliability of our product.

*"Application of Quality Control Methods in Wire and Cable Manufacture," C. K. Hamlin; program Ninth New England Quality Control Conference; November 3 through 5, 1955. Copies will be gladly furnished on request.

REVIEW OF 1956 NATIONAL ELECTRICAL CODE

In 1897, the first regulations governing the safe use and installation of electrical equipment were adopted under the sponsorship of the National Conference on Standard Electrical Rules. The purpose of these rules was, of course, to reduce the loss of life and property through the improper handling of electricity. For the past 45 years these regulations have been promulgated by the National Fire Protective Association and published as the National Electrical Code.

To keep pace with the rapidly expanding, ever-changing electrical industry, the Code must, of necessity, be periodically reviewed and revised to reflect the very latest in equipment design and installation practices. This is accomplished by a continual reappraisal of the Code requirements and periodic revisions issued in the form of an "Interim Amendment" or a complete reissuance of the Code. As a measure of its stature in the electrical industry, the Code is regularly adopted as an American standard by the American Standards Association and is the one standard generally accepted throughout the United States.

Although the work of the Utility Engineer is generally beyond the scope of the National Electrical Code, a working knowledge of its provisions can be extremely helpful and is, sometimes, necessary. Accordingly, a review of some of the more significant changes that will appear in the new 1956 edition of the Code may be helpful.

CONDUCTORS

Some new wire and cable types are recognized in the 1956 National Electrical Code. Of the three new types to be added, it is expected that considerable interest will be centered around new Type RHH. RHH is a general-purpose, 600-volt building wire designed for use in dry locations at temperatures of up to 90°C. Other than the high temperature insulating compound, the construction and general appearance of this product will be similar to a conventional RH-RW wire having either an outer braid or Neoprene sheath. RHH should be useful in high ambient locations or for feeders, services, etc., in sizes where voltage drop is not a serious factor.

The approved size range for Type UF (Underground Feeder and Branch Circuit Cable) is being extended from 14 AWG through 4 AWG to 14 AWG through 4/0 AWG. This will permit Type UF to be

used for larger feeder circuits—especially useful in commercial or industrial applications.

SERVICES

Recognizing the phenomenal growth in the use of electricity in individual residences, the Code now recommends a minimum 100-ampere, 3-wire service be provided in line with the "Adequate Wiring" and "Housepower" programs.

TEMPORARY WIRING

Because nearly all building contractors now require temporary electrical service to supply power tools, a new section has been added to cover these circuits. This section requires, in part, that there shall be a suitable switch or plug connector to disconnect all conductors of a temporary circuit by a single operation and that no bare conductors nor earth returns shall be used.

ALUMINUM

As the use of aluminum becomes more prominent for electrical conductors, it gains greater recognition in the Code. Previously the current-carrying capacity (ampacity) of aluminum conductors has been established at 84% of that of copper. This has resulted in a general use of an aluminum conductor numerically two AWG sizes larger than copper to obtain equivalent ampacity. As a result of an extensive industry study, the Code will contain new, complete aluminum ampacity tables 1A and 2A which will be based on a value ranging from 78% to 84% of copper, depending on the conductor size involved, such as 78% for size 12 AWG and 84% for 2000 MCM. In addition, the Code will provide for special current-carrying capacities for types RH, RH-RW, RHW and RHH aluminum conductors of a 3-wire single-phase service and sub-service as follows:

No. 2 AWG 100 amps. No. 2/0 AWG 150 amps.
No. 1 AWG 110 amps. No. 3/0 AWG 170 amps.
No. 1/0 AWG 125 amps. No. 4/0 AWG 200 amps.

The preceding special ratings apply, as indicated, for services and sub-services where considerable experience has indicated that through diversity of load these ratings are justified. For all other applications, the ratings in the Code tables which are approximately 10% lower shall apply.

DEFINITIONS

To provide a uniform interpretation of Code provisions, the section on definitions plays an important part. New definitions being added this year are:

Branch Circuit—Appliance: An appliance branch circuit is a circuit supplying energy to one or more outlets to which appliances are to be connected; such circuits to have no permanently connected lighting fixtures not a part of an appliance.

Branch Circuit—General Purpose: A branch circuit that supplies a number of outlets for lighting and appliances.

Branch Circuit—Individual: A branch circuit that supplies only one utilization equipment.

Conductor: Bare: A bare conductor is one having no covering or insulation whatsoever.

Conductor: Covered: A covered conductor is one having one or more layers of non-conducting materials

that are not recognized as insulation under the Code.

Ground: A ground is a conducting connection, whether intentional or accidental, between an electrical circuit or equipment and earth or to some conducting body which serves in place of the earth.

Grounded: Grounded means connected to earth or to some conducting body which serves in place of the earth.

Grounded Conductor: A conductor which is intentionally grounded, either solidly or through a current-limiting device.

Grounding Conductor: A conductor used to connect an equipment, device, or wiring system with a grounding electrode or electrodes.

Identified: As used in this Code, means the conductor or terminal to which it refers is to be recognized as grounded.

NEW WIRE AND CABLE TYPES IN THE 1956 NEC

Type	Approved Size Range	Insulation	Voltage Rating	Temperature Rating	Special Provisions
RHH Building Wire	14 AWG Through 2000 MCM	Heat-Resistant Rubber	600	90C (194F)	General-purpose Single-conductor building wire. In dry locations.
SPT-3 Flexible Cord	18 AWG Through 12 AWG	Thermoplastic (Combined insulation and sheath)	300	60C (140F)	2- and 3 Conductor parallel Flexible Cord. For use in Refrigerators or Room Air Conditioners and damp places. Not for hard usage.
SF-1 Fixture Wire	18 AWG Solid or 7 Strand	1/64 inch Silicone insulation	300	200C (392F)	
SF-2 Fixture Wire	18-14 AWG Solid or 7 Strand	1/32 inch Silicone insulation	600	200C (392F)	Special High-temperature Silicone insulated Glass-braided Fixture Wire for wiring recessed fixtures etc.
SFF-1 Fixture Wire	18 AWG Flexible Strand	1/64 inch Silicone insulation	300	200C (392F)	
SFF-2 Fixture Wire	18-14 AWG Flexible Strand	1/32 inch Silicone insulation	600	200C (392F)	

The foregoing represents a review of but a few of the 180 changes or additions that will appear in the 1956 National Electrical Code. Complete information regarding these revisions can be found in the "Analysis of 1956 Revision of National Electrical Code" published by the National Electrical Manufacturers Association. If you would like a copy of this helpful booklet, write to Department 109, Rome Cable Corporation, Rome, New York.

Even as the 1956 Code is being printed, further changes and improvements are under study in preparation for the next publication of the Code or additional interim amendments. For example, an

AN UNUSUAL POLYVINYL CHLORIDE COMPOUND

Polyvinyl chloride (PVC) compounds have been widely used in the wire and cable industry. These compounds have many useful properties and have found wide application as insulations and sheaths. These properties and applications were discussed in Current Trends No. 4, entitled "Progress Report on Polyvinyl Chloride Insulation." Like most materials, the conventional PVC compounds have limitations, and there are many applications where these weaknesses have prevented taking full advantages of the good features. This discussion is about a special PVC compound, which was designed and developed in an effort to incorporate into a single compound as many desirable properties as possible. Known as Synthinol 901, this compound was developed in the laboratories of the Rome Cable Corporation, Rome, New York. Today Synthinol 901 is being used as insulation and sheath for wires and cables in many

important public contribution is being made by the electrical industry through a study conducted by them to determine the maximum number of conductors that can safely be installed in raceways, as well as the appropriate current-carrying capacity of each individual wire when more than nine are installed in a conduit or other raceway. The results of this study are now being considered by a special Code committee. It is expected, it will shortly be adopted as a new Code provision.

Rome Cable has, as usual, been closely associated with National Electrical Code activities and will be prepared to furnish most of the quality wire and cable products described in the 1956 Code.

applications where conditions of installation or use require properties not to be found in conventional PVC compounds.

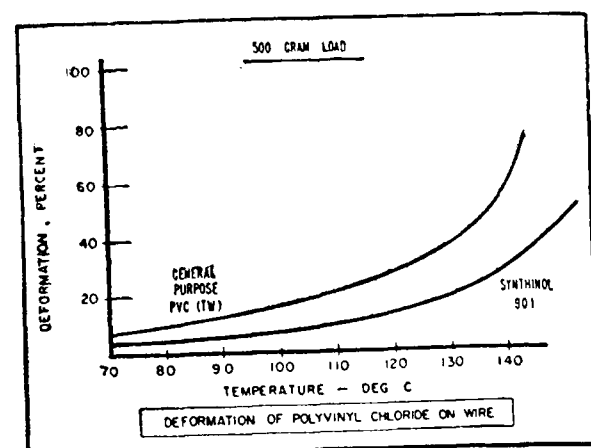
Shortly after World War II, the Underwriters' Laboratories established the need for a PVC insulated wire suitable for wiring appliances where an operating temperature rating of 105 C was required. Rome Cable laboratory attacked the problem of developing a PVC compound to meet U/L requirements. The laboratory was also given a list of desired additional properties for incorporation into this compound. This project assignment was completed in 1949, at which time Rome Cable introduced Synthinol 901. Since 1949 this compound has provided the solution to a rather impressive list of tough wiring problems.

