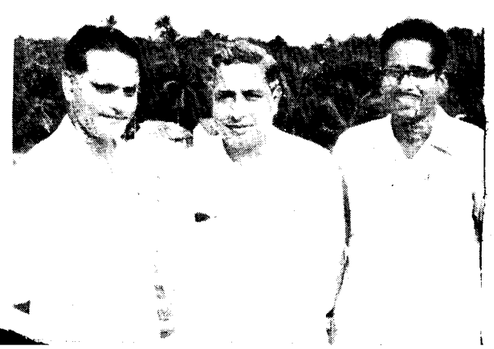
Mr. C. P. Sharma,
Superintendent, LRDE, Bangalore.

Mr. C. V. Mannadiar,
Executive Engineer, Kerala Elec. Board, with members of his family.

Mr. K. K. Raman, Managing Director, Seshasayee Bros. Private Limited with Mr. B. V. D. Menon, Managing Director, Managing Agents, Aluminium Industries Limited, Kundara.

Mr. E. Krogh-Hansen,
Director, Indo-Norwegian Project.



Mr. S. R. Kaiwar, ICS, Industries Secretary, Madras State, with Mr. M. Abdussalam, IAS, Industries Secretary, Kerala State, and Mr. T. V. Punnoose, Gnl. Manager, Kerala Government Ceramics.

ALCIND

AUGUST 1959

No. 17

Editor : R. PARTHASARATHY

THE PURPOSES OF THIS PUBLICATION ARE:

(i) *To record the accomplishments and achievements of our employees, their joys and sorrows so that our other friends like our customers, shareholders and neighbours may get to know our* family *better;*

(ii) *To encourage in our employees pride in workmanship and the high quality of our products;*

(iii) *To help create and sustain amongst them a sprit of friendliness; and*

(iv) *To tell the story of our business and that of our customers and other friends so that mutual understandings and respect might be fostered.*

★

News & Developments

MR. Y. B. CHAVAN, CHIEF MINISTER OF Bombay State, recently inaugurated Crompton Parkinson's Kanjur Works which is going to house their expanded Transformer, Switchgear and Motor Control Gear Sections.

Speaking on the occasion Mr. Chavan observed : "Every tyro knows to-day that electricity is a *sine qua non* of industrial growth. The country that is unable to produce and supply enough of this commodity condemns its people to a lowly and miserable existence unable to hold their own against their counterparts in other parts of the world. Therefore, they who make a contribution to an extension of the supply of electric power deserve well of their fellowmen."

Stating that in India, with the urgent need of the conservation of foreign exchange, the necessity of indigenous manufacture of electrical equipment was a compelling one, the Chief Minister declared : "The arrangements whereby you have been enabled to embark on your Project without any drain on the country's foreign exchange resources imply an understanding of the responsibility that rests on the electrical manufacturing industry in the context of national needs."

Earlier Mr. P. R. Deshpande, Director and General Manager, welcomed the gathering.

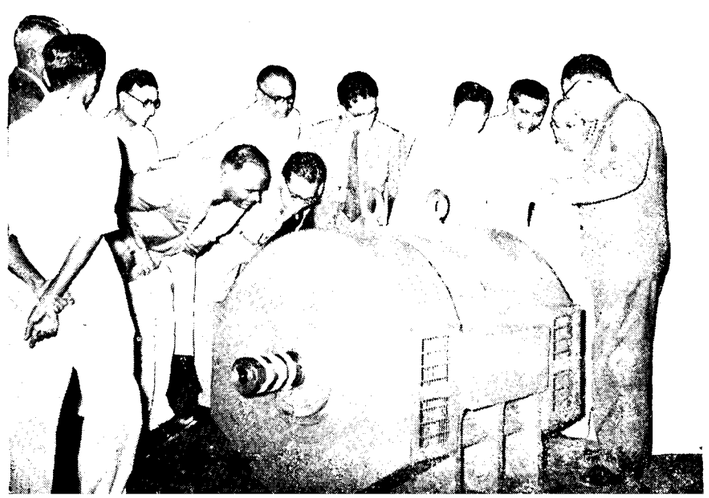
Nayar nominated to "non-ferrous" & HEI

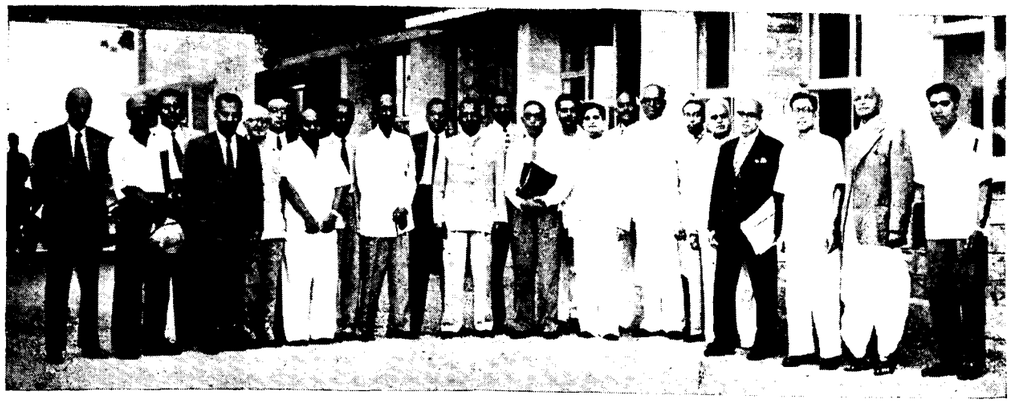
Mr. V. G. G. Nayar, General Manager, Aluminium Industries Limited, Kundara has been nominated a member of the Development Council for Non-ferrous Metals constituted by the Commerce and Industry Ministry, Development Wing. He has also been re-nominated to serve on the Development Council for Heavy Electrical Industries.

Largest ever motor made in India

Members of the Development Council for Heavy Electrical Industries who recently met in Bangalore took time out to go round the works of Kirloskar Electric Company and to witness for themselves the advances being made by the Company on development projects of electrical equipment. The Company is now also making larger types of motors ranging from 100 to 500 horse power. The 500 h.p. 1,500 rpm motor (*see picture below*) is one of the largest of its kind manufactured so far in the country.

Members of the Development Council for Heavy Electrical Industries who recently met in Bangalore inspect the largest ever Motor made in India.





A group photo of the Members of the Development Council for Heavy Electrical Industries when they recently met in Bangalore.

Union Carbide to double polyethylene production in U.K.

Plans for doubling Union Carbide's polyethylene production capacity in the United Kingdom were recently announced by Morse G. Dial, Chairman of the Board of Union Carbide Corporation. Existing facilities at Grangemouth, Scotland, which are operated by Union Carbide Limited, will be augmented by another 30 million pound per year production unit. The new unit is expected to be in production in 1960. Union Carbide Limited, as well as Bakelite Limited which markets Union Carbide polyethylene in the United Kingdom, are both affiliates of Union Carbide Corporation.

This latest expansion represents the sixth major investment by Union Carbide in the European petrochemicals field. In addition to the initial polyethylene plant at Grangemouth, Union Carbide Limited is constructing an ethylene oxide and derivatives plant at Fawley, England, which is expected to be in operation in the last quarter of this year.

Aluminium Transformers

In a note contributed to a recent issue of ELECTRICAL WORLD, D. F. Winter, Vice-President and Chief Engineer, Moloney Electric Company refers to the performance of an all-aluminium power transformer, recently completed by his company. According to him, the transformer indicates encouraging results in a number of areas of research interest.

Objectives in building the transformer included :

1. The study of the economics and commercial feasibility of more extensive use of aluminium.

2. Utilization of the latest techniques in joining aluminium and its alloys with themselves and other metals in modern transformer construction.

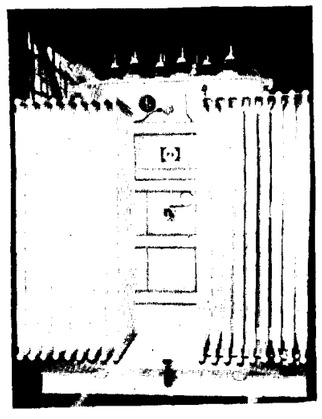
3. Study of the thermal efficiency of extruded finned aluminium tubing.

The transformer constructed is a 3-phase, 3,750-kVa unit with voltages of 2,400/4,160-Y to 480 V. The windings are aluminium conductors insulated with wrapped paper. The frames, tank and cooling tubes are made of various types of aluminium. The no-load tap changer utilises aluminium conductors flash welded to copper studs with the tap connections selected on the copper studs.

The substitution of aluminium for steel in tank and frame structures will require justification in technical performance of the product as well as by the economics. Foremost among aluminium's technical advantages is its ability to withstand severe corrosion conditions and thus reduce maintenance costs.

In recent years, the problems of joining aluminium to its alloys or to dissimilar metals have been reduced considerably by the extensive research efforts devoted to them. No difficulty was encountered in the manufacture of this unit using commercial equipment normally available to the manufacturer.

All-aluminium transformer made by Moloney Electric Company.



Aluminium Foil and Strip for Electrical Windings

by J. J. LEE, Graduate, I.E.E.,
Electrical Engineer, Aluminium Development Association

The designer must think in terms of aluminium rather than copper equivalents, and should take into consideration the physical properties of the material he is dealing with. The article indicates the characteristics of the material, including the electrical properties of the anodic film, and has been prepared primarily to guide designers now considering strip winding; but each design case must be considered on its own merits.

NOW THAT SATISFACTORY PROCESSES HAVE been developed for producing artificial oxide films on aluminium (Al_2O_3); by electrolytic process, i.e. anodising, it is possible to view the use of aluminium for electrical windings in a new light. In the past, adverse criticism has been directed against aluminium in electrical windings because of the relative current carrying capacity of aluminium when compared with copper. It is well known that the proportional conductivity of electrical purity aluminium is 61 per cent I.A.C.S. (International Annealed Copper Standard), which means that for equal I^2R losses in the aluminium, the cross section of the aluminium conductor will have to be 1.64 times as large, resulting, generally speaking, in a more bulky winding. What is not so well known, however, is that the current carrying capacity for aluminium to give the same temperature rise is 78 per cent of that of copper. This means that the cross sectional area of aluminium conductor need only be increased 1.282 times that of copper. The former statement is based on the assumption that existing insulating materials will be used, and the latter that such factors as emissivity and heat transfer are not taken into account. If consideration be given to the use of anodic films, which may be only several microns in thickness, the dimensions of the aluminium winding need be no greater than the corresponding copper winding for equivalent I^2R losses, and if current carrying capacity may be utilised the winding may be even smaller ; consequently the total space occupied would remain unaltered or be decreased. Furthermore, this extremely thin insulation and the use of strip in a coil in place of wire, results in very good thermal conductance inside the core ; hot spots are eliminated almost entirely and heat dissipation is excellent.

At present, the economies that may be achieved by using aluminium are not always readily apparent, and in the smaller sizes of anodised aluminium foil or strip the position may be unfavourable. In the larger sizes, however, e.g. where the cross sectional area of the conductor is of the order of 0.015 sq. in. or over, cost savings become apparent, and the material becomes more attractive as the area increases. It should be noted, however, that the quantity of material also enters into the economic consideration. Large bulk supplies will be cheaper in terms of cost per lb. than a small quantity.

At this point it may be advantageous to differentiate between material in the strip and foil forms. Foil is generally defined as material not exceeding 0.006 in. thick ; strip is material greater in thickness than this, but not exceeding 0.25 in.

During the last few years a number of anodising processes have been investigated with the object of determining the most satisfactory and economical one to adopt. In many cases it has been found that two or more processes are necessary to produce a film which is impervious to humidity changes. Some of these two-stage processes comprise two separate anodising procedures which are costly and have proved to be uneconomical. This does not apply to the common sulphuric acid process, which yields a film of hydrated aluminium oxide consisting of two layers—a very thin completely continuous layer (the barrier layer) next to the metal, and an outer layer which is many times thicker and is composed of many hexagonal cells resembling a honeycomb, Fig. 1. This outer layer is capable of absorbing impregnating materials, thus offering interesting possibilities not yet explored. The anodic film, although susceptible to some extent to humidity changes, is suitable for electrical windings. At the present time anodised strip, which is commercially available from producers now operating in this country, is anodised by the sulphuric acid process.

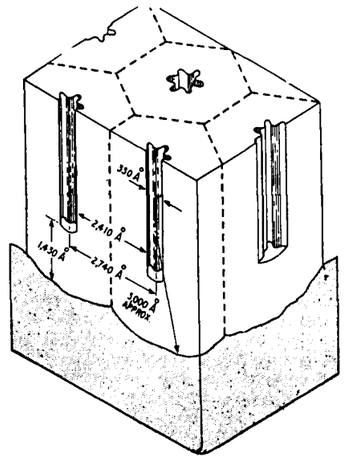


Fig. 1.—Structure of the artificial oxide film on aluminium produced by anodising. It comprises a continuous film adjacent to the metal (the barrier layer) and a much thicker superimposed porous layer of honeycomb structure. This layer can absorb dyes or suitable Impregnants. Magnification : 65,000 : dimensions in Angstrom units.

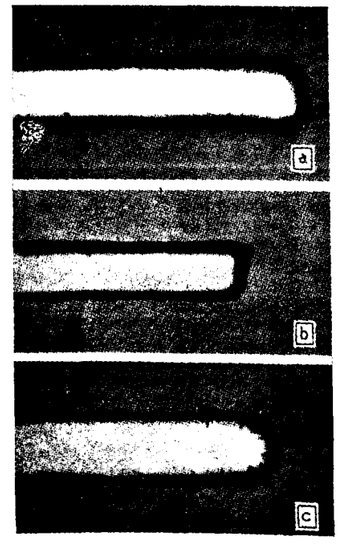


Fig. 2 (a, b and c).—The anodic film on aluminium foil 0.075 mm thick. Magnification : 200. The film is approximately 25 microns thick and average breakdown voltage for the three samples is 403, 303 and 422 V r.m.s., respectively ; note continuity of the film round the relatively sharp edges in (a) and (b).