True, there are many 105 C PVC compounds available today; there are likewise compounds available which possess one or more of the individual properties on the list describing Synthinol 901. What is unusual is that here, for the first time, was a single PVC compound which possessed all of these superior properties and which also retained all of the properties found in conventional PVC materials.

Rather than presenting data and charts, it is believed that the practical value of this compound is better illustrated by relating a few of the concrete results of eight years of continuous work with users who have had difficult problems. These case histories are all a matter of record.

1. OIL REFINERY, INDUSTRIAL AND CHEMICAL PLANT WIRING

Plant and oil refinery engineers had long used Type



Graph shows heat deformation vs. temperature, and compares Synthinol 901 with conventional Type TW compounds. Test run in accordance with Underwriters' Laboratories standard procedure, except for temperature.

TW for plant wiring. Results were good, but too often the heat deformation characteristics of conventional TW caused trouble in warm locations. Since one of the outstanding properties of Synthinol 901 was its superior resistance to deformation, this material was tried, and soon became widely used because of its much better record in service. During several years of experience Synthinol 901 proved to have chemical and solvent resistance so superior to conventional materials that it came into wide use where this resistance was needed. In these industrial applications, which are not under the jurisdiction of the National Electrical Code, the higher temperature ratings have made possible appreciably higher current carrying capacities, with consequent savings.

In chemical plant wiring the corrosive action of chemicals and solvents has always been a tough problem. Although PVC has inherently better resistance to chemicals and solvents than many other materials, engineers desired further improvement. One user ran a series of long time tests with samples immersed in various solvents, acids, and alkalis. The results clearly showed that Synthinol 901 would give longer life than other PVC compounds, when exposed to these chemicals.

2. OIL-FILLED TRANSFORMERS

Transformer engineers have long been searching for a cable construction to replace the varnished cambric-insulated cable used for high voltage and tap changer leads in oil-filled transformers. One transformer manufacturer, encouraged by successful experience with Synthinol 901 in other applications, began a comprehensive study of this insulation in lieu of VC on these high voltage leads. In operation these leads are immersed in the transformer oil at elevated temperatures. This test program extended over several years, and included evaluation of almost every conceivable effect of Synthinol 901 on the life and performance of the transformer. These engineers came up with the following reasons for standardizing on Synthinol 901 for this application:

1. There was less sludge in the oil than when VC insulation was used.
2. There was no harmful degradation of electrical properties of the oil.
3. Conductors ran cooler when insulated with Synthinol 901, permitting a 7% increase in current rating of the lead cables.
4. The use of Synthinol 901 in lieu of VC afforded substantial dollar savings.

3. COIL LEADS

Many manufacturers of small coils for use in electrical and electronic components had tried for years to use PVC insulated lead wires in their manufacturing operations. These coils, with leads attached, are put through a varnish or wax impregnation followed by a baking cycle. The baking cycles may be as long as 16 hours at temperatures as high as 150 C. In a great many of these cases PVC insulated lead wires had given trouble due to shrinkage, cracking, and stiffening during the impregnation and subsequent baking. Here is an application where Synthinol 901 has been doing an almost faultless job. After nearly eight years of wide usage, there has been no case of shrinkage, cracking, or stiffening of insulation reported where Synthinol 901 has been used in this application.

4. PANELBOARD WIRING

For many years panelboards and switchboards have been wired with Type TA wire. This wire has a layer of asbestos over a primary insulation of PVC. The asbestos has been used as a protection against the heat deformation which was known to occur at sharp bends and points where wiring was held under clamps. Transformer and machine tool manufacturers have found that the superior resistance of Synthinol 901 makes the asbestos covering unnecessary. In this application, for additional safety, the insulation thickness is normally 1/64" heavier than standard. These manufacturers have found Synthinol 901 to be an economical solution to their particular needs.

These case histories are only a few of the applications where this unusual compound has served well. Synthinol 901 has been proven by test and actual use to be superior to conventional PVC compounds in the following ways:

1. Suitable for continuous operation at higher temperatures.
2. More stable under severe heat cycling.
3. Suitable for continuous immersion in hot transformer oil.
4. Superior resistance to chemicals and solvents.
5. Greater resistance to heat deformation.

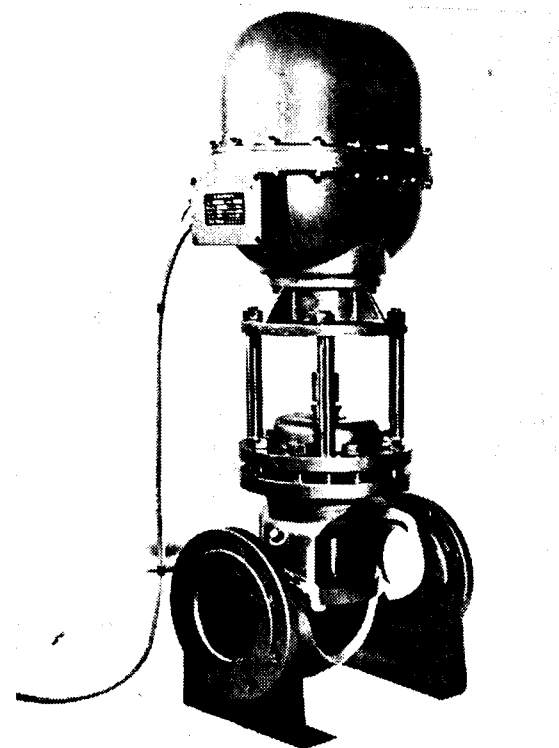
All of our experience and knowledge in this field is available to you. If you have a wire and cable problem where you think Synthinol 901 might prove useful, why not let us help you?

(Courtesy : *Electrical World*)

A Self-contained Power Pack for Remote Valve Control in any Location

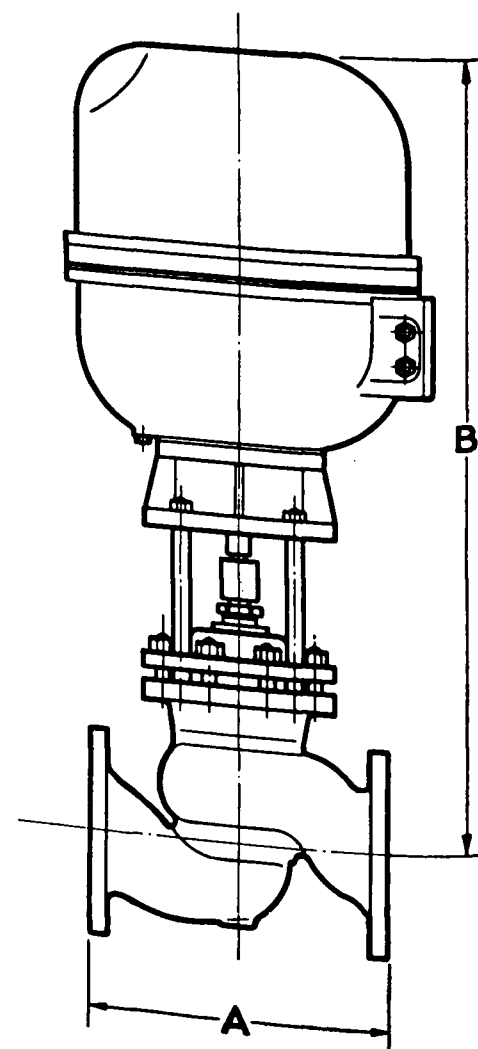
AN electro-hydraulic power package unit which operates valves in any remote location and at any distance from the control point is the latest addition to the range of automatic valve equipment manufactured by Richard Klinger Ltd., Sidcup, England.

The power package unit operates Klingeromatic piston valves of from 2½ in. to 8 in. and might be used for other valves of suitable construction. It is completely self-contained and need only be connected to an electricity supply to become operative. It can therefore be used in the most remote locations, provided only that a suitable electricity supply is available. The unit is so constructed that it can be used in any position—upright, horizontally or upside-down. The electric and hydraulic parts are housed in dust-proof compartment.



The Klingeromatic Power Pack Unit Mounted on a Sectioned 6" Klingeromatic Seatless Piston Valve.

The power package unit is rated at 1 kW., and operates at 220-volts single phase or 400-volts 3-phase to produce a force of about five tons. The unit is controlled by a 24-volt 15-milli-amp. current from a control desk or by other electronic means.



Speeds of opening and closing can be regulated independently; the minimum time for one stroke of an 8 in. double-beat valve is 10 seconds, and 11 seconds for a 6-in. valve. Maximum stroke is about 5 in. A feature of the equipment is that it locks the valve in any position by means of an auxiliary hydraulic valve.

MODERN AUTOMATIC DISPATCHING SYSTEM

... a new tool for improved system economies

This modern automatic dispatching system for electric utilities makes possible improved system economies, new operating features, and freedom from dispatching problems.

By

R. L. Tremaine M. J. Brown

Assembled Switchgear & Devices Department, Westinghouse Electric Corporation
East Pittsburgh, Pennsylvania

NO longer does the term *automatic dispatching* mean simply an automatic means of matching generation to load and controlling frequency. Today, economics has become an integral part of the modern automatic dispatching system; the automatic dispatching system must not only control net interchange and hold frequency, but as an integral part of the control it must load all individual machines in the system to reduce the power generation cost to a minimum. Economic loading of machines must be continuous and accurate if maximum economy is to be achieved.

A great deal has been learned in recent years about the economic laws that govern the cost of power generation. This work has led to an understanding of how system machines should be controlled to reduce the cost of power generation. For the power production cost to be a minimum, all system generating sources must be continuously dispatched so that the cost of the next increment of power delivered to the load is the same from any machine. This requirement must be satisfied regardless of machine location; hence, the incremental cost of transmission losses associated with delivering power from any station to the load must be continuously and accurately computed to achieve maximum economy.¹

System dispatchers have spent countless tedious hours determining distribution of generation for different system conditions. Transmission costs should be included in such computations, but without modern computing facilities, only educated guesses of these costs can be made. When methods for including transmission losses were developed, the mathematics of the problem proved so complicated that this new knowledge could not be used without special-purpose computers.

ECONOMIC DISPATCH COMPUTER FORERUNNER OF MODERN AUTOMATIC DISPATCHING

The development of the Economic Dispatch Computer gave the system dispatcher an invaluable tool for determining machine loading to achieve minimum cost of system power generation. Experience with these computers proved the value of automatic computation in improving system economies. For example, the savings realized from the West Penn Electric Economic Dispatch Computer are reported to be about \$50,000 per year.²

Because the Economic Dispatch Computer could determine the load to be carried on each station under any normal system condition, it was natural to think of the Economic Dispatch Computer as a means for controlling existing equipment for matching generation to load in such a manner that economic dispatch could also be achieved. The Economic Dispatch Computer is still very useful for this function where such load-frequency control dispatching systems exist, but in a modern automatic dispatching system it is no longer required.

The Economic Dispatch Computer will continue to be a valuable tool even though its function of controlling a load-frequency type dispatching system has been superseded by the modern automatic dispatching system. It can determine the worth of power at any tie point, which allows important savings in contracting for oncoming power transactions. Accurate calculations of the increase in the cost of power due to taking machines out of service for maintenance can be made. The average worth of power at any tie point can be determined for past or future conditions for billing

purposes. The average worth of power from individual machines can be determined, enabling the dispatcher to determine more accurately which machines should be used.

THE MODERN AUTOMATIC DISPATCHING SYSTEM

The requirements of the modern automatic dispatching system are many. Not only must it perform functions of existing dispatching systems—control frequency and swings, match generation to load, and include economic dispatch as an integral part of the control—but it must also overcome the shortcomings and have improved features over present systems. For instance, the fact that station swing capability varies has long been recognized; but it is now necessary to recognize that swing capabilities of individual machines within a station also vary. The modern system must be able to correct for major system disturbances automatically without manual assistance, either during the disturbance or afterwards. It must recognize that the shape of machine incremental cost curves vary rather frequently due to machine condition and cooling-water temperature. The dispatching system must be able to utilize the maximum capability of all machines in the system if necessary to correct for major system disturbances. Misunderstandings between a station operator and the system dispatcher, or an error on the part of either should not cause the system to go out of economic dispatch or endanger machine safety by causing load swings in excess of machine capability. The possibility of a higher degree

of station automation than is currently in practice must be allowed for by the dispatching system. The dispatcher's problems must be drastically reduced so that he can devote time to more important functions, such as contracting for future power exchanges. Naturally, reliable fail-safe operation must be built into the dispatching equipment.

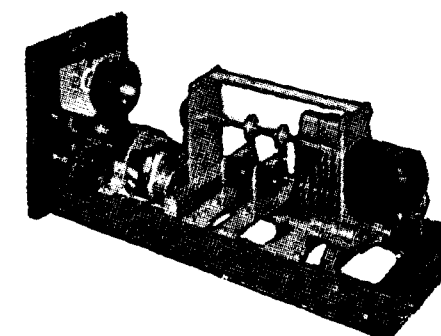
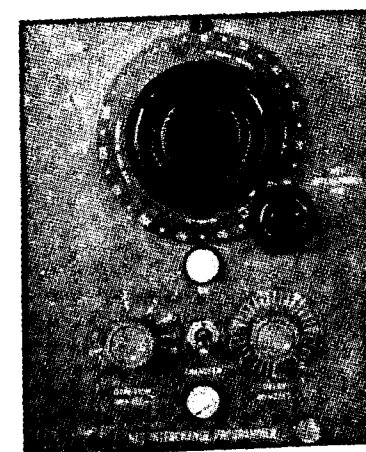
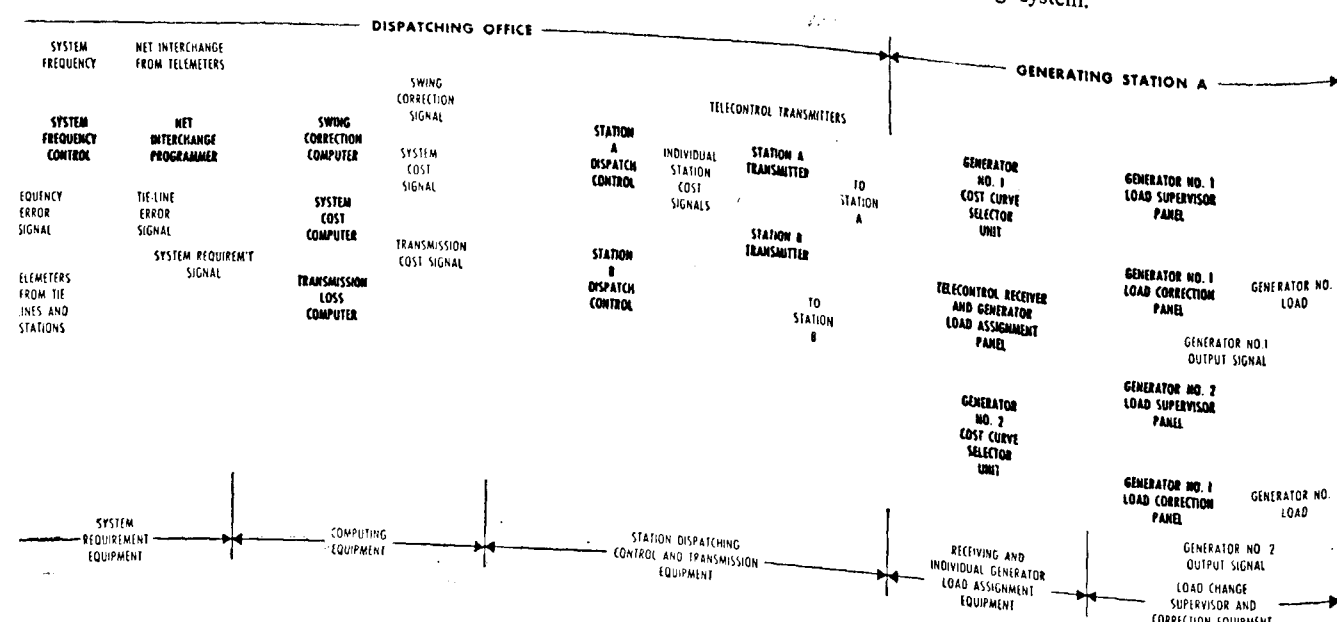
AUTOMATIC DISPATCHING SYSTEM

Modern automatic dispatching as accomplished by the Westinghouse system is shown schematically in the block diagram of Fig. 1.

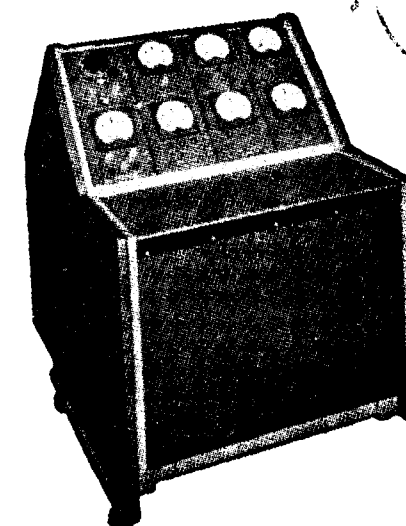
The first function of the dispatching equipment is to determine continuously whether generation should be raised or lowered, and if so how much. To make this determination, two items of information are required—system frequency and net tie-line interchange. These two values are compared with the desired values of system frequency and net interchange, and their weighted sum supplied to the computing equipment. The computing equipment uses this signal to determine generation changes required to control swing, and to calculate the incremental cost of delivered power. This cost, called *Lambda*, must be accurate regardless of system operating conditions. To continuously calculate transmission losses, a transmission loss computer is required. This is the computer originally developed for the Westinghouse Economic Dispatch Computer.

At this point, all the information necessary to keep the system in exact economic dispatch and, at the same

Fig. 1 Schematic diagram of the Westinghouse automatic dispatching system.



Front and inside view of a typical drawer of the dispatcher's console.



Station dispatcher's controls are located on this station control console.

time control momentary swings, is available. Next, values for individual stations must be computed. *Lambda* minus the incremental transmission losses associated with a particular station determines its bus-bar cost; to this value the station's portion of swing is added. These computations are made by the individual station controls. The combined signal is then supplied to the telecontrol transmitter, which sends it over any normally available channel to the individual stations.