Electrical Characteristics

From tests conducted on samples of material anodised in this manner, minimum voltage breakdown figures of 200 V r.m.s. have been obtained on anodic film thicknesses of the order of 0.0002 in. (5μ). It is possible to design coils, therefore, with interturn voltages not exceeding this value. The three most important characteristics of an anodic film are the electric strength, the permittivity and the resistivity. These values will vary with methods of producing the oxide film and the thickness of the film. Conservative and reproducible figures in the case of the sulphuric acid process are :

Electric strength	47.2 kV/mm
Relative permittivity	7.5-8.

It must be borne in mind that the electric strength has been calculated from values obtained from a very thin film and does not indicate that such a figure would be obtained from the more usual thicknesses. It is sometimes necessary to know, also,

the loss tangent and resistivity of the film. At the present time, however, these have not been established.

Naturally, it is important that the film should be continuous, particularly at the edges of the strip or foil. Continuity is influenced both by edge contour and anodising technique. Generally speaking rounded edges are preferred, with absence of burrs and sharp points. A satisfactory edge condition can now be achieved, however, in good continuity of the anodic film even when the edge is not smoothly rounded : Fig. 2 (*a*, *b* and *c*) shows a continuous film on edges of varying contour. If necessary the anodic film thickness can be increased towards the edges in order to give higher electric strength at these vulnerable places : Fig. 3 shows a cross section through material so treated which gave an average voltage breakdown of 342 V r.m.s. at the centre and 403 V r.m.s. at the edges.

Mention has been made of the equivalent I:R losses when considering cross sections of aluminium conductors ; this is of importance in power engineering, as it is inadmissible to increase the load losses. If the minimising of load losses is not of importance, however, then it is possible to increase the current density in the aluminium winding, with a resulting increase in temperature. The heat generated by the increased current density is partly absorbed by the thermal capacity, as the *specific heat of aluminium is far greater than that of copper* ; a further proportion is lost by dissipation because of the improved heat transfer characteristics of the winding, and the remainder causes a temperature rise in the winding. Conversely, in view of the increased thermal capacity of aluminium, it is possible to allow for a higher current density for the same temperature rise. The specific heats of aluminium and copper are :—

Aluminium	0.230 cal/gm/deg. C
Copper	0.095 cal/gm/deg. C

For determining resistance of aluminium strip at higher or lower temperatures than 20 deg. C, a figure of 0.00403 deg. C may be used as the constant mass temperature co-efficient. If large variations of temperature are envisaged, however, the following formula may be applied[3]

$$\frac{P_\theta}{P_0} \quad 1+0.3867 \cdot 10^{-2}\theta+1.10 \cdot 10^{-6}\theta^2$$

where P_0 resistivity at o deg. C

and P_θ resistivity at θ deg. C.

Fig. 3.—Cross-section of film on 0.075 mm foil thickened towards the outer edge by special treatment. Magnification × 30. The film is 0.001 in (25μ) thick at the edges, diminishing to 0.0003 in (7μ) at the centre.

A value often quoted for current densities in copper is 1,000 A/sq. in. In the case of aluminium this figure does not apply and the current density of the conductor should be calculated on the basis of permissible temperature rise.

Resin Coated Materials

It is possible to wind coils from resin coated material which has the same space-saving advantage as anodised material. The resin, of the epoxy phenolic type, may be cured *in situ* on the finished coil, making it extremely strong mechanically. There are temperature limitations, however, which restrict the use of such coils to about 180 deg. C. One point worth considering is that, for every small gauges of material, there may be an advantage in using this type of winding material. Reference should be made at this point to the use of aluminium strip wound with interlayer insulation. This type of coil, although requiring increased volume for equivalent load losses, may yet offer economic advantages over the corresponding copper strip and wire wound coils. But this winding is not capable of high temperature performance, as the insulating materials may be used only at much lower working temperatures than Al O films; further, its heat dissipation from the interior of the coil is not so good.

Flexibility and High Temperature

The flexibility of anodic films is dependent on the anodising process and also on the thickness of the film. By suitable adjustments very flexible films can be obtained. It has been shown by experiment that the special anodising process, generally known as " hard anodising," is unsatisfactory in this respect, and it has not therefore been adopted.

The use of normal sulphuric acid processed material has shown this to possess good flexing properties. Anodised foil 0.0035 in. thick may be wound round a mandrel of 0.125 in. diameter without damage to the film, the film thickness in this instance being 0.0002 in. (5μ). This is usually quite adequate for coil winding. Flexing tests on material on which thicker anodic films have been deposited show a slight diminution in flexibility.

Abrasion resistance of anodic films is also good, both on the flat surface and on the edges : rubbing the edges of material together quite vigorously did not damage the film in a test, the potential between individual samples remaining at 250 V.

Coils wound of anodised aluminium foil or strip may be operated at temperatures in the region of 500 deg. C without deterioration of the oxide film, which is advantageous where ambient temperatures are high, such as in atomic energy reactors, supersonic aircraft, or guided missiles.

The operation of aluminium windings at elevated temperatures is dependent in the main on the insulating material being utilised and on the adjacent components. In the case of an oxide film the limitation of temperature working is determined by the melting point of the conductor itself (659 deg. C for aluminium), the melting point of the oxide film being considerably higher than this (2,050 deg. C). This condition is unique. In no other case is the conductor melting point lower than that of the insulation. Apart from the thermal capacity and insulation considerations for aluminium windings, there is also the advantage of heat transfer characteristics which are exceedingly good. In the case of stripwound coils, the temperature gradient across the winding is small and uniform, obviating high spot temperatures and possible resulting failures which may occur in conventional windings. These unique characteristics have been substantiated by the continuous operation of anodised aluminium coils at temperatures up to 500 deg. C.

Reduced Safety Factor

In transformers and motors where possible fault condition current loadings have to be taken into account in design, it is of interest to note that when copper and conventional insulating materials, or even silicone varnishes, are used, a large safety factor is allowed on the rating of the conductor for temperature rise reasons. In the case of anodised aluminium, these large safety factors may be greatly reduced in view of the improved heating and cooling characteristics : the coils are capable of withstanding considerable surges.

Coil Winding

There is a definite saving of time in winding coils of strip in preference to round wire winding, and the technique lends itself more readily to automatic control. Modifications to coil winding machines will be necessary to ensure good line-up of the layers. It is possible that some electronic device coupled with a photoelectric cell may provide a means of obtaining extreme precision windings.

Anodised material in foil and strip forms is commercially available from a number of manufacturers in this country ; two such are Tyne Chemical Co. Ltd., River Drive, South Shields, and Acorn Ano-Coil, Ltd., Boreham Wood, Hertfordshire. Anodised wire and certain sizes in drawn strip are available from the Aluminium Wire & Cable Co., Ltd., 30, Charles II Street, St. James's Square, London, S.W.1.

The sizes range from foil as narrow as 0.125 in. wide to strip material 20 in. wide. In the intermediate sizes, thicknesses range from 0.001 in. to 0.064 in. depending on width. Typical sizes are foil 0.375 in. wide by 0.003 in. thick, 4 in. wide by 0.003 in. thick, or strip 6 in. wide by 0.010 in. thick. Material used by manufacturers may be of electrical purity supplied to the maximum resistivity value (2.8264 micro-hms/cm²/cm) ; or it may be of 99.0 per cent minimum purity for foil and 99.5 per cent minimum purity for strip. Unanodised material is also available without restrictions on width or thickness for use in interleaved windings.

Material is usually supplied in an intermediate or hard temper, which is the most suitable for winding : some material is supplied in the soft or fully annealed state, but this tends to stretch and lose shape when handled and coiled.

Fig. 4.—Experimental anodised foil winding of 100 turns made from material 1½ in. wide by 0·006 in. thick.

Present Applications

At the present time the manufacture of anodised and interleaved aluminium windings is beginning both on a production and an experimental basis. An anodised coil (Fig. 4) is manufactured from anodised foil material 0.006 in. thick and 1·5 in. wide, of a hundred turns. From experiments conducted on this coil it has been possible to obtain quite high current densities with temperature rises ranging from 78 deg. C to 186 deg. C as shown in Fig. 5. There is a notable absence of hot spots. From this graph it can be seen that despite the higher specific resistance of aluminium conductors, a small cross sectional area with resultant high current densities and operating temperatures are well within the scope of the anodic film.

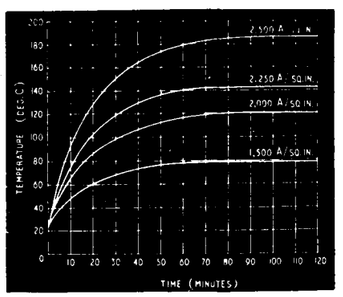


Fig. 5.—Temperature-current data for the experimental coil shown in Fig. 4.

In the electronic field headway has been made in using aluminium foil windings for travelling wave tubes. In this application the coil, Fig. 6, was wound, using resin varnish as the insulation between turns. The volume is approximately the same as that of a copper wire coil but the weight has been reduced to a third. The minimum field required to focus any particular travelling wave tube is up to 25 per cent less with the foil coil. The completed electromagnet for a power output travelling wave tube is shown in Fig. 7.

Automobile use of aluminium strip has taken a step forward by the introduction of field winding for engine starters. Fig. 8 shows a production set of these windings.

The space factor has so far been considered on the basis that aluminium strip would replace copper strip. If in actual fact the aluminium is replacing conventional round section copper wire, then it is quite probable that the space factor for coil cross-sectional area would be considerably improved.

The main attraction of aluminium strip windings is the added scope offered to the designer by the anodised material for high temperature operation. Air-cooled transformers, working in the Class H condition, are but one example. Making allowances for increased conductor area, the overall volume of the winding will remain the same, or in some cases will be even smaller. If a reduction in area is obtained, a corresponding reduction in core material may be achieved. This applies equally well in the case of power transformers as the load losses would remain unaltered. Advantageous changes in capacitative reactance of the windings may be achieved.

There are certain advantages to be gained from the use of anodised aluminium for rotary machines, where they are working at high temperatures, particularly in the case of d.c. machines where both field and rotor windings of aluminium may reduce space, heating and inertia problems. Use of aluminium windings, either of the interleaved or anodised type, may be of advantage where weight is concerned, for example, in lifting magnets. Weight may be considerably reduced, sometimes by as much as 50 per cent, by replacing copper with aluminium. The actual saving will depend on the space occupied by the copper winding being replaced. Generally speaking the space factor of an aluminium winding is likely to be between 0.99 and 1.0.

The operation of electrical machines in road vehicles may be improved by being wound with anodised aluminium, in particular engine starters and dynamos. In the case of starter motors the conductor area may be considerably reduced as the heating loss is much smaller than with copper. There may also be a case in the transport field for introducing aluminium windings into such items as ignition, headlamps and horn coils.

One of the deterrents to using aluminium windings in the past has been the jointing problem ; scepticism has existed on the jointing of these coils, which is fostered largely by lack of familiarity with aluminium for electrical conductors, but it is

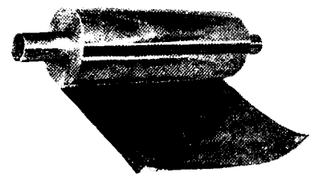


Fig. 6.—Coil wound from aluminium foil coated with resin varnish and used for a small electromagnet (see Fig. 7).

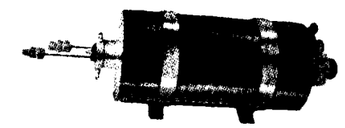


Fig. 7.—Travelling wave tube incorporating an electromagnet energised by resin coated aluminium foil. (Courtesy of English Electric Valve Co., Ltd.)

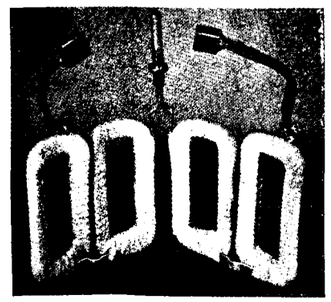


Fig. 8.—Field coil winding for an automobile starter, comprising four coils of electric purity aluminium drawn strip 0·25 in. wide, 0·045 in. in thickness with rounded edges. Paper interleaving is used for insulation ; aluminium/aluminium and aluminium/copper joints are involved, made principally by resistance welding methods. (Courtesy of Joseph Lucas, Ltd.)

actually quite unwarranted when the facts are considered. One important general point is that strip and foil windings present a large contact area available for jointing and this, in the main, renders the problem easier to solve than with wire windings. It is now possible to produce satisfactory joints by spot welding, cold welding, ultrasonic welding, soldering and mechanical jointing. The welding methods are straightforward, but in the case of soldering there is a choice of methods which may be adopted. In the case of unanodised aluminium it is possible to use a flux and a special solder to make good joints, or the use of an ultrasonic soldering iron and solder without flux. In the case of anodised aluminium an ultrasonic activated solder bath may be used, in which the anodic film is broken down as it is dipped into the bath, enabling the aluminium to be soldered. If a more robust method of jointing is required it is quite permissible to make bolted joints, with the proviso that the mating contact surfaces are abraded with a wire or nylon brush to ensure breakdown of the oxide film. The mating surfaces of the aluminium may alternatively be treated with a jointing compound which dissolves the oxide film. Cold welding is readily accomplished on anodised aluminium, and the need for scrupulous cleaning of the surface and scratch-brushing is eliminated.

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Aluminium Development Association Information Bulletin No. 23.

Courtesy : ELECTRICAL REVIEW.

Aluminium-Clad Conductors Replace Steel at Crossings

AN EFFECTIVE STRINGING ARRANGEMENT WAS used to install new-type aluminium-clad stranded-steel conductors in place of plough steel conductor during the recent modernization of a 2,900-foot crossing over Croton Lake at Yorktown Heights, N.Y. on the Consolidated Edison Co. system. The old steel conductors, of ½ in. diameter had been installed in 1934 and were supported on original insulators from 80-foot steel towers erected in 1916. The new conductors were installed to correct a rust condition and increase circuit capacity. New insulators were also installed on the line.

Two 13 kV feeder circuits and a shield wire were involved in the reconductoring operation which was done one-conductor-per-day due to load conditions that required both circuits to be in operation at time of evening peak each day. As a consequence, each new Alumoweld conductor had to be sagged, dead-ended and completed each night. It could not be strung one day and left over night for sagging the following day.