The telecontrol signal is received at each station, where it is interpreted in terms of the power to be carried on each machine. Individual machine assignments are supervised to insure that a machine is not called upon to change load in excess of capability. The governor motor responds to these signals, adjusting generation to the value of power assigned.

DISPATCHING-OFFICE EQUIPMENT

All controls that the dispatcher may have occasion to adjust, and the instruments useful to him are mounted in the dispatcher's console, which is mounted adjacent to the dispatcher's desk. The remainder of the equipment is mounted in separate cabinets.

Area-Requirement Equipment—Frequency deviation is converted to a voltage that is proportional to the difference between system frequency and desired frequency. Desired system frequency is normally 60 cycles, but to correct for time, it is frequently necessary to deviate slightly from this value. The *frequency deviation unit* supplies a voltage proportional to the difference between desired and actual system frequency, which is corrected for frequency bias.

The net interchange error is determined by comparing desired net interchange with actual net interchange. Smoothly changing from one level of net interchange to another requires time-consuming coordination between dispatchers of neighbouring systems. The *net interchange programmer* is designed to automatically handle this function. The dispatcher sets the time when the next change is to begin, the rate of change, and the final value of the new interchange. A smooth change from one level of interchange to another is accomplished on schedule and at a rate agreeable to all parties in the interchange.

System Computation Equipment—System requirement—the combined signal of frequency deviation and net interchange error—is received by the *system swing computer* and the *system cost computer*. The swing computer is basically an amplifier with an output proportional to area requirement. For a major system disturbance, the swing computer can put out a large signal to insure that the maximum capability of the machines on the system can be utilized if needed. Since the system-requirement signal contains frequencies above the response capability of machines, some filtering action intentionally takes place in this device. It has an adjustable dead band so that minor swings can be ignored if desired. These features contribute to reducing unnecessary generator governor wear. The output of the swing computer is supplied to the individual *station dispatch controls* for transmission to the individual generating stations.

Computation of Lambda—the incremental cost of delivered power—is accomplished by the system cost computer. This device is a slow acting servo whose output is the time integral of the system-requirement signal. It operates slowly because the cost computer need only change its signal as fast as the value of system Lambda changes during the day. It is extremely sensitive to low values of system requirement, and will gradually creep up or down until the system-requirement signal goes to zero thus bringing the entire system into exact economic dispatch.

The development of the system cost computer has allowed the elimination of the Economic Dispatch Computer as a component part of the modern automatic dispatching system. This has greatly simplified the system, improved reliability, and eliminated the need for duplicate cost curves in the dispatching office.

Automatic computation of Lambda is relatively simple. To illustrate, assume that at a given moment the value of Lambda should be lowered. As a consequence, individual stations are receiving bus-bar costs that are too high, and generating power in excess of system need. This power excess causes the net interchange and/or system frequency to be too high. This condition is detected immediately by the system-requirement equipment, which then supplies a signal to the computing equipment asking for a decrease in generation. This information is passed to the machines immediately by the swing computer. At the same time the cost computer slowly lowers the value of Lambda. This causes bus-bar costs to be gradually lowered, which in turn lowers economically assigned power. The system reaches equilibrium when the bus-bar costs transmitted to the stations are such that the total value of generation exactly equals the load, and system requirement is zero.

Tie-line and station powers are available in the dispatching office for the dispatcher's use. These values and Lambda, as determined by the cost computer, are supplied to the "B" co-efficient matrix in the *transmission loss computer*. The transmission loss computer supplies voltages that are proportional to the incremental cost of transmission losses for each individual station.

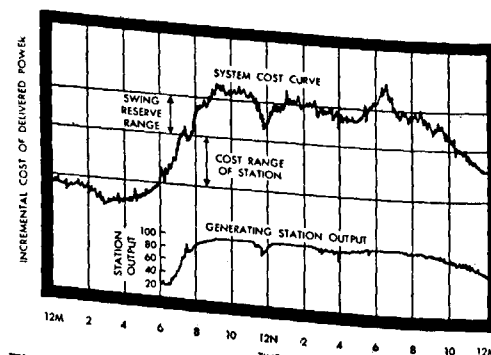


Fig. 2 Power generation curve of an intermediate-cost station during a daily load cycle.

Station-control Equipment—Voltages proportional to swing, Lambda, and incremental transmission loss for a particular station are supplied to its *station dispatch control*. This provides the dispatcher with complete

control of the station, although under normal operating conditions no readjustment need be made during the daily load cycle. Adjustments for minimum and maximum cost, swing participation, and cost range are provided.

To illustrate the use of this control, an intermediate cost station will be assumed, with a cost range shown in Fig. 2. The swing capability of this station is to be used before it becomes economical in the morning and during the system peak. The operator brings the station machines up to minimum load and puts them on automatic control. The dispatching system then controls station output until the machines are taken off the line in the evening.

By setting the *minimum cost control* at the minimum cost for the station, positive swings are sent to the station, and the machines take positive swings even though they remain at minimum base load. As soon as the station becomes economical, it is picked up automatically and held in economic dispatch throughout its cost range as shown.

To hold swing reserve in the station, the *maximum cost control* is set just below the maximum cost for the station. Under this condition, the station deviates from economic dispatch to provide swing control. If this swing control is not needed during the entire system peak, the cost sent to the station can be biased so that it ignores swing when bus-bar cost exceeds a certain value.

Occasionally system operating requirements require that a station be taken out of economic dispatch. If the dispatcher wishes to increase the load carried by a station at any time, the setting of the *minimum cost control* is increased until the station has the desired output. Conversely, to decrease output, the maximum cost adjustment setting is lowered. To keep the station at constant load, the maximum cost is set equal to minimum cost. The swing participation of a particular station may be increased or decreased to meet abnormal conditions. The *cost range adjustment* on the station dispatch control is used to adjust for fuel cost changes. The output of the station dispatch control is supplied to the *telecontrol transmitter*, where the signal is converted to a form that can be transmitted over the channel. The channel can be any conventional telemetering channel such as microwave, power-line carrier, leased-line circuits, or private wire.

GENERATING STATION EQUIPMENT

The continuous signal received by the station can be easily monitored. Should the channel fail, station output remains constant at the last value received unless manually changed. When the channel is restored, the operator immediately receives information telling him to raise or lower generation to bring the station back into economic dispatch. No resynchronizing is required.

Controls and instruments that the station operator may wish to observe or operate are mounted in a console; the remainder of the equipment is in cabinets.

Load Assignment Equipment—The base load that should be carried by an individual station is determined by the bus-bar cost component of the received signal. The load-assignment servo, which ignores swings, turns its shaft in a direction to increase or decrease base load, depending upon whether the received signal calls for a higher or lower bus-bar cost. Tapped potentiometers, one for each machine, are mounted on this shaft. Ten selected points on each machine potentiometer are connected to the ten-point cost curves associated with the particular machine. Six cost curves for each machine, readily selectable by means of a selector switch, are mounted in the generator control equipment. These cost curves are fixed resistors whose values represent the incremental heat-rate curve of the machine. Since shaft position is a function of bus-bar cost, a voltage proportional to base-load assignment for each machine can be obtained directly from the cost cards. The station receives a combined signal consisting of base-load assignment and swing, but the output of the load assignment servo is only base load. Therefore the received signal can be easily compared with the output of this device and the difference is obviously swing. This signal, which is the reconstructed swing, is supplied to the generator control equipment, where it is combined with the base-load assignment signal to determine the power carried by each machine.

Generator Control Equipment—Complete control of each machine is available to the operator. The desired cost curve can be selected by a selector switch. Lamps indicate that the machine is continuously under automatic control. Maximum and minimum kilowatt limits are provided. The minimum limit is set at the level of power corresponding to the minimum load of the machine. The maximum limit is set at the maximum kilowatt output desired from the machine under

normal conditions. Provision for manual control of the load to be carried by the machine is provided. In addition, the instrument on this drawer indicates the load to be carried on the machine as determined by the load assignment equipment.

Generator Load Supervision Equipment—Because the modern automatic dispatching system must be able to use the maximum capability of the system machines to recover from major system disturbances, limits on the swings carried by individual machines cannot be imposed in the dispatching office. A device that knows exactly what load changes an individual machine has been called upon to make is necessary so that, at any time, the capability of the machine to accommodate a change in load is known. This is the function of the *load supervisor equipment*. This device is basically a memory circuit, which remembers what the machine did before and knows what it can do at the moment. By having one of these devices for each machine, the maximum capability of the entire system can be utilized to accommodate major system disturbances without damaging individual machines.

As shown in the schematic (Fig. 1), the load supervision equipment recognizes generator load electrically, not as turbine valve position. By comparing the load assigned with load carried by the machine, a signal proportional to desired load change is produced. This signal is supplied to the load correction equipment.

Load Correction Equipment—The load correction equipment generates signals of correct polarity and magnitude to make desired load changes. A timed repetition rate, variable-duration pulse system is used. Turbine generators, particularly reheat machines, have a relatively long response time, which causes an appreciable delay between the operation of the governor motor to change valve position and actual change in generator output. To eliminate overshoot, the response time of the turbine generator set determines pulse repetition rate. The duration of pulses sent to the governor motor is a function of the magnitude of desired load changes.