Achuthan Pillai & Co. move into new premises

THE WELL-KNOWN FIRM OF SHIPPING AND clearing agents—Messrs. Achuthan Pillai & Co.—recently moved into new, posh premises in Willingdon Island, Cochin. The official opening ceremony was performed by Mr. B. V. D. Menon, Managing Director, Managing Agents, Aluminium Industries Limited, in the presence of a large gathering of friends.

New premises of the firm.

Mr. B. V. D. Menon performs the opening. By his side is Mr. Achuthan Pillai.

G. Narayana Pillai—Chandrika.

M. Philips—Aswathi.

N. Gopinathan Pillai—Thankamma.

Our Family

They were married...

M. Philips, Clerk, Accounts, with Miss Aswathi.

T. V. Kuriakose, Supervisor, Elecl., with Miss Mary.

K. M. Ebrahim, Chargeman, Elecl., with Miss Mymoon Beevi.

G. Narayana Pillai, Asst. Engineer, with Miss Chandrika.

K. S. Anantharaman, son of Mr. K. A. Sundaram, Accountant, with Miss Vimala.

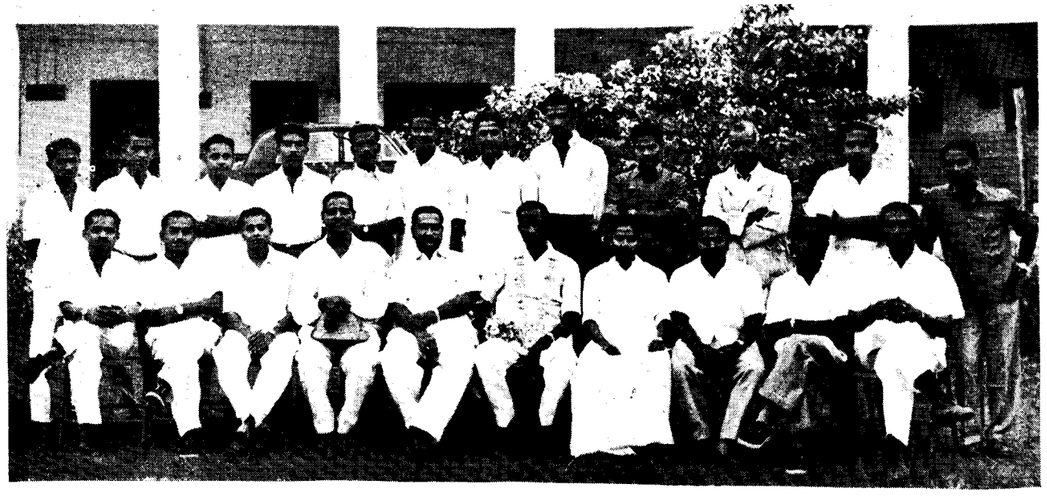
Miss Anandavalli, daughter of Mr. A. Narayanan, Welfare, with Mr. Adithiyadasan.

N. Gopinathan Pillai, Inspection, with Miss Thankamma.

Births...

M. R. G. Menon — a daughter ; **N. K. B. Nair** — a daughter ; **V. S. Menon** — a son ; **M. A. George** — a son ; **S. Kunjukrishna Pillai** — a son ; **P. Antony** — a son ; **K. V. Marshally** — a son ; **N. Sadanandan** — a son ; **V. Kunjukunju** — a son ; **T. P. Kunjukoshy** — a son ; **N. Raghavan** — a son ; **M. R. C. Nair** — a son ; **N. Thankappan Pillai** — a daughter ; **K. R. C. Nair** — a daughter ; **P. R. C. Nair** — a daughter ; and **M. Shanmughadas** — a daughter.

Mr. B. V. D. Menon recently declared open a Coffee Booth for employees.



"Group" taken on the occasion of the send-off party got up in honour of M. Aundi Pillai (centre) on the eve of his return to Plant I at Kundara from Plant II at Hirakud.

Report from Hirakud

Weddings

To **B. V. Ramanamurthy**—Foreman, Wire Mill, who married Miss Lakshmi, our congratulations and good wishes.

Visitors

The following distinguished persons visited our works :—

Mr. N. Dharmarajan, Superintending Engineer, Hirakud Dam Project, with family ; Mr. Shyamsunder Parija, Labour Commissioner and Chief Inspector of Factories, Orissa ; Mr. K. M. Panigrahi, Asst. Labour Commissioner, Cuttack ; Mr. B. B. N. Dash, Executive Engineer, Hirakud Utilisation Division II, Rajgangpur ; Mr. K. C. Gantayat, Electrical Inspector, Government of Orissa ; Mr. S. P. R. Tata, Purchase Officer, Hirakud Dam Project, with family ; Mr. G. S. Row, Principal, Hirakud Polytechnic, with family ; Mr. S. P. Chugh, Executive Engineer, Stores and Workshops, Hirakud Dam Project, with family ; and Mr. J. M. Das, Executive Engineer, Electrical Operation and Distribution Division, Hirakud Dam Project.

Mr. Clasen, Furnace Erector, (of Russ Electroofen) is now at Hirakud. He was met at Santa Cruz Airport by M. P. M. Pillai, our Bombay Representative.

Personnel

We said welcome to . . .

Banshidhar Sahoo—Guard ; **Habib Khan**—Guard ; **Gourishankar Pandey**—Trainee ; **G. Thankappan Nair**—Probationer (Mill Clerk) ; **N. Gopala Krishnan Nair**—Probationer (Accounts) and **M. Joseph**—Operator, Rod Mill, *On deputation from Kundara.*

We bade farewell to . . .

Gourang Sunder Rey—Trainee ; **G. N. Biswakarma**—Trainee ; **Sibaprasad Chhuria**—Clerk (Probationer) ; **P. Padmanabhan Nair**—Clerk (Probationer) ; **Abdul Hakkim**—Guard and **M. Aundi Pillai**—Foreman, Electrical, Kundara Plant. (On expiry of his assignment at this works he returned to Kundara on 31st March 1959.)

T. R. MENON

Shipping Foreman

FROM THE MERCANTILE MARINE to almost "Don't-go-near-the-water" shipping is the translation T. R. Menon, Shipping Foreman, has undergone since he burnt his boats in Calcutta in 1954 and accepted a berth with us here at Alind. Shipping at Kundara is principally a land-locked business, and means, for the most part, sending out goods by rail !

In the years 1938-1941 Menon worked for Caltex India Limited, James Finlay & Co., Limited, and Frank Ross & Co., Limited, in the order named. From 1941 to 1948, he was Superintendent of Shipping with the Supply Department, Calcutta. Later, he went over to the Dominion Trading Company, Calcutta, managing its Steamer Department. This company somehow went west, and in 1950, Menon accepted an appointment with the Eagle Steamship Company.

At Alind, he is concerned with the transportation of materials, supervising Moving & Handling, etc., —all of which work entails care, despatch and expedition.

A senior Foreman, he is that agreeable, but seldom-come-across paradox — an elected representative of the workmen ! The workers have such abundant confidence in him, and his being where he is, is a standing refutation of the theory that a worker's interests cannot be safe in his foreman's hands. As Vice-President of the Works Committee, he takes the chair in the absence of the President, who represents management.

Menon has practically no hobbies to speak of. Excepting for a bit of pottering about in his garden and spending some little time with his two little children . . . other interests get from him a wide berth !

As one who has spent nearly twenty years in Calcutta, he knows to speak, read and write Bengali, and is still quite nostalgic about the place.

Endowed with an essentially practical mind, Menon can always get to the core of a problem, stripping it of its non-essentials.

A most capable man, his real shipping background is standing him in good stead in his present position. He knows his ropes—and cables !

Rather reserved, he commands the respect of the men in his section.

Here's to Menon and his crew—between whom there is always such smooth sailing !

Left to Right : *Mr. Radhakrishnan, Inspector of Factories, Kundara, Master Kukillaya, Dr. E. K. Raman Pillai, Company Medical Officer, Mr. P. S. Kukillaya, Chief Inspector of Factories, and Dr. R. Kesavan Nair, Superintendent, Medical College Hospital, Trivandrum.*

To be on the safe side . . . Alind celebrates a week!

"Out of this nettle, danger, we pluck this flower, safety"—SHAKESPEARE.

FOR THE FIRST TIME IN KERALA'S industrial history, a Safety Week was successfully organised. And the *kudos* for it goes to Alind !

The observance got off to a good start with a meeting held in the Wire Mill area in front of 5 and 6 stranders on April 20, presided over by Mr. P. S. Kukillaya, Chief Inspector of Factories.

Dr. E. K. Raman Pillai, Company Medical Officer, welcomed the gathering which included besides our own employees and workmen local and Quilon doctors and Factory Inspectors of the area. Considering we had an audience of close to 400, we might truthfully describe it as a jam-packed session!

G. K. Warrior, Supervisor, Safety and Housekeeping, who m.c'd the proceedings, first outlined the programme of observance.

Dr. R. Kesavan Nair, Superintendent, Medical College Hospital, Trivandrum, who was the principal speaker of the day, stressed the importance of observing safety rules.

In the course of a brief talk, V. O. Mathew, Labour Officer, dealt with statutory obligations cast on a management and its workers for maintaining industrial safety.

With a vote of thanks proposed by Peer Mohammed, Works Manager, the meeting terminated.

The valedictory meeting came off on April 25, Dr. E. K. Raman Pillai presiding and Mr. Radhakrishnan, Inspector of Factories, Kundara, being the main speaker.

During the observance of the week on three days, a five-minute safety talk was given by the foreman/supervisor/chargeman to the shifts concerned. Subjects covered were : *To be broke is tough ; Bad tools : The well-dressed worker ;* and *Pain was the price.*

Also several safety films were screened—grateful thanks for which go to USIS, British Information Services and the Films Division of the Government of India.

The fire-fighting demonstration staged by our Security Staff on April 24 set us all properly a-blaze! They put up a very fine show, indeed.

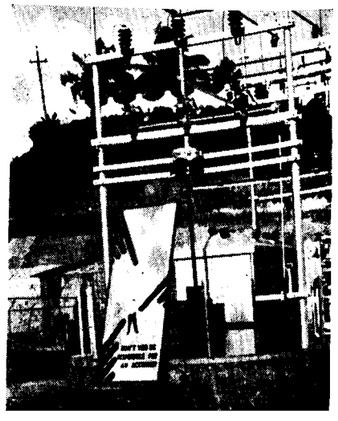
And during the week, oh, how the machines gleamed ! Housekeeping reached a new high, rather it held the floor ! But something always hit us in the eye . . . a poster. In whatever direction one might turn one had it : *Safety is everybody's business, Safety is no accident,* etc.

We had a slogan contest, too, the prize-winner being A. John, Yard Cleaner. His entry (which was submitted in Malayalam) went something like this.

Books can only rules propound
But only practice can keep your
limbs safe and sound.

Altogether, it was a highly successful week. G. K. Warrior thoroughly deserved the congratulations showered on him.

The fire-fighting demonstration that set us all properly a-blaze. (Right) *One of the several posters on display during the Safety Week celebrations.*



Safety is his business!

G. K. Warrior.

We present . . .

GOPALAKRISHNA VARIER, KNOWN for short as G. K. Warrior, the orthographic amendment being a contribution by the British Army to the gaiety of Indian names.

First, alone on a wide, wide sea of girls, he was like a male island ; he was the only boy in an exclusive girls' establishment up to his third form : later, he studied at the S.M.V. School and the Maharaja's Science College, Trivandrum.

The unimaginative Board of Intermediate Examiners would not see eye to eye with Warrior *re* his "original" answers, so they failed him and he beat it to Bombay with a heart for any fate and a pocket flush with money—Rs. 2 and As. 8 of it !

True to run-away tradition, he joined the Navy—as a communication branch rating. This was back in the year 1944.

Warrior soon afterwards underwent radar mechanics training in Karachi. At the Radar School, he avenged his Intermediate defeat by scoring 99 per cent marks in all the subjects.

Well, Warrior rock'd 'n' rolled about the world a bit in naval ships.

He was in the thick of the R.I.N. Mutiny of early 1947, but thanks chiefly to his moderating counsel, the British Captain did not get himself thrown overboard ; out of sheer gratitude, the Captain gave him an overnight transfer order to some army outpost with the result that when retribution came, it left Warrior untouched.

In 1948, he got his commission in the army ; in 1949, he was serving with the J. &. K. Mounted Battery : and in 1951, he was made a Captain.

Invalidated out of the army in 1953 (because of a bad attack of neuritis), he joined Alind in 1955. He was first with Personnel, then went to Works as Safety and Housekeeping Supervisor—in which latter capacity he is turning out much creditable work.

Well-versed in Indian philosophy, Warrior is also deuced good at the occult sciences. A secret vice with him is perpetrating poetry ! Drawing, painting and electronics are his other interests.

Supervisory Study Group

ON FEBRUARY 6, MR. RAJENDRAN OF ACBI, Management Consultants, addressed the Group on "Work Study". His talk was the first of a series to be continued in coming months—such as Cost Accounting and Budgetary Control, Motivation, Incentive, Communication, etc.

Work study, Mr. Rajendran said, consisted of an analysis of a job—critically—in order to eliminate uneconomic, old ways and synthesise a new method which would utilise better men, material and money.

The next meeting was held on March 4, at which N. Sathiyanadan, Additional Accountant, presented his paper on Cost Accounting and Budgetary Control. A well thought-out and well-prepared paper, it stated lucidly the case for budgetary control measures.

"Motivation" will be dealt with by Peer Mohammed on his return from Hyderabad.

On April 27, Mr. Krogh Hansen, Project Director, Indo-Norwegian Project, Neendakara, addressed a special meeting of members. Successor to Mr. Lund, he was ,prior to his present assignment, Norway's Ambassador at Peking.

In his talk, Mr. Hansen stressed the friendly ties that bound India to Norway. "A good many Norwegians are serving in Kerala State," he said.

On June 7, a meeting was held to say "*Au revoir*" to S. Peer Mohammed, Works Manager, who was proceeding to attend a short-term course at the Administrative Staff College, Hyderabad.