ADDITIONAL FEATURES OF THE WESTINGHOUSE AUTOMATIC DISPATCHING SYSTEM

Only those components necessary to a modern automatic dispatching system have been discussed. The building-block concept is used throughout, so that simpler systems can be used if desired. For instance, if transmission losses are negligible, the components

that compute transmission losses can be omitted and the operation of the entire system remains unchanged except for the deletion of this function. No change is required in the remaining components. Frequency can be disregarded if desired. If swing control is not required, those components that perform this function can be eliminated without otherwise affecting the performance of the equipment.

Manual Cost Control—Temporary conditions might require that the system be dispatched manually. Provision for manual control is provided by the system manual cost control. This control is equipped with an instrument which normally indicates Lambda. To transfer to manual control, the dispatcher turns the selector switch to the *transfer* position, at which time the instrument is alternately connected between the output of the *system cost computer* and the *system manual cost control*. The dispatcher varies the manual cost setting until this instrument no longer fluctuates. At this point he can safely transfer to manual operation. To return to automatic operation, the dispatcher again sets the selector switch in the *transfer* position and raises or lowers the output of the *system cost computer* until the instrument no longer fluctuates, at which time he can transfer to automatic operation.

Manual Control of Older Machines—Erroneous dispatch of older manually controlled machines can adversely affect system economics. Readouts of the loads to be carried on these machines can be provided in either the dispatcher's office or in the stations. With this information, older machines can be manually held in economic dispatch during system peaks using relatively little equipment.

Bus-Bar Cost and Tie-Line Worth of Power Indicator—In checking to determine if increments of power have been contracted for at advantageous rates, and thus achieving a further increase in system economy, it is frequently useful to have an indication of the worth of incremental power at tie points. This is accomplished by a readout instrument, which receives Lambda and the value of the incremental transmission losses associated with each tie and indicates the incremental worth of power at tie points. A selector switch is provided so that the dispatcher can switch from one tie point to the next and read directly the incremental worth of power at each point.

The worth-of-power indicating instrument can be extended to indicate bus-bar cost at any station by providing additional points on the selector switch. With this instrument, the dispatcher can read directly

the incremental bus-bar cost associated with each of the older stations that have manually regulated machines. The dispatcher can determine the powers to be carried on these older machines by reading the values off their cost curves. This information can be telephoned to the station operators.

Additional Indications in the Dispatcher's Office—Frequently, other indications not required by the dispatching equipment are useful to the dispatcher and hence are most conveniently located on the dispatching console. Such indications are total system generation, net interchange, deviation from net interchange, and magnitude of area requirement. Other indications can be provided if necessary, by adding the necessary instruments to the dispatching console.

Graphic recorders can be readily added to the equipment in the dispatcher's office. In this connection, it must be remembered that only those values desired for historical purposes or to indicate trend need be recorded.

FAIL-SAFE OPERATION

Reliability in a control system is directly related to the reliability of individual components. The use of high-reliability components assures system reliability. In such a system, external influences, which are outside of the control of the designer, become the dominant factor responsible for system incapacitation. To meet this situation, the designer must include protection against malfunction when abnormal conditions exist, and therefore must include components to assure fail-safe operation.

In some cases, the Westinghouse automatic dispatching system uses differential methods to get fail-safe operation—slide wires are balanced differentially against slide wires, swing operation is balanced differentially against base-load operation. In other cases, continuous supervisory signals are maintained in the equipment. For example, the variable-frequency telecontrol signal continuously supervises its own channel, and the Lambda analog current continuously supervises station dispatch equipment. Abnormalities sensed by the fail-safe equipment lock out the automatic functions and the equipment reverts to manual control.

CONCLUSION

Modern automatic dispatching has placed in the hands of the system operator new concepts in the field of improved system economies, important new operating features, and a new freedom from dispatching problems formerly requiring manual operation. True economic dispatch 24 hours a day has been achieved. No longer can a system be considered to have an adequate dispatching system unless its system meets the many requirements stated previously. Actual dispatch of a system can be a completely automatic process requiring no adjustments throughout the day for normal system conditions. This portion of the dispatching problem should no longer occupy a high percentage of the system dispatcher's time.

REFERENCES

1. "Economic Load Dispatching" by E. L. Harder, Westinghouse ENGINEER, Nov. 1954, p194-200.
2. "Economic Dispatch Computer" by W. H. Osterle and R. B. Squires, Westinghouse ENGINEER, May 1958, p66-70.

ALUMINIUM CABLE SHEATHING PRESS

The advantages of aluminium cable sheaths — low weight, high compression strength, tensile strength and fatigue resistance as well as good conductivity — gave rise to the development of a double-acting horizontal aluminium cable sheathing press which meets the technical and economical requirements of the cable industry. This press permits the manufacture of cable sheaths of pure aluminium of any desired length up to an outside sheath diameter of 100 mm.; the sheaths may be extruded both on to cable core with plastic insulating materials sensitive to heat and on a dry or impregnated dielectric.

It is possible to extend the production range through extrusion of wire rods, sections and tubes of pure aluminium.

In January 1957 the first plant of this type commenced production in the United States. Another press has been in operation in Germany since December 1957. The makers — SCHLOEMANN Aktiengesellschaft Düsseldorf — are at present erecting three further presses in France, Norway and Germany; another four plants are in the course of manufacture.

CIBA

THE Company was established in Bombay under the Indian Companies Act on 13th June 1928, under the style of CIBA (India) Ltd., its object then being to import and sell the products of The Society of Chemical Industry in Basle, Switzerland. Later, in 1945 the parent organization in Switzerland assumed its present style of CIBA Ltd., Basle.

CIBA products, even in the early twenties, were not new to the Indian market, since the Swiss firm had been trading in dyestuffs with merchants in Bombay and the other principal Indian cities from its very inception. Later years saw the addition of pharmaceutical specialities to the list of merchandise which CIBA had to offer to the Indian markets and eventually to keep pace with the growing volume of business in this line, a Pharmaceutical Department was opened in 1941. By 1947 CIBA's business in both the dyestuffs and pharmaceutical lines had grown to such proportions that it was found necessary to have two separate companies to look after the interests of the respective trades and thus CIBA Dyes Ltd and

CIBA Pharma Ltd came into being.

CIBA entered the Plastics field in India in 1949 and it was left to CIBA Dyes Ltd. to handle this line of business. Since then, CIBA's "Aerolite" urea formaldehyde adhesives, epoxy resins under the trade name of "Araldite" as hot and cold setting casting resins, adhesives, coating resins and "Cibanoid" urea formaldehyde moulding compounds and urea and melamine varnish resins have, in their respective fields, established a sound reputation for their unsurpassed quality, dependability and economy in use.

Most of CIBA pharmaceutical specialities and Binaca toiletries are now manufactured and processed in their well-equipped modern factory in Bhandup, while a range of CIBA's dyestuffs is manufactured by Atul Products Ltd, Bulsar, under agreement with CIBA Ltd, Basle. The manufacture of Synthetic Resins in India is also under consideration and CIBA looks forward to an era of greater contribution to the industrial growth and well-being of India.

BICYCLE BOTTOM BRACKET ASSEMBLY COMPONENTS

At the instance of the Tariff Commission and the Development Council for the Bicycle Industry, the Indian Standards Institution is engaged on the formulation of series of Indian Standards on Bicycle and Bicycle components. Forming a part of the series the Institution has issued the following four Indian Standards:

- i) Specification for Bicycle Bottom Bracket-Axle (IS: 1131—1958)
- ii) Specification for Bicycle Bottom Bracket Adjustable Cup (IS: 1132—1958)
- iii) Specification for Bicycle Bottom Bracket Fixed Cup (IS: 1133—1958)
- iv) Specification for Bicycle Bottom Bracket Locking Nut (IS: 1134—1958).

Included in the IS: 1131—1958 and IS: 1133—1958 respectively, as typical examples, are fully dimensioned drawings of the two more popular designs of bicycle bottom bracket adjustable cup and fixed cup which are current in the country.