Speaking at the function, P. A. Ibrahim—striking a humorous note—expressed the hope that besides "working off his polygamous instincts," Mr. Peer Mohammed would return to Kundara "a very much more skilled manager."

Would-be South Sea Islander!

K. NARAYANAN NAIR, SALES, VICE PRESIDENT, STAFF Association has a most impressive academic background. After doing his B.Sc. at St. Berchman's College, Changanacherry, and B.Com. at the N.S.S. College, he rounded off his studies further with general education courses at the Royal Naval Colleges at Dartmouth, and Greenwich, London.

A former lieutenant in the Indian Navy, Nair is a widely travelled man. Indeed, the *wanderlust* bug has bitten him so badly that although he has already visited practically all the European countries, the Mediterranean States and the West Indies, he would still like to travel around some more . . . and end up finally in the South Sea Islands!

Cricket, Hockey, Tennis, Football, Badminton Squash and Sailing are all pursuits in which he is vastly interested.

Smart, well-mannered and business-like, Nair (now on deputation at Bhubaneshwar) has made several friends at Alind, although he joined the Company only about two years ago.

* * * *

'V' for various things!

BEFORE COMING TO US IN 1950, M. A. JOSEPH, CHARGEMAN, Mechanical Maintenance, had been with several firms. Electrical & Allied Industries, Kerala Ceramics, Peirce Leslie and Volkarts are all organisations for which Joseph has worked at one time or another.

Volleyball is his favourite game ; Vegetable gardening his favourite hobby ; Vallathol his favourite poet : and Vyjayanthimala his favourite star!

Fond of his little girl Mercy to whom he would like to give the best education possible, Joseph's one ambition is to lead a peaceful life.

A good workman—Joseph.

* * * *

Alinders

Service above self is his motto

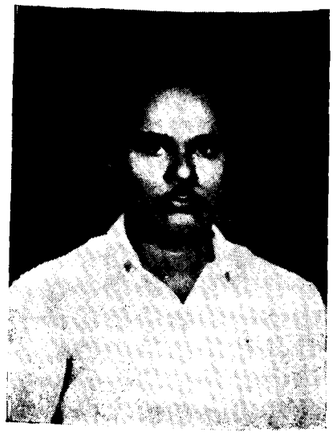
K. T. RAO, STENOGRAPHER, SALES, IS THE JOINT SECRETARY of Aluminium Industries Staff Association.

A matriculate of the Madras University, Rao is by birth a Tamil, by domicile a Keralite. And he is living with a Telugu family.

Cricket, which he played while at School, is still his principal sporting passion.

Smart and clever and well-mannered, "to be of real service to others always" is the ruling ambition of his life.

K. N. Nair.



M. A. Joseph.

K. T. Rao.

"Some day, I must win a big prize"

TO WIN A BIG PRIZE IN A LOTTERY IS NOT GIVEN TO MANY men. Neither has it been given to V. Bhaskaran Nair, Chargeman, Works Office, as yet, though this desire is fast becoming an obsession with him.

An E.S.L.C. from the local High School, Bhaskaran Nair has been with Alind for the past nine years.

Detective fiction and Tamil pictures are his two off-work interests. Nageswara Rao is his movie hero.

Quite an intelligent type—Bhaskaran Nair.

* * * *

Would-be inventive genius

FROM CERAMICS TO CONDUCTORS IS NOT PERHAPS A FAR cry, if the case *resumé* of Edwin Fernandez, Helper, Mech. Maintenance, is anything to go by. Before joining Alind in 1949, he was a fitter with the Kerala Ceramics, a next-door neighbour.

Father of four children, Fernandez considers his marriage as the most memorable event in his life.

Caroms, football and cricket are his principal sporting interests.

His ambition in life is to invent something new.

* * * *

State player who gives us all a kick!

K. K. MADHAVAN NAIR, JUNIOR OPERATOR, WIRE MILL IS hero to many not only here at Alind, but, also, elsewhere throughout the State.

A first-rate footballer, he is a State player, on one occasion skippering the State Team. We've said it before, but the crack would probably bear repetition—his being in the State Eleven gives us all a vicarious kick!

An S.S.L.C. from St. Joseph's High School, Trivandrum, Madhavan Nair joined the Company about four years ago.

Good in his work and quite unassuming for all the laurels he has won, he is popular both on and off the sporting field.

V. Bhaskaran Nair.

Edwin Fernandez.

K. K. Madhavan Nair.

M. R. Chandrasekharan Nair.

Smart type

AN EX ARMY AND POLICE MAN, M. R. CHANDRASEKHARAN Nair, Guard, joined Alind in 1957.

A first-rate athlete, he has won several prizes while at school. Of swimming and wrestling, he is specially fond.

Detective fiction, and pictures with a social slant, are his principal relaxational pursuits.

A smart man, this Chandrasekharan.

* * * *

A. K. Isthappan.

Intelligent Isthappan

A. K. ISTHAPPAN, OPERATOR, DIE SHOP, WAS FORMERLY working for Kerala Ceramics before taking up work with us here at Alind—which he did back in 1949.

Hindi pictures—tragedies preferably—and cards are his chief off-work interests.

Intelligent and business-like, Isthappan is a well-liked personality.

* * * *

K. Abdul Rahiman Kunju.

Father of nine

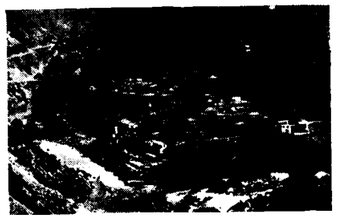
K. ABDUL RAHIMAN KUNJU, HOUSEKEEPING, CAME TO ALIND in 1952 ; before that he was with Travancore Minerals, Chavra.

Cycling and tug-of-war are his favourite sporting interests. His reading preferences lie in mythological books.

Father of nine children, asked about his ambition, he replied, ' Hard work '. Yes, yes, we know !

Here's a modern *Pilgrim's Progress*... the religious diary of an electrical engineer who felt in the Himalayan shrines of Kedarnath and Badrinath a presence that disturbed him with the joy of elevated thoughts. Mr. V. G. G. Nayar and Mrs. Nayar went on a pilgrimage to these shrines in May. At your Editor's request, Nayar produced this "log". Those planning on a visit to "K & B" would find in this diary much useful, helpful information.

The party that undertook the pilgrimage : it consisted of V. G. G. Nayar, Mrs. Nayar, two other ladies, a Swami of the Ramakrishna Mission, and a Panda of Kedarnath, besides two coolies who could take many things in their stride !



Devaprayag.

Rudraprayag.

6th May, 1959—Journey starts to-day from Hrishikesh. We have already engaged three coolies to carry our 400 lbs. of baggage. Lucky to get a well-known *Panda* of Kedarnath, Pandit Mahadev Prasad Sharma, who will accompany us throughout our trip. The whole of yesterday was spent in collecting the many needments of the trip such as a hill stick, cooking utensils, essential provisions, a water-proof sheet, an electric torch, candles and matches, offerings for the shrines, patent medicines, blankets and chuddars. The coolies cost approximately one rupee per pound of baggage for the whole trip. They will handle the loads at intermediate stops, help our ladies cook, wash clothes, draw water from the streams—in fact act as veritable " Men Fridays " for the next three weeks. The party consists of eight people, Mrs. Nayar and myself, two ladies from Bangalore, Swami Amitananda of Sree Ramakrishna Mission, the Panditji, and the coolies.

Pandit explains to us the significance of the pilgrimage through Uttarkhand or Kedarkhand of the *Puranas*. In Uttarkhand or the Tehri Gahrwal area of U.P. are situated the ancient shrines of Jamnotri and Gangotri, Kedarnath and Badrinath, all over 10,000 ft. above sea level. We follow the course of the Ganges up to Rudraprayag and then follow the Mandakini to go to Kedarnath and back, and the Alakhananda to go to Badrinath. Man worships at these shrines only during the warm six months, May to October and then symbolically hands over worship to the Devas for the wintry six months. Himavan is hallowed by song and legend. Here in Badrikasrama lived Vyasa who wrote the Mahabharata ; at Hrishikesh, on the banks of the Ganges, the Vedas were given their final four-fold form : Vasishta, sage and seer, lived here long, long before Christ. Gautama taught on the banks of the Mandakini. And in this *yuga*, Shankara, Ramanuja and Madhwa wrote here their respective Brahma Sutra Bhashyas. All the *Puranas* and all Sanskrit literature are so full of references to this Tapobhoomi, this Yoga bhoomi . . .

Our bus was going up the narrow hill road all the time within sight of Mother Ganga—sometimes tumbling deep down in a canyon—elsewhere spreading out on a broad sheet—we could see several beautiful bridges across the river. At Devaprayag, the bus stopped long enough to enable us to offer worship at the temple of Rama at the confluence (Prayag). For here, after vanquishing Ravana, Rama did penance. Bhagirathi and Alakhananda meet here, the former a clear stream, the latter a muddy, milky thing.

The next stop is Sreenagar, once the capital of Tehri Gahrwal, but now just a bus stop.

Towards dusk we reach Rudraprayag, made familiar to western readers by Jim Corbett through his well-known *Man-Eating Leopard of Rudraprayag*. The coolies tie up the baggage on their backs in no time and we cross the river over a suspension bridge and get to the Satchidanandashram on the promontary overlooking the confluence of the Mandakini and Alakhananda. The Ashram authorities control the Rudra temple here and also run a Sanskrit school and an Intermediate College. We were their guests for the night. Had a refreshing dip in the Prayag ; was a " must " after the dusty bus journey.

7th May. We continue the bus trip and reach Agasthyamuni where the sage Agasthya is believed to have performed tapas. Here there is a small airstrip. Soon we reach Kakda, the last stop on the bus route. The climb to Guptakashi is steep and strenuous especially for the novice climbers —we were tired when we reached Guptakashi in the evening. Accommodation was easily available at a *chatti* (a temporary halting place made up of huts) prepared by the village Banias. The owner or Lalaji is most helpful in providing utensils, and other conveniences, to all those who buy

foodstuffs from him. Rice, atta, potatoes, spices, tea and other necessaries are available at all *chattis* on the way.

8th May. We worshipped at the temple of Vishwanathji or Ardhanareeswara. At Narayankothi, an old temple of Lakshminarayana is flanked on either side by shrines dedicated to the Navagrahas, which have been partially destroyed by vandals.

Maikhandia is famous for the Kali temple there, for here the fabled Mahishasura was killed by the goddess. There is a *joola* or swing here, associated with Droupadi of the *Mahabharata*. Stopped at Rampur *chatti* for the night.

9th May. Path is through wooded jungle. Reach Gaurikund for lunch. Gaurikund is famous for its steaming hot springs 130° F. flowing into a tank and later into the cold Mandakini. Here in the sacred waters legend has it Gauri had her daily bath prior to the worship of Shiva. Stop at Jungle *chatti*.

10th May. The climb is stiff. The snowy peaks of Kedarnath can be seen. Lunch at Rambarha. Panditji says that the Sumeru range enveloping Kedarnath is the longest continuous range of the Himalayas with average height 20,000 ft. plus. Off and on have to pass over snow lanes and cross river on ice bridges.

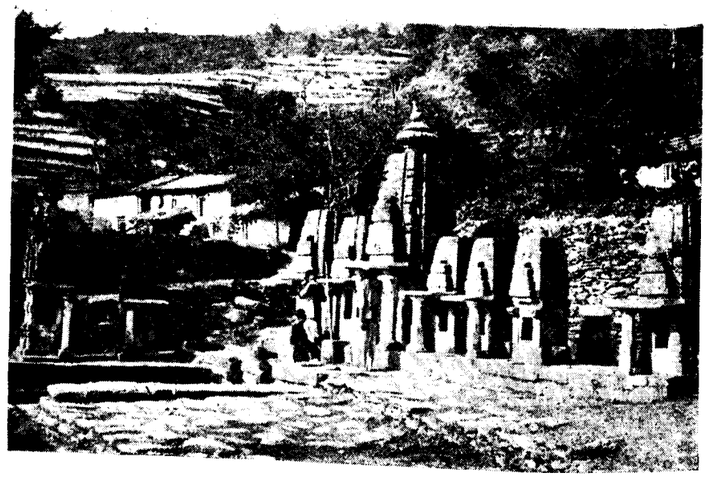
The gorgeous Kedar valley is at last reached. Rewarding and magnificent sight, ancient temple setting off the endless rows of snowy summits all over 21,000 ft. high, and all clothed in snow gleaming in the sun. Behind the temple one can trace the origin of the Mandakini, coming down in icy cataracts. High upon a snow-surrounded natural throne Shiva taking the form of a yogi is apparently lost in eternal meditation. Mother Ganga virtually spouts from His matted locks. At Kedarnath, Divine Presence will be felt even by sceptics and materialists.

The Kedarnath temple is believed to have been built by the Pandavas. Sankara infused a new spirit into Kedarnath and regularised worship here as he did at Badrinath. The high priest who hails from Bellary (Mysore) conducts the *arati* (worship) in an impressive and dignified manner.

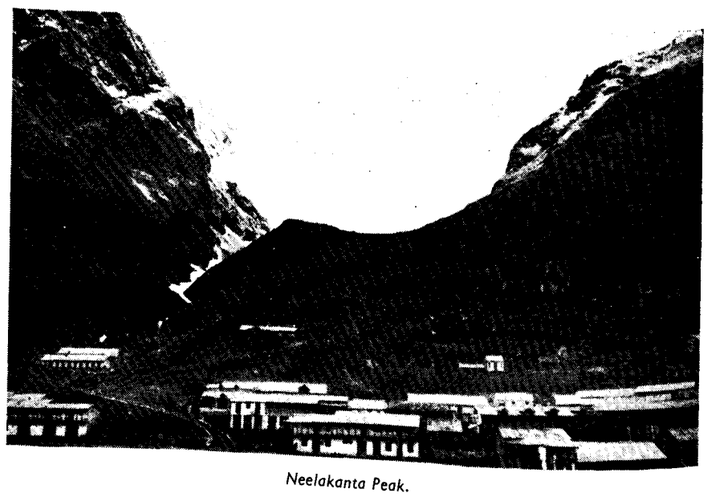
11th May. To-day is Akshaya Tritiya—an auspicious day for Shiva worship. The morning was very cold (4°C.) although the sky was blue and the sun bright. Snow had just been cleared from the temple yards and the approach roads. With the help of the Pandit we worshipped Shiva to our hearts' content. In this supercharged atmosphere, it was not difficult for us to identify ourselves with Divine Presence and realise as we chanted *Chidananda Roopam Sivoham Sivoham*. A Bengali boy was shedding tears of joy after taking (on his back) his nonagenarian mother into the temple.

Downward trek. Reach Gaurikund quickly enough and rest there for the night.

12th May. Get off in the small hours of morning. Hundreds of waterfalls over rocky precipices on either side—besides Mandakini roaring her way down in one



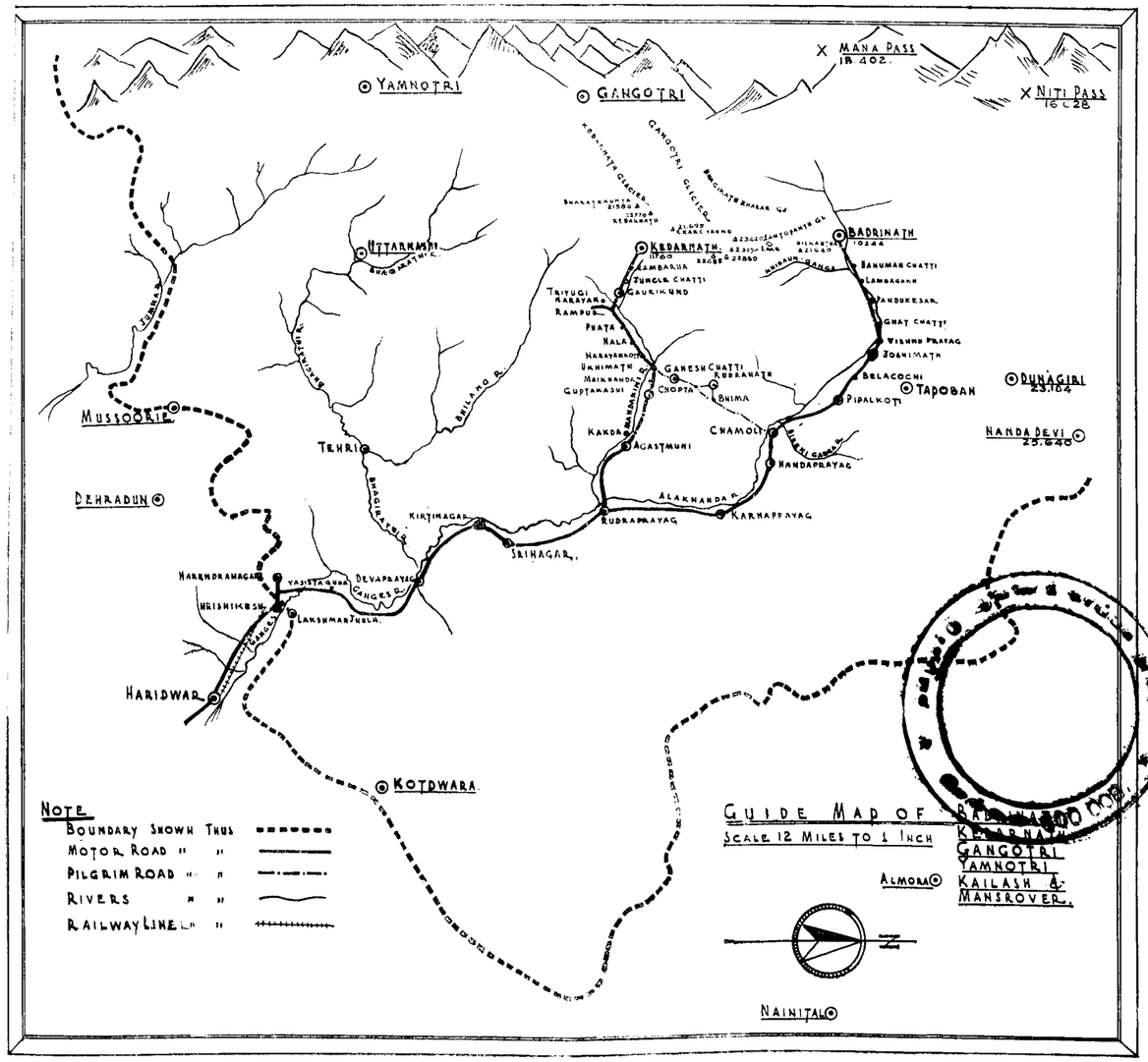
Narayankothi Temple.



Neelakanta Peak.

The Kedarnath Temple: According to legend, the Pandavas built this shrine.

The "encircled" lady, a devout pilgrim, was reportedly 108 years old!



continuous, eternal "Om". These falls are several times the size and height of our own Courtallam.

Gaharwalis—a handsome, honest, happy-go-lucky mountain folk. Their diligence has resulted in efficient cultivation of difficult mountain slopes. In several places flour mills are run by water diverted from the mountain streams into water wheels of crude and ancient design. Development Block officials and Public Health officials are everywhere hard at work trying to improve economic and hygienic standards. Phata *chatti* for the night.

13th May. Rudraprayag in the evening.

14th May. Bus journey—very rough going indeed. Hills around Pipalkoti ablaze with forest fires—an "eerie" night!

15th May. Reach Belacochi early morning, but could reach Joshimath only late in the evening.

Joshimath, over 6,000 ft. above sea level is a health resort and a military outpost, but is even more famous as an outpost of Shankaracharya. Adi Shankaracharya did tapas here in his teens under a banyan tree which must be at least 2,000 years old. The Narasimha temple here is the summer resort of Badri Narayan. Worship performed by South Indian priests.

Go down bridle path and soon reach the bridge overlooking Vishnu Prayag where the Vishnu Ganga and Alakhananda have a turbulent meeting, rolling huge boulders in spirals in their violent clash. The foot-path is narrower here than on the Kedar route, and there is heavy traffic. Stop at Ghat *chatti* for the night—more or less on the river bed.

16th May. Proceed to Pandukeswar. At Ghat *chatti* witness tragedy of a woman whose husband is washed away by unrepentant river. Poor dear old soul! She has to go the rest of the pilgrimage to Badrinath—and the longer pilgrimage of life, alas, very much alone.

Pandukeswar is associated with Pandu who lived there during his last years. Alakhananda—*doodh* Ganga—looks like a mighty cascade of milk. Through the narrow gorge one can see the two peaks Nar and Narayan.

Stop at Lambagadh for the night. Experience the "music of the Alakhananda" said to be composed of differently pitched notes from different cataracts *plus* the echoes from the steep banks.

17th May. The climb from Hanuman *chatti* is rather difficult. Route dangerous. Possibility of loose rubble. The traffic from Tibet of the traders, and their laden mules, and the shepherds with goods-laden sheep and black Tibetan cows is matched only by the hundreds of pilgrims going up shouting *Jai Badri Visal-ki-Jai*. Most of them are elderly and are travelling either on mules, *kandis* or *dandis**. Bhima's discomfiture at the obstruction caused by the mighty tail of a petty monkey (Hanuman) is probably symbolic of the tiresome climb from Hanuman *chatti* to Badrinath, 4,000 ft. in seven miles makes us all tired and out of breath. But our ladies, because of their greater devotion, appeared to take the climb in their strides.

At last the valley suddenly opens out and a rampart of snowy peaks appears, some of them half losing themselves into the powdery clouds. The town of Badrinathpuri suddenly unfolds itself before our eyes. The golden dome of Badrinath is a re-assuring sight. All the pilgrims, young and old, shout with gusto, *Jai Badrinath-ki-Jai*. Stay at the temple guest house. Rest for a while and then attend *arati* at the temple. The night was even colder than Kedarnath—2 deg. C.

18th May. Behind our guest house room we could see the Tapthakund and the Alakhananda. In the Tapthakund a ferrugenous spring containing little sulphur and having a temperature of over 130 deg. F. discharges more than one gallon of refreshing hot water per second into the ice-covered Alakhananda right round the year. All pilgrims bathe in the hot springs and emerge fresh and vigorous. We now go to the temple.

Unlike at Kedarnath, several thousand pilgrims could be seen at Badrinath. Several Vaishnavites from Mysore and Madras are also there. The high priest is a young *Namboodiri* Brahmin from South Malabar and only he conducts the ritual worship. To-day is *Ekadesi* day and we are lucky and blessed in being able to have the *Singara Darsan* and *Viswarupa Darsan* of Sree Badri Narayan on such an auspicious day. The Brahmins continuously chant the Vedas while the priest disposes of the devotees one by one by anointing the sandal *cum* sindur paste on their foreheads.

The image of Badri Narayan is unlike that of Vishnu or Sree Krishna—it reminds one of a Yogi in the *Padmasan* pose and resembles the image of Shiva or Buddha.

* *A* kandi *is a single-man vehicle, where the passenger sits in a basket on the carrier's back. A* dandi *is a carriage like an easy chair carried by four persons.*

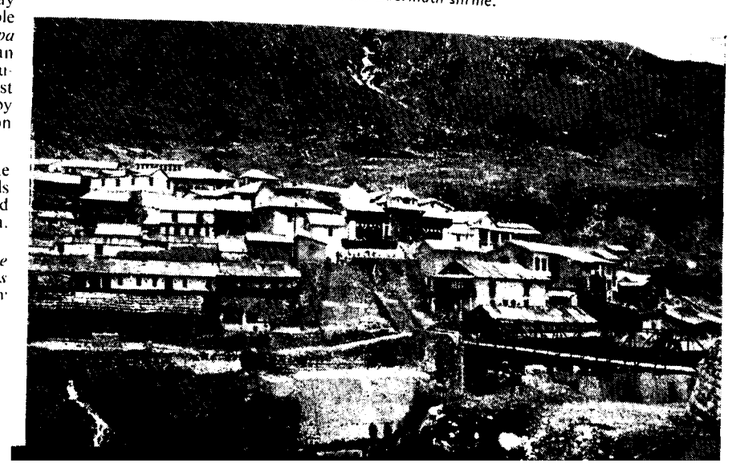
Dandi—a mode of transport in which the passenger is "chairborne" by four men.

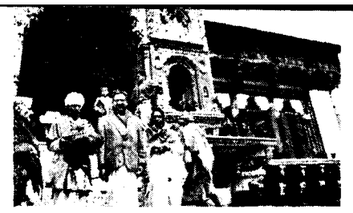
Kandi—a one-man vehicle in which the passenger is carried in a wicker basket.

Near Badrinath.

On the way down from Badrinath—9,000 ft. —Mr. and Mrs. Nayar.

The celebrated Badrinath shrine.





Mr. and Mrs. Nayar at Badrinath.

The deity appears as the *ishta devata* of the particular pilgrim, whether it be Shakti-worshippers or Buddhists, a veritable demonstration of the unity of godhead! On the same pedestal is seated Nara, Narayana, Narada, Uddhava, Brahma, Ganesa, Kubera, Lakshmi and Hanuman. The main idol is said to have been recovered from the river by Shankaracharya and installed by him in the present temple. Badrikashram was at one time a centre of Buddhism.

In the afternoon it suddenly started raining and later it was heavily snowing. The first experience of snowfall is always a thrill, and those of our party who had not experienced it rushed out to receive the snowflakes with both hands!

In spite of the heavy snowfall and frosty weather, the temple was filled to capacity with eager pilgrims.

19th May. Called on Swami Gnanananda who had several years back left a flourishing practice as an advocate at Ernakulam and disappeared into the mighty Himalayas. For the past three years this sage has insisted on remaining at Badrinath, where according to him, if the Lord wishes, He will certainly take care of His devotee. In winter, there are barely two or three human beings in and around Badrinath and they gather together in the small rooms around Tapthakund for everywhere else snow will pile up 10 to 15 feet high. The Swamiji gives us an insight into some of his experiences and visions during long wintry vigils. Real knight-errant of devotion, the Swamiji radiates joy and cheer all around him.

He accompanies us for a few miles, explains to us some of the peaks now boldly standing out in the deep blue sky. The most beautiful sight was that of the Neelakanta peak—barely 5 miles from Badrinath—but still unconquered by man—all white except for one or two dark spots below the top where boulders jut out and prevent the snow from staying. The climb down was swift.

There is difficulty again in getting through bus connection to Hrishikesh. At Joshimath we hang on for a full day along with hundreds of others.

Take advantage of enforced delay to call on a 130-year-old saint staying at the Shankaracharya Mutt—the old baba is not very pleased with his gradually wasting physique, but is certainly at peace with himself.

20th May. The bus rattles its way on meandering roads along the river valley to Sreenagar, which we reach towards nightfall. On the way there are two other Prayags, Karnaprayag and Nandaprayag, named after the stalwarts who did penance at these places.

Rested at the Sreenagar Travellers' bungalow.

21st May. Reach Hrishikesh by bus at noon. Place can justly claim to be the 'Sadhu Capital' of India or even of the world! Every one man in five in Hrishikesh/Hardwar is a Sadhu! Call on the great Swami Sivananda of Divine Life Society.

Over the river on the bridge first believed to have been built by Lakshmana himself, we reach Lakshman Jhoola. Swargashram maintained by Kalikamlawalla incorporates hundreds of hutments amidst woods where Sadhus can retreat and practise spiritual austerities—their physical needs being met by the Kalikamlawalla. Gita Bhavan is a great organisation maintained by the Gita Press of Gorakhpur—a splendid structure right on the banks of the river—with residential facilities, and vast halls whose walls are inscribed with illustrated verses from the Gita—an ideal place for seekers of rest, solace and strength.

Spend the night at the Kankhal Sevashram of the Ramakrishna Mission.

22nd May. Proceed early morning to Vasishta Guha, 15 miles from Hrishikesh. Swami Purushothamananda—again of Kerala—a 90-year-old sage, who has resuscitated the sacred cave of Vasishta is real personification of peace and joy—a deep Vedantin conveying more through his smile than through hundreds of lectures or books—living the real life and possessed of God.