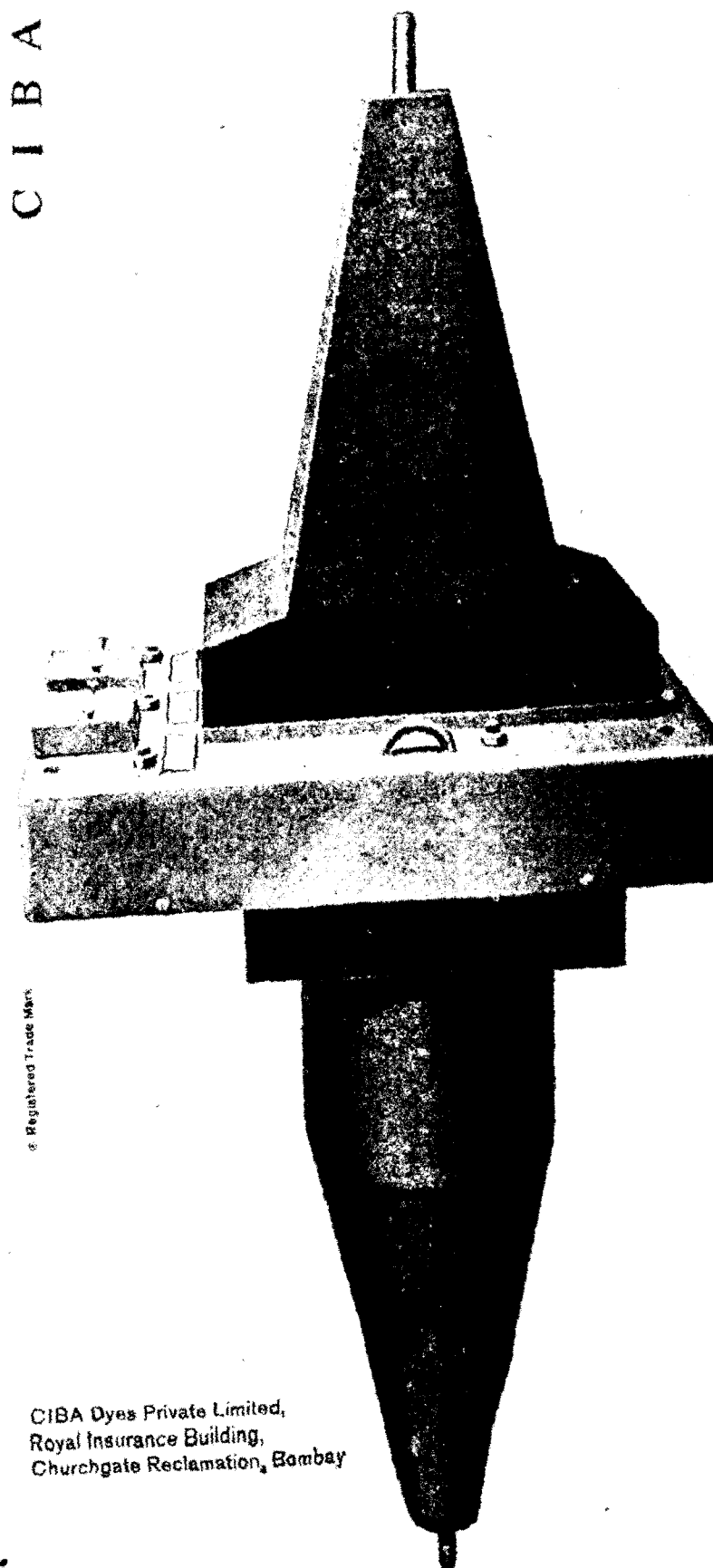
Realising that one or two manufacturers, who may be using Whitworth threads, may experience difficulty

in changing over to bicycle threads immediately, the standard permits the use of Whitworth threads in bicycle bottom bracket assembly components, as an alternative to bicycle threads, till the end of 1959.

Copies of the standard, published in English and priced at Rs. 2.00 for each set of four standards, are available from the offices of the Indian Standards Institution, located at New Delhi, Bombay, Calcutta and Madras.

Heavy Duty fans for handling abrasive gases at elevated temperatures can be used for steam boiler gas recirculation, fly ash precipitator purging, induced draft for waste heat boilers, or similar applications. Available in ratings from 10,000 to 500,000 cfm. for pressures up to 70 inches of water, these centrifugal fans operate in range from 20 to 850 F. Designated as Series 7000, they have radial blading with heavy tapered blade sections for minimum stress of rotating parts. Unobstructed gas passage provides maximum self cleaning. They may be equipped for capacity control. Can be had from Westinghouse Electric Corporation, Pittsburgh 30 PA. U. S. A.

CIBA



CIBA Dyes Private Limited,
Royal Insurance Building,
Churchgate Reclamation, Bombay

The World Uses® Araldite

Switzerland

Combined current and voltage transformer,
60 kV, with Araldite insulation.
Manufacturer: Moser-Glaser & Co. A.G.,
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Araldite Casting Resins
Araldite Coating Resins
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Araldite Adhesives

"HANDING IT ON A PLATTER"

By R. Parthasarathy

The merest flick of a finger summons today a genie of such amazing power and versatility as to make Aladdin's servant in the Arabian Nights fable look like the anaemic apology of an understudy! The modern genie: Electricity.

ON January 16, 1959, the first reel of aluminium conductor made at the new plant of the ALUMINIUM INDUSTRIES LIMITED at Hirakud was handed over by the company's general manager V. G. G. Nayar to Mr. M. S. Thirumale Iyengar, Chief Engineer, Hirakud Dam Project.

Behind this simple act, lies the story of the continuous development of a company which has pioneered the large-scale manufacture of aluminium conductors and accessories in the country.

The Hirakud plant is the company's modest contribution to India's ambitious Second-Five-Year Plan—a plan which has a provision of 22,000 million k Wh. More about this plant later.

First, let us consider the Kundara works of the company. This plant was commissioned back in 1950. From an initial 1,500 tons of ACSR (Aluminium Cable Steel Reinforced) and AAC (All-Aluminium Conductors) per annum, production had, over the years been stepped up to reach the present 9,000 tons per annum. Facilities at Kundara include a continuous casting and rolling mill for making aluminium re-draw rod—the famous Properzi process—and an up-to-date laboratory where conductors and accessories are tested. Alind also manufactures the full range of conductor accessories for all sizes of ACSR and AAC.

Early in 1957, a new facility was added for the manufacture of covered aluminium conductors—ALIND ALL-WEATHER for house service applications and ALIND KER-AL-LITE for general purpose wiring. Capacity is of the order of 10 million yards per annum.

Up to the end of December 1958, Alind has supplied a total of 150,000 miles of aluminium conductors. The company's roster of customers includes all the big power project authorities like Bhakra-Nangal, Damo-

dar Valley Corporation, Koyna, Muchkund, Periyar and Hirakud. Which brings us to our present story? Kundara is no doubt a picturesque village and commands all the facilities of a good factory site, but still the place being down south, customers up north have been obliged to pay a heavy freight on the conductors ordered out on the company. Of what avail it is, if aluminium costs less, if a heavy freight is going to mop up the savings?

As we are wondering what we should do to meet our customers at least half-way, the Hirakud multi-purpose project was taking shape. And when on January 13, 1957, our Prime Minister inaugurated the Dam, he heralded, indeed, an era of agricultural plenty and industrial prosperity for the people of Orissa.

Electricity being a vital requirement in aluminium production, (it takes 10 to 12 k Wh to smelt a pound of aluminium) the Indian Aluminium Company Limited decided to build their new 10,000-ton smelter at Hirakud. And that settled us too... at Hirakud!

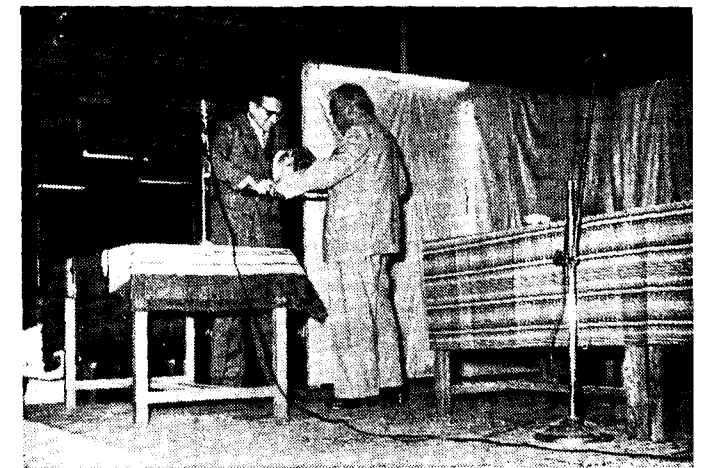
Power was available in plenty, raw material was not a problem, Calcutta was not far off, Sambalpur Railway Station was near enough, and what is most important, our customers in Orissa and Uttar Pradesh, Andhra and Assam, Bengal and Bihar would not also have to pay too heavy a price on transport.

Considering we hit Hirakud only on March 27, 1957—a little under two years ago—we should think we've really pulled a fast one!

Equipment at Hirakud comprises a battery of wire-drawing and stranding machines and other related pieces—all practically built to our specifications and incorporating features not normally included in conventional designs. An improved model of the rod mill at Kundara is also being installed. The wire mill unit is now "on stream".

As Nayar handed over the first reel to the Hirakud Dam Project Chief Engineer, he said: "By handing over the first reel of conductor made at Hirakud to you, sir, we symbolically dedicate the production of this plant and the services that go with it to all our customers in Orissa and the neighbouring States."

Accepting the reel on behalf of the Hirakud Dam Project, Mr. Thirumale Iyengar observed that the Seshasayees were pioneers of many industries in the South, and that in the early years they were connected with the management of several electric supply undertakings in South India. "They established a factory at Kundara in Kerala State about nine years ago for the manufacture of aluminium conductors and now they have come over to far off Orissa to erect a factory at Hirakud, next door to their raw material supplier—the Indian Aluminium Co. Limited" he said. He added: "Conductors are the life-lines of the transmission and distribution networks of a country and will continue to be so until technological developments advance to such an extent as to make a conductor-less transmission and distribution system possible". "Until then, the conductor-manufacturing industry will occupy a supreme position in the electrical field, confronted with the task of feeding heavy and small industries in various parts of the country and for supplying power to major and minor industries so as to help the economy of the country, an economy which is backward".



Mr. V. G. G. Nayar, General Manager, The Aluminium Industries Ltd., handing over a symbolic reel to Mr. M. S. Thirumale Iyengar, Chief Engineer, Hirakud Dam Project.