* * *

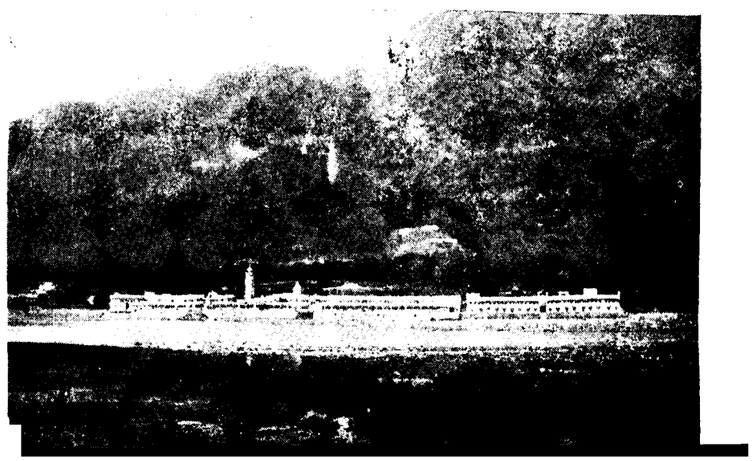
Even after we get back to the sun-scorched plains of Delhi and plunge ourselves into humdrum routine work, the mind wanders back to the oasis of calm that the Himalayan holiday has been in this world of storm. And this mighty snow-clad complex is conceivably the greatest manifestation of divine power—ineffable beauty and effulgent peace—indeed the most outstanding object on the surface of our planet. The Himalayas represent unsurveyed reserves of untapped power, not merely from a hydro-electric point of view (there are 30 million kWs of residual power which can be generated from these mountain streams), but also from a spiritual angle. For just as the many thousands of streams feeding the Ganges and Indus and the Brahmaputra emanate from the Himalayas—the tens of thousands of pilgrims who go into Himalayan shrines and retreats represent a reverse flow of spiritual power making the Himalayas an ocean of spiritual power, just as it is a great reservoir of potential hydro-electric power.

—V. G. G. NAYAR

Jagat Guru Sri Sivananda Muni of Tirunelveli and Pandit Mahadev Prasad Sharma.

Swami Gnanananda: he left a flourishing practice as an advocate to retire to the Himalayas.

Hrishikesh—the "Sadhu capital of India!"



P. R. PANIKER—*A tribute*

by H. K. RAMASWAMI, *Director, Seshasayee Bros. Private Limited.*

[As we go to Press, we have learnt with sorrow the news of the sudden death of Mr. P. R. Paniker in Bombay at his daughter's place on August 8. Mr. Paniker had gone on a fortnight's holiday for rest and recuperation, but an unkindly Fate had decreed otherwise, and we are, forever, going to miss his genial personality.

For long, General Manager of the Allied Industrial Distributors Limited, our selling agents for Madras State and Andhra Pradesh, he was latterly AID's Chief Salesman and Liaison Officer while continuing as Representative of all the companies coming under the "Seshasayee" aegis.

Poonthottathu Ravunni Paniker was born on Sept. 16, 1896. A graduate of the Madras University with Philosophy for his main subject, he later took a Law degree from the Bombay University. For a short spell, he served in the Madras Revenue Board, but soon gave up Government service in favour of business. Joining first the Belgian Manufacturers' Association, Bombay, he took up afterwards an appointment with ACEC, Bombay. When a Madras Branch of this Company was opened, Paniker was named its Manager.

His association with "Seshasayee" concerns dates back to his early ACEC days.

Some idea of the personality of Paniker might be had from this tribute of Mr. H. K. Ramaswami who has known him for about 25 years. *Ed.*]

I HAVE KNOWN MR. P. R. PANIKER FOR THE last twenty-five years.

My acquaintance with him began when he was the Madras Manager of ACEC (India) Ltd, who were selling electricity cables, motors, transformers and other equipment in India. This was in the years 1934–35 just when the Madras Hydro-electric Grid had come into being.

At that time, except for a few private licensees like Trichy-Srirangam Elec. Supply Corporation Limited, Sri Minakshi Elec. Supply Corporation Limited etc. Government-owned or European-owned electricity concerns patronised only British goods.

It is a tribute to Mr. Paniker's smooth salesmanship that he secured orders from the Madras Electricity Department for three 2,500 kVA transformers for their Negapatam substation, breaking an established buying tradition.

From this "departure" onwards the Madras Electricity Department was one of his biggest customers for transformers and cables.

During the War when continental materials stopped arriving in India Mr. Paniker left ACEC and started business on his own. At the same time he was urging Mr. V. Seshasayee to set up an aluminium wire and cable factory. Mr. Seshasayee also readily took to his idea and in successive years, Mr. Paniker came to be closely associated with the selling end of the aluminium cable business in the southern zone.

As a seller, Paniker was persuasive, and at the same time he always showed anxiety that the customer received the fullest satisfaction. He would not hesitate to tell his principals any adverse comments from buyers and he would see to it that defects were rectified.

Mr. Paniker deemed it his religious duty to take part in the social activities of his employers and friends though by nature he was rather a recluse, and preferred quiet contemplation at home. He had built up a wide circle of friends in all spheres who would not hesitate to seek his kind help and advice as they knew that it was freely given without any strings attached.

He was deeply attached to his family. His only daughter—Parvathi—was his greatest treasure. He gave her his best attention and brought her up with care and devotion. He took pride, very legitimately, in her pleasing qualities.

Mrs. Paniker whom he invariably addressed as "Madam" was held in great regard by him, and though she is a very reserved and quiet lady and a devoted wife, I think, he never did anything of importance without consulting her first or which had not her unqualified approval.

Paniker had also helped a number of his relatives by educating their children, seeking employment for them, arranging marriages for them and so on. I think he spent a good deal of his income in this manner.

He was also a deeply religious person. He was a regular pilgrim to the Guruvayur temple, and at home every evening, he would have his food only after a bath and *puja*, in whatever state of health he might be.

He was a man of simple and unostentatious habits. Always dressed in a simple white khadi shirt and pants, a characteristic feature of his *ensemble* was a soft hat which he always kept on.

He was very kind to his staff and had often pleaded for their betterment, without giving publicity to it.

His particular devotion was to Mr. Seshasayee, whom he regarded as his patron. To the end, he was always rendering some small service or other to him.

I am personally very much indebted to him. He was the guardian of my daughter and son for nearly 10 years when they were in the Madras Medical College. He looked after them as his own children, visited them regularly in their hostels, took them home, did their shopping; they had grown to love him as a member of the family.

He had a subtle sense of humour and had quite a fund of entertaining stories and anecdotes.

I saw him at Madras on the day he left for Bombay to spend a fortnight with his daughter, son-in-law and grandchild. Though he was suffering from blood-pressure, he was quite cheerful and happy and his end came suddenly and without any notice.

Paniker belonged to a generation that prized highly courtesy, friendship and other eternal human virtues. What a pity that race of men is fast dying out!

Suggestion awards

SUGGESTIONS PUT FORWARD BY THE FOLLOWING EMPLOYEES HAVE BEEN ACCEPTED FOR implementation and the company has announced the awards noted against the names:

K. Kunjan Pillai, Stores ... ... Rs. 20/-
No. 336 ... (*Continuous check on materials issued on M.R.*)

N. Thankappan Pillai, S.S. & H.K. ... ... Rs. 50/-
No. 337 (*Assignments of duties to guards.*)

K. Thomas Muthalaly, Rod Mill ... ... Rs. 50/-
No. 338 ... (*Issue of gloves for economical use.*)

K. Thomas Muthalaly, Rod Mill ... ... Rs. 20/-
No. 339 ... (*Tools for cleaning channels—improvement in design.*)

M. Yohannan Paniker, Security ... ... Rs. 10/-
No. 341 ... (*Provision of a key board in the Office.*)

A. Shahudeenkutty, Wire Mill ... ... Rs. 10/-
No. 346 ... (*Provision of tags on wire spools unloaded from machine.*)

C. Damodara Kurup, Wire Mill ... ... Rs. 10/-
No. 347 ... (*Printing instead of writing of numbers on tags.*)

N. Sadanandan, Mechanical ... ... Rs. 150/-
No. 348 ... (*Fitting of pumps outside the gear boxes.*)

C. G. Madhavan Pillai, Wire Mill ... ... Rs. 30/-
No. 349 ... (i) (*Installation of a name board indicating direction, at the Sub-Registry Junction.*)
(ii) (*An area fenced with small angle iron pieces near the wire drawing machines, for the unloaded wire spools should be provided to avoid the unloaded spools dashing against walls, pillars &c.*)
(iii) (*A big tray provided near the wire drawing machine will collect all spilt oil, lubricants, &c., and will thereby facilitate better house keeping and re-use of such oils, &c.*)

R. Sundaresan Nair, Wire Mill ... ... Rs. 10/-
No. 350 ... (*Steps to minimise shutdown time for repairs and maintenance.*)

A. Shahudeenkutty, Wire Mill ... ... Rs. 10/-
No. 352 (*Provision of suitable furniture in the Lunch Room.*)

A. Shahudeenkutty, Wire Mill ... ... Rs. 10/-
No. 353 ... (*Name boards at junctions.*)

V. I. Thomman, Electrical ... ... Rs. 50/-
No. 354 ... (*Provision of (i) float switch on the overhead water tank to avoid overflow and wastage; (ii) guide rails for 3 one flex wires for butt welders.*)

C. Damodara Kurup, Wire Mill ... ... Rs. 10/-
No. 355 ... (*Better display of I.S.I. certification card on reels.*)

P. M. Varghese Paniker, Wire Mill ... ... Rs. 20/-
No. 357 ... (*Provision of pulleys (bigger size) over No. 1 Strander to facilitate better operation and to avoid scratches on conductors.*)

P. M. Varghese Paniker, Wire Mill ... ... Rs. 15/-
No. 358 ... (*Additional stop switch with Wire Stranders, for emergency operation.*)

P. M. Varghese Paniker, Wire Mill ... ... Rs. 15/-
No. 359 ... (*Shelter over areas where taps are provided outside the works buildings.*)

Our Neighbours

Mr. M. S. Venkataraman, Administrative Officer.

PORT OF COCHIN

For "Our Neighbours" we have pleasure in presenting in this issue of the CHRONICLE *the Port of Cochin. Here's the story of the* Queen of the Arabian Sea *as related by Mr. M. S. Venkataraman, Administrative Officer.*

THE PORT OF COCHIN, THE FINEST natural harbour in India, and one of the three major ports in the west coast is situated about 200 miles north of Cape Comorin, the southernmost point of India and about 580 miles south of Bombay at latitude 9° 58′ north and longitude 76° 14′ east, the distance from Cochin to Colombo being 318 miles. In view of its beautiful scenery, its lagoons and backwaters over a stretch of nearly 125 sq. miles, Cochin has rightly been called the "Venice of the East" and the "Queen of the Arabian Sea".

This historical port naturally attracted the seafaring nations of Europe in their quest for an ocean route to the East and the first European settlement in India was here. The Portuguese Admiral Cabral brought his fleet into Cochin Harbour in 1500. Vasco da Gama arrived in 1502 and died here.

Prior to the development of the harbour a rock-like barrier of sand prevented ships from entering the inner harbour and landing and shipping operations were carried on in the open roadstead, small cargo boats or lighters being used for taking cargo to and from ships lying at anchor. For more than a hundred years, the possibilities for developing the Port by cutting a deep channel for ships to enter were explored and after a thorough study and carrying out certain experiments and other observations, Sir Robert Bristow, the architect of the Port, stated that with a suitably designed dredger the approach channel could be cut and maintained. This was the 'key' to the making of the Cochin Harbour.

After many daring experiments and surveys, the cutting of an approach channel from the deep sea across the bar to the harbour was accomplished. The work was made possible by using a suction dredger—"Lord Willingdon"—with pipe line. By the year 1929, the approach channel, 450 ft. wide and 3½ miles long, was cut across the bar, connecting the harbour mouth with the deep sea. The Port was thrown open for vessels up to 30 ft. draft from the year 1930 providing a splendid anchorage at all times of the year.

From harbour to port

The conversion of the harbour into a major port was effected in four stages. The *first stage* consisted of preliminary work of an investigatory nature prior to 1920. The *second stage* consisted mainly of foreshore protection, a part of the reclamation wall and the experimental dredging inside and outside. The *third stage* consisted of the major dredging operations inside and outside, the laying of a few moorings, the construction of a few residential quarters, a large area of reclamation and a dry dock. On this reclamation of about 780 acres in area arose Willingdon Island, the nerve centre of port activities. The *fourth stage* included all the works necessary to convert Cochin into a first class modern port, like the provision of bridges, wharf, quay berths, cranes, warehouses and transit sheds, offices, reserve light and power plant, roads, residences, port railways, water supply and a number of small Jobs.

In 1936, Cochin Port was declared a major port and the Government of India took direct control of its administration. The provision of facilities of a first class terminal port was completed by the end of 1938. The first ship came along the new wharf on 2nd June 1939.

Willingdon Island is connected to the mainland on the east by a combined road and rail bridge and a road bridge to the mainland on the west. Regular train service was established from 1st October 1940. The Island thus became the terminus station for the Madras–Cochin rail service. In 1941, an aerodrome was constructed on Willingdon Island and Cochin is one of the very few ports in the world having all the three main forms of transport,—land, sea and air—centered in the same place.

By the year 1951, the Port had four wharf berths capable of accommodating four vessels of 450 ft. length, in addition to the Boat Train Pier which was meant for passenger ships, but used as a coal berth, 13 stream moorings in the Mattancherry channel in the western side and three stream moorings in the Ernakulam channel mainly intended for use of oil tankers. A separate Coal Berth was constructed and put into commission in the year 1953. While further developments were being planned, the Five-Year Plan started and the projects relating to the Port became part and parcel of the Plan.

Under the Plan, two Oil Tanker Berths have been constructed in the Ernakulam channel with connecting jetty and pipe lines to the Ernakulam shore to facilitate pumping of oils direct from vessels to shore installations. This scheme has not only resulted in the quick turn-round of tankers, but has replaced the old process of carrying oil through barges from ships to the installations, which involved considerable cost and risk. The Boat Train Pier at north end of Willingdon Island was provided with facilities for pumping black oil from and to the oil installations on shore. Facilities have also been provided to supply bunkers from the shore installations direct to vessels working at the deep water wharf.

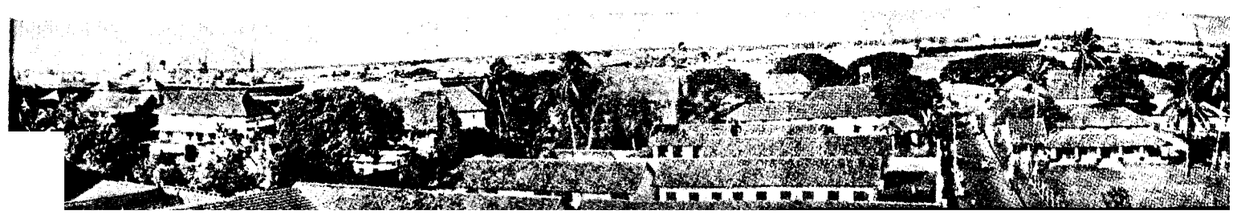
The most important major development project undertaken during the Plan period is the construction of additional wharf with four berths and all ancillary facilities at the eastern shore on Willingdon Island facing the Ernakulam channel. The work is in rapid progress.

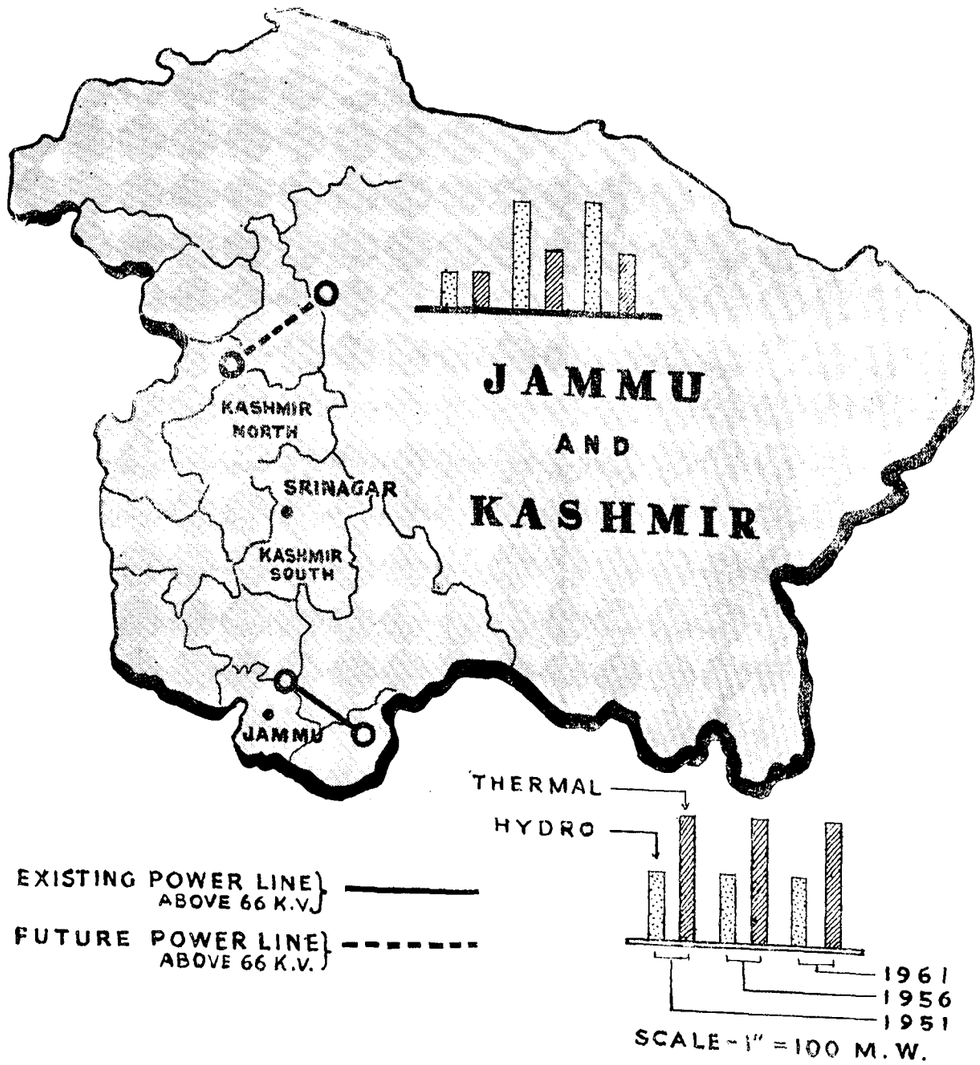
The work in connection with providing metre gauge facilities on Willingdon Island, necessitated because of the construction of the Ernakulam-Quilon metre gauge rail link, has been commenced which will bring the Port nearer to the high-range hills and the planting districts of Kerala.

The construction of a second Coal Berth on Willingdon Island facing the Mattancherry channel has also been started.

The trade of the Port has increased from 75 million tons in 1935-36 to 1.8 million tons in 1957-58 out of which 1.33 million tons have been handled at the Port wharves. With the vast resources in hydro-electric power available in this part of the country, the trade of the Port has great possibilities. Cochin is the only Indian port on the direct route to the Far East. The facilities available at the Port for passenger traffic open out for the tourist some of the gorgeous regions in India and the marvellous beauty of the backwaters of the Malabar Coast.

Queen of the Arabian Sea—Cochin Port—an aerial view.





SEVERAL YEARS AGO WE CAME OUT with a press advertisement headlined " From Kashmir to Comorin ". Friends who do not know us really well might have suspected that the caption was used just for a euphonious or an alliterative effect, without actual foundation in fact. The truth, however, is that Jammu and Kashmir Electricity Department is one of our first customers, so, here goes their story.

Around Independence, the only source of power in J. & K. State was the 3,200-kW Mohara Power House built as far back as 1908, but which had long outlived its usefulness. A station generating at the non-standard frequency of 25 cycles, its distribution voltage was also not standard.

Sindh Hydel Scheme

During the First Plan period, the problem of power for Kashmir was tackled on an emergency footing. To meet the immediate and pressing demand for power, the Sindh Hydel Station was planned at Ganderbal with an initial, installed capacity of 6,000 kW, and commissioned in 1955.

This Hydel Station which utilises the waters of the river Sindh has been designed on a minimum discharge basis of 300 cusecs, the flowing river water being tapped at Purang, 11 miles from Ganderbal with a headworks there. A lined canal, 10 miles long, takes the water to the balancing reservoir and forebay tank. From the forebay tank, the water is taken by a single penstock pipe—the upper and reduced diameters being 61 in. and 41 in. respectively—which, bifurcating at the Power House level, feeds two 4,365 h.p. Francis Turbine Sets with a working head of 462 feet. Each unit generates 3,000 kW at 0.8 power factor and 6.6 kV.

The voltage is stepped up to 33 kV by two 3,750 kVA transformers and transmitted to Srinagar receiving station.

In the final stage, capacity will be 15,000 kW two more 4,500 kW sets being installed.

Jammu Hydel Power House

This hydel project utilises the waters of the river Chenab. A lined canal diverts the water from the river and feeds into three horizontal type hydro sets 350 kW each, with a net head of about 30 feet. This hydel power is now supplemented by two diesel sets, one 265 kW and another 200 kW.

A 640 kW hydel station was built at Udhampur to meet the immediate demand of Udhampur town and its suburbs.

In addition to meeting the demand of power in Jammu province, a 66 kV line was also built from Jogindernagar in the Punjab to Jammu, for purchase of bulk power from the Punjab system.

Projects included in the Second Plan

(i) *Mohara Power House :* As the sets at the old Mohara power house generating power at 25 cycles had already outlived their useful life, it was decided to replace the old sets by two new 4,500 kW sets. The project is expected to be completed next year.

(ii) *Ganderbal :* Two additional sets of 4,500 kW each are to be installed, thereby increasing installed capacity to 15,000 kW. A second penstock line will, also, be erected. The work is expected to be completed towards the end of the Second Plan period.

(iii) *Jammu Hydel Power House :* The three old horizontal sets have since been replaced by two new vertical type hydro sets of 500 kW each.

(iv) In order to purchase more bulk power from the Punjab, the construction of a second 66 kV line from Pathankot to Jammu has also been undertaken in this Plan period.

Transmission System

Since Jammu and Kashmir are separated from each other by 10,000-foot high Pir Punjal Range, and both provinces are to have independent power systems, it is very difficult also to link up the systems.

(i) *Kashmir :* Two 33 kV ACSR wood pole lines from Ganderbal to Srinagar feed the city of Srinagar and suburbs.

(ii) A 33 kV ACSR wood pole line from Srinagar to Anantnag *via* Pampore feeds Anantnag, Awantipura, Pampore, etc.

(iii) A 33 kV ACSR wood pole line from Ganderbal to Markundal feeds Sonwari area.

(iv) An old 33 kV wood pole line from Mohara to Srinagar meets part of the demand in Srinagar. The 25 cycles are converted into 50 cycles. The 33 kV lines are also extended from this line to Pattan, Baramulla, Gulmarg, etc.

(v) When the Mohara power system is renewed, a 66 kV ACSR steel tower line between Mohara and Ganderbal will grid the two power systems. The line is under construction.

(vi) Another 33 kV ACSR wood pole line, now under construction from Ganderbal to Pampore, the industrial town, will meet the requirements of the projected industries and industrial estates in that area.

Jammu

(i) A 66 kV line from Jogindernagar to Jammu enables the purchase of bulk power from the Punjab.

(ii) So that more power is available for meeting the demand of Jammu province, another 66 kV ACSR steel tower line is under construction from Pathankot to Jammu.

Rural Electrification

Villages situated at convenient distances from the H.T. feeders are being electrified by H.T. or L.T. line extensions being taken. But where it is neither economical nor feasible to take very long extensions from existing lines to remote towns and villages surrounded by high peaks, and where the load will not also such extensions, tiny hydel sets or warrant small diesel units are being installed.

Major centres where such sets have either already been installed or are under installation are :

Kashmir Province :

Bandipore	Hydel
Pahalgam	Hydel
Kupwara	2 x 25 kW + 1 x 50 kW
Dachigam	1 x 19 kW Hydel
Chrari Sheriff	3 x 400 kW Hydel

Jammu Province :

Poonch	2 x 30 kW + 1 x 90 kW Hydel
Rajowri	2 x 100 kW Hydel
Kathua	2 x 50 kW Diesel
Ramnagar	1 x 250 kW ,,
Katra	1 x 66 kW ,,
Banihal	Small Diesel set
Batote	,, ,,

By the end of this year, all important towns and villages of the Jammu —Srinagar national highway would have been electrified and it is expected that in the next 15 years every village in the State would be electrified.

Review of achievements in the Five Year Plans :

The following is a review of the achievements of the electricity department of the State in the two plan periods:

First Five Year Plan : Expenditure in the plan Rs. 2.00 crores.

Installed capacity at the beginning of Plan—3,200 kW.

Installed capacity at the end of plan—12,000 kW.

Erection of 66 kV lines—68 miles.

Erection of 33 kV lines—73 miles.

Erection of 11 kV lines—105 miles.

Erection of 400 kV Distn. lines—65 miles.

Receiving station installed—3.

Sub-stations erected—19.

Centres electrified—77.

Power supplied to tube wells—21.

Second Five Year Plan :

Expenditure—Rs. 3.25 crores.

Installed capacity at the end of Second Plan (including tiny projects)—25,000 kW.

Erection of 66 kV lines—124 miles.

Erection of 33 kV lines—52 miles.

Erection of 11 kV lines—21 miles.

Receiving stations installed—4.

Centres electrified—65.

The per capita consumption which was approximately three units in 1947 is now nearly three times, present per capita consumption being 10 units.

Projects envisaged in Third Plan

The water power potential of this State is considerable. Survey work is going on at Gautimala in Kashmir and Riasi in Jammu for the construction of hydro electric power stations of large capacity. A major handicap in the construction of huge power systems especially for Kashmir State, is transportation. The transportation cost is prohibitive, the only means of transport being trucks or lorries. Due to the high transportation cost, a power project in Kashmir costs easily around Rs. 2,200 per kW.

Naushehra Hydel Scheme : A project for utilising the waters of River Jhelum at Naushehra, about 7 miles from the existing Mohara power station has been investigated. This site has a power potential of 40,000 kW. The water will be tapped from the river by the erection of a barrage across the river so that the entire minimum of 1,750 cusecs will be utilised. Seven miles of lined canal will take the water along the hill on the right side of the river to the power house site and gain a head of 220 feet.

Power will be taken by 66 kV double circuit tower lines to Srinagar and then to Pampore, the potential industrial centre.

Salal Project : A project for utilising the water of the river Chenab at Salal (Riasi) in Jammu Province has been investigated. This site has a power potential of about 0.5 million kW, but in view of power requirements and available financial resources, the State Government are investigating the possibility of developing about 60,000 kW near Dhiangarh. There are two or three choices, but the one most likely to find favour will have a cross-head of about 90 feet. Power will be transmitted by 66 kV overhead line to Jammu which is the main consuming centre. Riasi is a highly mineralised area in this region and the bauxite deposits are of a very superior quality. It is likely that a cement factory and a small aluminium refinery may spring up near this place on availability of cheap hydel power. The present 66 kV line and the one under construction between Pathankot and Jammu could then be utilised for supplying surplus power to the Punjab.

In addition to this power project there are two other small hydro electric projects for generating about 2,500 kW at Nichlina near Banihal, and about 3,000 kW at Chenani. These two projects are intended primarily to make power available for the projected ropeway between Chenani and Verinag.

Besides the above there are a number of small hydel projects under investigation during the Third Five-Year Plan.