Concluding he said: "It is a privilege for me to receive the first reel of conductor made at this plant using Hirakud power, and this reel will be used for transmission of Hirakud power to Balasore."

The Hirakud plant is our modest contribution to the country's Second Five-Year Plan. It is our sincere hope that this second plant of ours will play as significant a role as our first in taking the benefits of electric power to remote rural areas as to towns and cities.

ELECTRIC HAND-LAMPS & COMPOSITE UNITS OF SWITCHES AND FUSES

The Indian Standards Institution has drafted the following two Indian Standards for wide circulation with a view to eliciting comments from interested parties.

(i) Specification for Electric Hand-Lamps [Doc: ETDC 7 (33)]. This standard lays down the minimum requirements for portable hand-lamps for use on supply voltages exceeding 24 volts but not exceeding 250 volts, A.C or D.C, and suitable for general use, excluding situations where flameproof, gas-tight, water-tight or dust-proof hand-lamps are necessary.

(ii) Specification for Composite Units of Switches and Fuses for use in Domestic Circuits and Industrial System [Doc: ETDC 7 (25)]. This specification relates to any series combination of air-break

switches and fuses forming a composite unit having not more than four fused poles, within metallic enclosure or enclosures and intended for use on d. c. systems or a. c. systems whose frequency, unless otherwise indicated, is 50 cycles. This specification covers a maximum voltage of 250 volts to earth and current ratings up to 200 amperes.

This standard has been prepared primarily to meet the requirements of the industry and the domestic users. It covers units of low and medium voltages and for currents.

The tests for performance laid down in this specification are related to the average climatic conditions normally prevailing in this country.

Copies are available, free on request, from the offices of the Indian Standards Institution, located at New Delhi, Bombay, Calcutta and Madras.

HIGH-VOLTAGE TRANSMISSION LINES

By an Engineer
Budapest

THE industrialisation programme of the Hungarian People's Republic has also caused a marked development in the electric power generation and distribution fields, as a result of which electrical machinery and equipment have been developed to such an extent, that now not only can home demands be coped with, but export activities can also be carried out on a wider scale.

The aluminium and allied industries owe their rapid development to the increasing occurrence of Hungarian bauxite. Now our well equipped cable factories manufacture :

Aluminium cables

Aluminium-alloy cables and

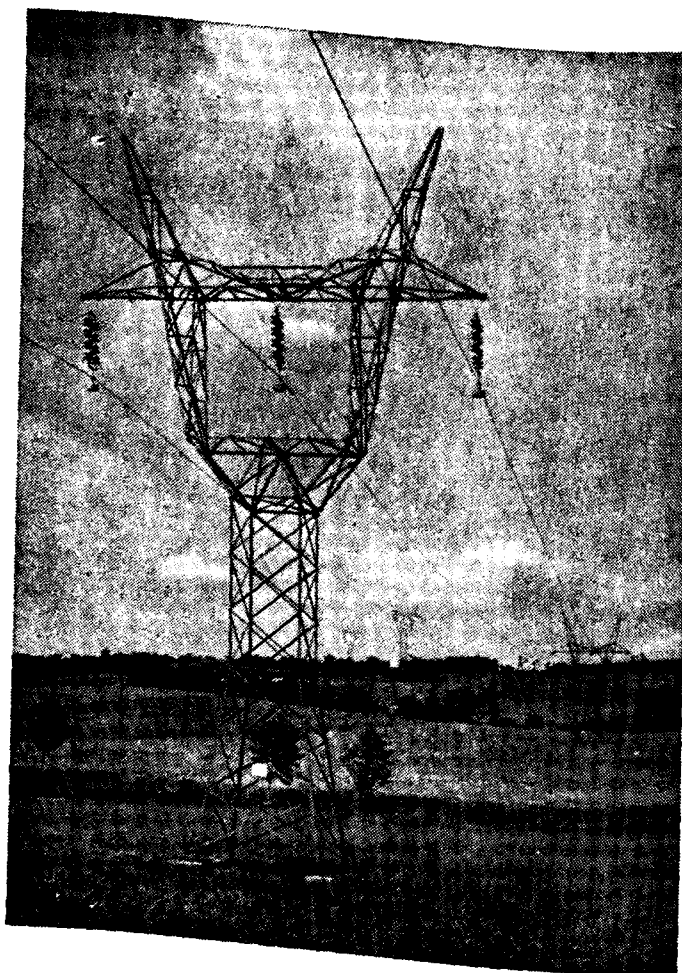
Steel-cored aluminium cables

in ever-increasing quantities, with the result that these products have attained high fame among our clients for their excellent quality. Cables exported to all parts of the world have been found to comply with the B. S. S., the Canadian CESA, the German DIN-VDE and Soviet GOST standard specifications in accordance with the requirements of our numerous clients.

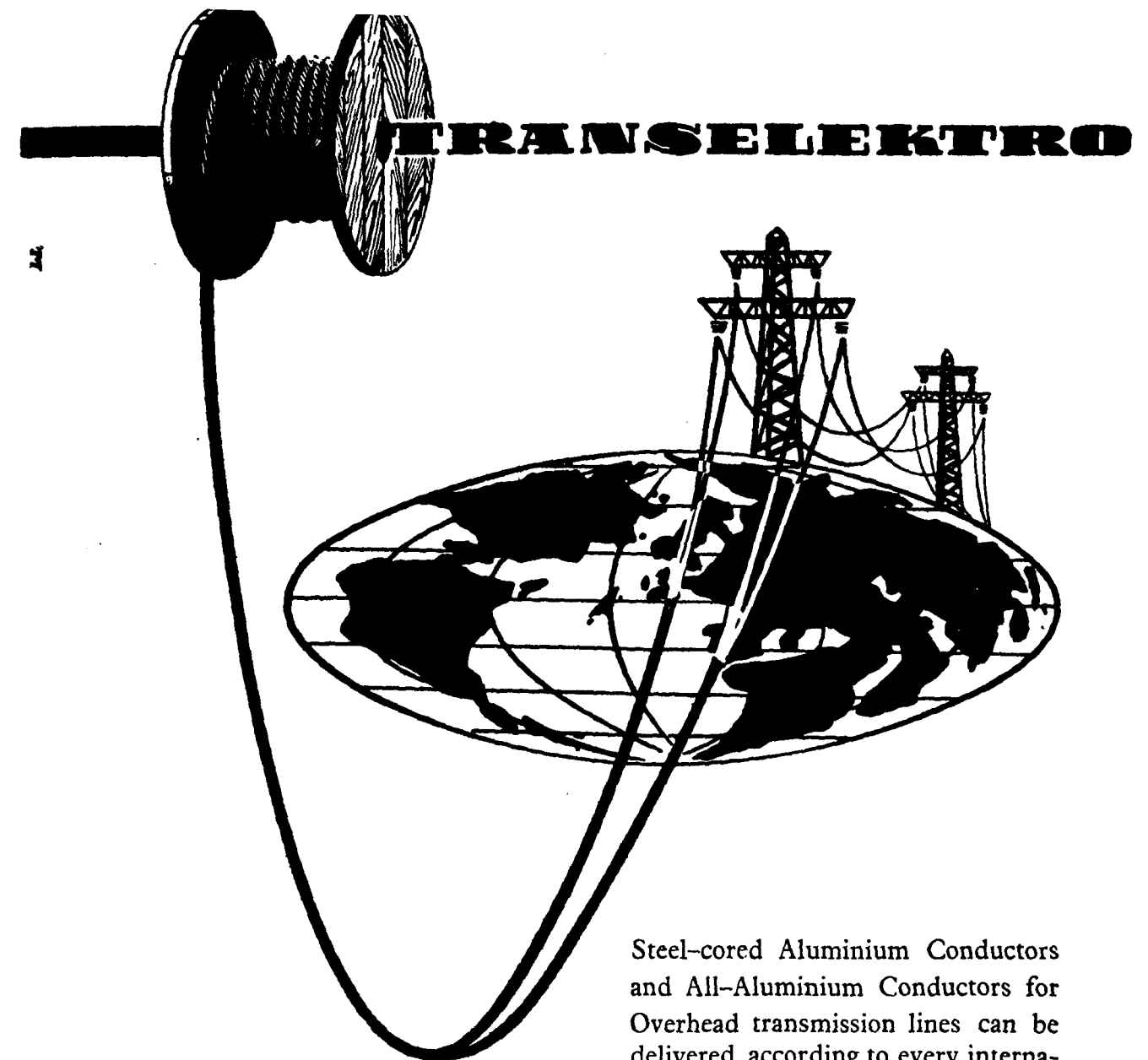
Qualified technicians trained in our world-renowned ornamental porcelain industry centres (Herend and Zsolnay-Pecs) were the first to establish the manufacture of high-voltage porcelain insulators in Hungary. There are numerous kinds of pin insulators, cap and pin insulators, as well as unpuncturable solid core insulators made in all voltage series, which serve insulation purposes on up-to-date high-voltage (3-220 kV) transmission lines. Our high-voltage insulators are exported in ever-increasing quantities from year to year. Our porcelain insulator factories are equipped with most up-to-date laboratories to carry out the most stringent tests on their products, thus ensuring that their excellent quality is always maintained.

Arc protection fittings, string insulator attachments,

furthermore accessories for clamping and joining the stranded conductors of high-voltage overhead transmission lines are also manufactured in a large variety of types by our inland factories, and these are also exported in large quantities together with the insulators.



Generally, in order to erect reliable and up-to-date overhead transmission lines, it is by far insufficient just to simply supply good quality materials. When designing transmission lines, full attention must be paid to climatical conditions prevailing at the site where the lines are to be erected, and care must also be taken to see that the insulation level of the whole power system is properly co-



Steel-cored Aluminium Conductors and All-Aluminium Conductors for Overhead transmission lines can be delivered according to every international standard certification in excellent quality and on the basis of the most favourable conditions

By :

Hungarian Trading Company for
Electrical Equipments and Supplies

TRANSELEKTRO

Letters : Budapest 62, P. O. B. 377.

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HUNGARY

ordinated, suitable arc and over-voltage protection has been provided for, as to constitute the most vital conditions for a trouble-free and complete transmission line project. These are precisely the reasons why the export of complete transmission lines are given preference against the simple supply of the line material itself, especially in such cases where the supply of energy has to be ensured in spite of extremely adverse weather conditions.

It is due to these facts that the firm TRANSELEKTRO not only undertakes the supply of materials and fittings for high-voltage transmission lines, but can also undertake the designing, supply and erection work of complete transmission lines for high-voltages of 35—220 kV. Our designing offices and factories are at the disposal of our customers for works of such a

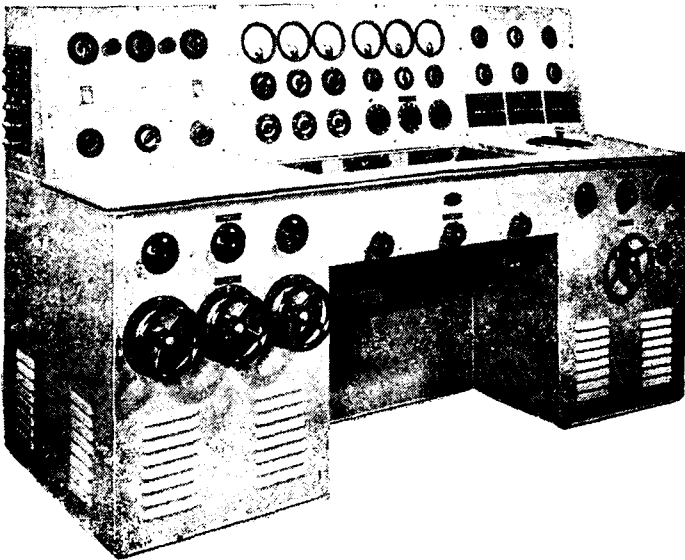
nature, and we are willing to give technical advice and assistance on request.

Beside the line materials mentioned previously, we are also able to supply steel structure towers, concrete masts, various kinds of conductors, insulators, fittings and earthing material for erection works on request from our customers, and tensioning gear, machinery and special tools for transmission line erection work can also be supplied.

On the request of our clients we are also willing to send fitters to install or erect the materials we supply, even although we may not have been entrusted with the erection work itself, and fitters sent out for such work may stay for as long as their services are needed for by our clients.



THREE-PHASE METER TESTING EQUIPMENT



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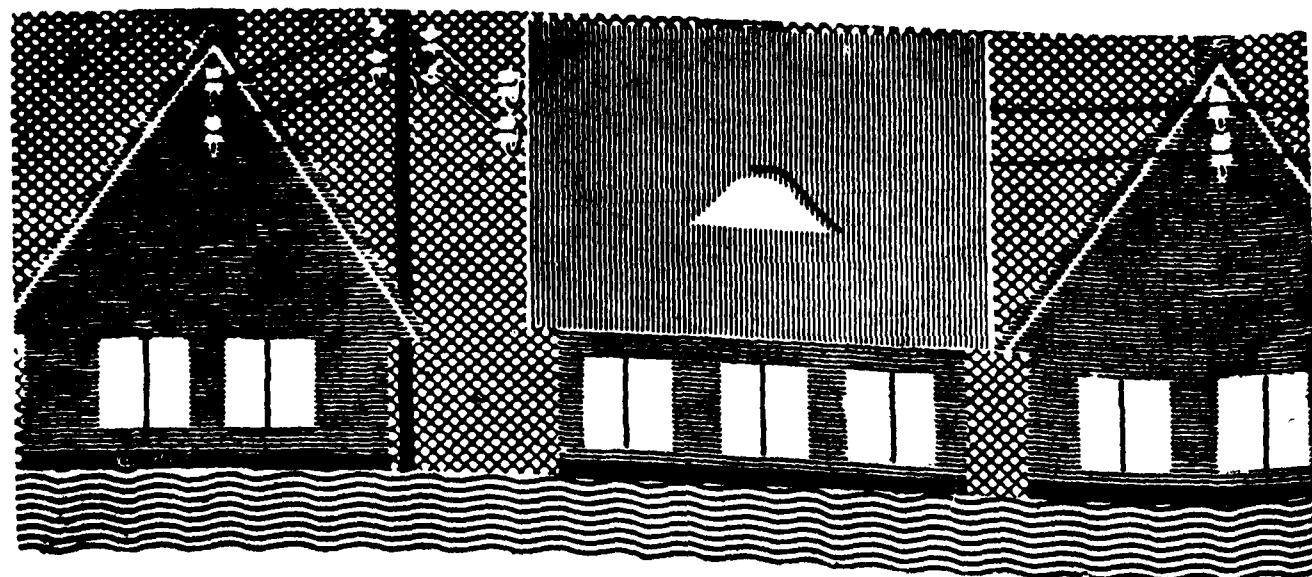
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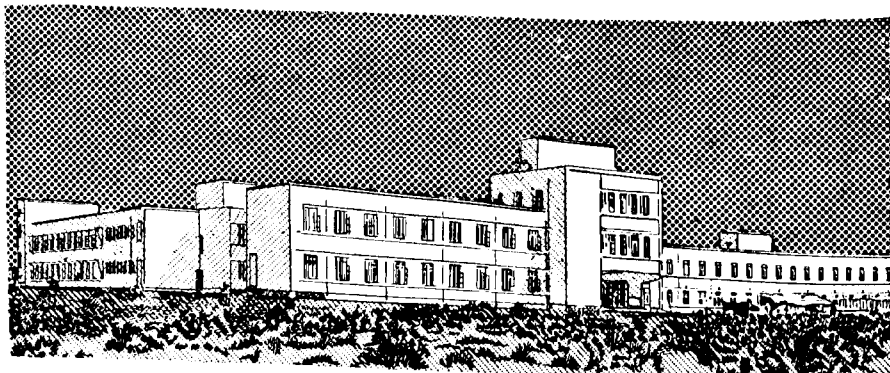
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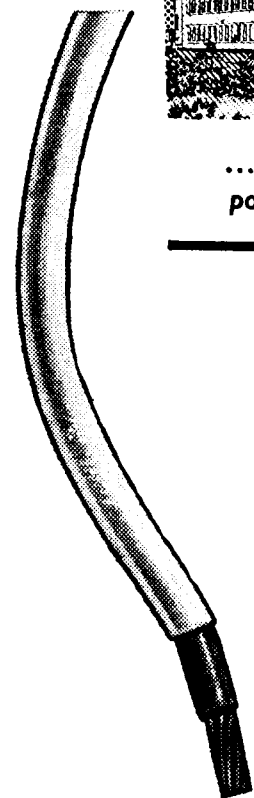
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M.K.PRESS. Tanjore.

Memorandum of Books, and periodicals etc., printed during the Month of

April, 19 59.

1	The title of the book and the contents of the title page	JOURNAL OF INDUSTRIAL ENGINEERING'
2	The language in which the book is written	- English. 65/
3	The name of (a) the Author, (b) the Translator, and (c) the Editor of the book or any part thereof	- Sri.T.S.Nagaraja Rao.
4	The subject	- Industrial Engineering.
5	(a) The place of printing, and (b) the place of publication	- T A N J O R E. - (But issued from 62, Jayaprakashnagar, Goregaon, Bombay-44.)
6	(a) The name or firm of the Printer, and (b) the name or firm of the Publisher	- Messers.M.K.PRESS, Tanjore. - Sri.T.S.Nagaraja Rao
7	The date of delivery from the press and of the publication	- 13-4-59.
8	The number of leaves, sheets or pages	- 112 pages.
9	The size	- 1/4th Demy.
10	The first, second or other number of the edition	- VOL : III . No, 3. (Electrical Industries Supplement.)
11	The number of copies of which the edition consists	- 400 copies.
12	Whether the book is printed or lithographed	- Printed.
13	The price at which the book is sold to the public	- Rupees Three and naye Paise fifty only;
14	The name and residence of the proprietor of the copyright or of any portion of such copyright	- Sri.T.S.Nagaraja Rao -Proprietor, 2254, Bhutgoswami Vattaram - Tanjore- now residing at 62, Jayaprakashnagar, Goregaon BOMBAY-44.



M.K. PRESS,
Tanjore, 13/4/ 19 59.

I declare that the above entries are correct and true to my knowledge.

(Publisher)

Printer (Proprietor of the Press)