SUPER-GRID SYSTEM FOR INDIA

by M. HAYATH and V. VENUGOPALAN

(Central Water and Power Commission)

IT IS UNIVERSALLY RECOGNISED THAT electric power is indispensable to the modern community and the progress of our civilization. The per capita production of electricity is in fact a good index of the economic progress of a country and the standard of living of its people. In India, the per capita production of electricity in 1957 was about 28 units per annum as against four-digit figures for Norway, Canada, Sweden, U.S.A., and some other advanced countries. Power Supplies are now available in only two per cent of the villages, wherein are living over 80 per cent of our population. The development of our power resources and their transmission and distribution over the widest possible areas are, therefore, of vital importance in accelerating the agricultural and industrial progress of the country. As coal and hydro power resources are not evenly distributed over this vast sub-continent, it is desirable to evolve plans for a Super-Grid System to reinforce and supplement regional transmission systems, and thereby ensure an even flow of benefits all over the country.

Advantages of Interconnection

The modern trend in advanced countries in power development is towards the construction of super powerstations of capacities approaching and even exceeding 1 million kW, closure of small, old or uneconomic power stations, transmission of large blocks of power at voltages exceeding 220 kV to distant load centres, and interconnection of adjacent power systems. A combined hydro and thermal grid system has agreater firm capacity than the sum of the individual systems operating in isolation. In such a combined system, the base load is carried by hydel power during monsoon periods and by thermal power during the dry seasons. The installed capacities of both thermal and hydel power stations are used more effectively, thereby minimising spare generating units and effecting substantial economies in capital cost and maintenance. The frequency and voltage of interconnected systems are less susceptible to variations on account of sudden changes in load and fault conditions than in the case of isolated and small power systems. Key industries can be dispersed and located to suit the availability of raw materials, transport and utilisation. Rural electrification will also be possible on a large scale.

Economics of High Voltage Transmission

The following are the factors governing the economics of high voltage transmission :

(*a*) The load-carrying capacity of a transmission line is proportional to the square of the operating voltage.

(*b*) The transmission line and terminal equipment costs rise rapidly with voltage, but more approaching the first power than the square.

(*c*) As a consequence of items (*a*) and (*b*) the investment cost of transmission decreases as the voltage increases, provided the full capacity of the line can be utilised.

These factors, combined with the economics of Super Power Stations with large-size units, have resulted in significant development of high-voltage long-distance transmission systems in all the advanced countries of the world.

Grid Systems in Other Countries

Before dealing with transmission systems in India and the plans for the future, it is good to have a broad picture of similar developments that have taken place in other countries. During the past 30 years or so, good progress has been made in this direction in Sweden, U.S.A., Canada, U.K., France, and U.S.S.R. In fact, the system interconnections have overflowed national frontiers in Europe for the purpose of exchanging power to the mutual advantage of the countries concerned. Some of these developments are described below.

Sweden: The hydro power potentials in this country are concentrated in the north while the power demands are mainly in the south. This has necessitated the construction of long-distance transmission lines from the north to the south. After the completion of six such 220 kV lines in the years 1936—1949, it was found necessary to go in for higher voltage lines. In 1952, a 600-mile long 380 kV single circuit line from Harspranget to Hallsberg was put into service to transmit power to 400 mW. By 1958, the 380 kV network would comprise 1,900 miles of lines. As the insulation level of the present 380 kV lines is on the conservative side, the possibility of raising the voltage of the 380 kV system to the 450 500 kV level, at least in some parts of the system, is being studied by Swedish engineers. At the same time, investigations are being made about the adoption of a higher voltage of transmission. A 650 kV line using four bundled conductors can transmit about 2,000 mW with series capacitor compensation. It is considered that two or three 650 kV lines, running from north to south, along with the four 380 kV lines, expected to be in service by 1960, would be sufficient to transmit the bulk of hydro power which can be harnessed in northern Sweden in the near future. The limit for high voltage transmission in Sweden may therefore, be regarded as 650 kV.

United States and Canada : The United States and Canada have extensive transmission systems operating at 220-287 kV. The highest voltages in operation are 330 kV in the USA and 345 in Canada. For power development in the western States, the U.S. Bureau of Reclamation envisages a 500-kV grid. No significant development in super voltage transmission systems has been witnessed in these countries, probably for the reason that power resources, both hydro and thermal, are not so unevenly distributed as on the Continent.

United Kingdom : An extensive 132 kV Grid System has been in operation in this country since the early thirties. In order to meet the growing demand for power, a super-grid at 275 kV has been planned, with some sections designed for eventual operation at 380 kV. In 1955, a double-circuit line running from Staythorpe to Drakelow in the Nottingham area (47 miles in length) was energised at 275 kV. It is envisaged that about 1,500 route miles of 275 kV lines would be in operation by 1960.

France : The principal thermal stations are situated in the Parisian region, the collieries in the north and south of France, and the hydro-electric stations in the Alps, Pyrenees and Massif Central. An extensive transmission system has been developed, covering the entire country and interconnecting the hydro and thermal stations. The maximum transmission voltage of 150 kV was stepped up to 225 kV as early as 1925, and by 1938 the French transmission system comprised about 5,300 km of 150 kV lines and 2,050 km of 225 kV lines. With the increase in load demands and the augmentation of generating capacities, the need for employing a still higher voltage was soon foreseen, and an important trunk line, 405 km long, consisting of two 225 kV circuits, which could eventually be converted into one circuit at 380 kV, was put into operation in 1946. By the end of 1957, the transmission system had about12,090 circuit km, 225 kV system, of which about 2,090 circuit km were designed for eventual operation at 380 kV. The operation of the Genissiat-Paris section, 450 km long at 380 kV is reported to have started early in 1958.

U.S.S.R.: The highest transmission voltage in operation in Russia is 400 kV (AC). The first stage of a scheme providing for the development by 1960 of a consolidated power system in the European sector of 30,000 mW capacity entails the construction of 5,000 km of 400 kV lines with 17 substations, in addition to 500 km of 800 kV (AC) line. The second stage which would increase the capacity to 50,000 or 60,000 mW, envisages the addition by 1965 of 6,000 to 7,000 km of 400 kV lines and 25 substations. The interconnection of power stations in Irkutsch and adjoining districts in the Asiatic sector to operate an integrated 400 kV system is also proposed during the same period. One double circuit line from Kuybishev to Moscow at 400 kV (AC) of over 800 km was put into service in 1956. The Stalingrad-Moscow 400 kV double circuit line, 1,000 km long, is scheduled for commissioning in 1958-59. Problems of stepping up the 400 kV AC lines now in service to 500 kV and of designing equipment for 600 or 750 kV operation are reported to be under investigation.

Direct Current Transmission

In the field of long distance transmission of large blocks of power, high voltage DC transmission offers certain inherent advantages over AC, and this has prompted a number of countries, notably Russia, Sweden and Switzerland, to carry out extensive investigations on this subject. The main advantages of DC transmission are listed below :

(*a*) Use of two conductors in place of three cuts down capital and maintenance costs ;

(*b*) With a given insulation, a greater amount of power can be transmitted with DC by using a higher voltage ;

(*c*) DC is free from operational problems associated with line inductance and capacitance.

(*d*) Unlike AC, DC corona does not produce any harmonies causing interference with adjacent telecommunication circuits.

However, there are various problems encountered with DC transmission, such as the availability of suitable conversion equipment and circuit breakers, etc., which are holding up the large-scale employment of DC transmission. Notwithstanding these difficulties, a few advanced countries have put into service some DC transmission lines into commercial operation. A 100-kV DC submarine cable laid in the Baltic Sea connecting the mainland of Sweden and the Island of Gotland was put into operation in 1954, the transmission capacity being 20 40 mW. In Russia, a 200-kV, DC line with two single core underground cables is operating over a distance of 67 miles between Moscow and Kashira for transmitting 30 mW.

Although DC high voltage transmission is a comparatively new development, there are promising indications that the adoption of DC will be more economical than AC for loads of 300–400 mW and above and for distances of 350 miles and above. A 800-kV, DC transmission line over a distance of 500 km is under contruction from Stalingrad.

Power Expansion Plans in India

The total installed generating capacity, which was about 2.3 million kW at the beginning of the First Five-Year Plan, rose to 3.4 million kW by the end of the Plan period. The Second Five-Year Plan envisages an increase of 3.0 million kW in the installed capacity, bringing the total to 6.4 million kW by 1960–61. It is estimated that it would be necessary to add about 6 million kW during the Third Five-Year Plan period in order to cope with the growing demands of power.

Regional Grid Networks and All-India Grid

At present the highest voltage of transmission in operation in India is 132 kV. As on 31st December 1956, there were nearly 2,700 circuit miles of 132 kV transmission lines in service in this country. The 132 double circuit line from Nangal to Delhi (about 200 miles in length) is designed for eventual operation at 220 kV. In addition, under the Koyna, Sharavati and Kundah Projects in the States of Bombay, Mysore and Madras respectively, construction of 230 kV lines is scheduled under the Second Five-Year Plan. Sizeable interconnected systems already exist in many States such as Madras, Kerala, Mysore, Andhra Pradesh, Bombay, Punjab, Uttar Pradesh, Bihar and West Bengal. The trend in the various States has been towards the interconnection of the important generating stations, hydro and thermal, within their regions. However, there has not been any significant expansion of the regional Grids across the State boundaries, except in respect of the Damodar Valley Corporation transmission system which covers Bihar and West Bengal.

Coal and hydro power resources are not evenly distributed over this country. Coal occurs largely in Bihar and West Bengal, and to a little extent in some parts of Central India. Hydro resources are mainly concentrated in the Himalayan region and the Western Ghats, the total power potential which can be economically developed being 40 million kW at 60 per cent load factor. The consumption of power is centered around large industrial cities like Calcutta, Bombay, Madras, Ahmedabad, Kanpur and Bangalore. The future pattern of development will be on the lines of making power supplies available over the widest possible areas in this subcontinent. It is in this context that it becomes important to expand the scope of the regional Grids across State boundaries, and thereby evolve in stages an All-India Super-Grid System which will serve as the backbone of the country's industrial and agricultural development.

The proximity of the regional networks of the four Southern States of Andhra Pradesh, Kerala, Madras and Mysore, and the power imbalance in certain regions, brings to the fore the importance of a co-ordinated operation of the systems by means of suitable interconnections. The 220-kV transmission lines proposed under the Koyna Project in Bombay State may well constitute the beginning of a Super-Grid system in the Western region which may extend beyond the borders of the State towards Mysore in the south and ultimately link up with the Chambal Hydel Project in Madhya Pradesh and Rajasthan. The Punjab-Delhi Grid System may be eventually linked with the Ganga, Sarda and the Rihand Grid Systems in Uttar Pradesh. The DVC hydro-thermal system and the Calcutta thermal system are already interconnected, and this will be extended to cover the Rihand and the Hirakud Systems during the next few years. Side by side with the establishment of these supra-regional Grid systems, an All-India Grid can be developed in stages by means of suitable interconnections.

Super-Grid for the Southern Region

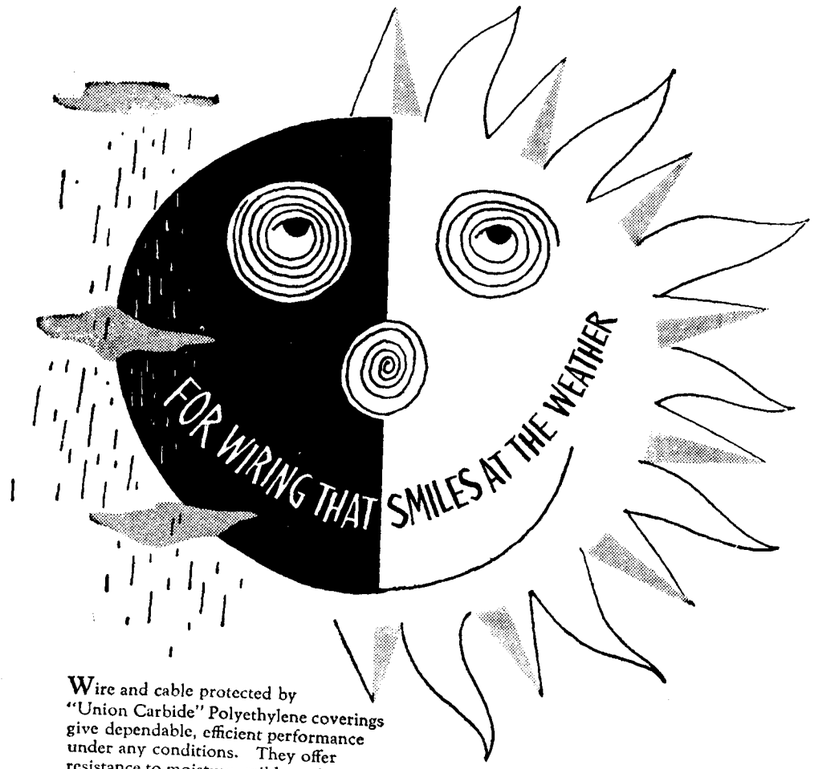
As a first step towards the objective of forming the All-India Grid, a study of the Southern Grid covering the States of Andhra Pradesh, Kerala, Madras and Mysore has been initiated by the Central Water and Power Commission (Power Wing). In the Telangana region of Andhra Pradesh there is an estimated reserve of about 4,042 million tons of coal. This may well serve as a suitable site for a Super-Thermal Station of large capacity for feeding into the Grid System. The hydro resources in this region are largely concentrated in the Western Ghats and in the Godavari river. Some of the major hydro power potentials in this area, *excluding those* that are projected in the Second Five-Year Plan, are given below.

The utilisation of these hydro power resources can be taken up not only to meet requirements of the States concerned, but also to serve the requirements of the southern region as a whole :

State	*Name of Scheme*	*Power Potential in MW at 60% Load Factor.*
Andhra Pradesh	Siddeswaram	150
	Srisailam	270
	Lower Sileru	300
	Lakshmipuram	310
	Polavaram	172
Kerala	Perumkulam	275
	Arakulam	180
	Chalakudi	148
Madras	Mettur Tunnel	200
Mysore	Barapole	140
	Aghanashini	210
	Kalinadi	646
	Bedtisonda	420
	Jaldurga	280

Broadly, the Super-Grid will embrace the principal hydro-stations and most efficient and large-size thermal stations in the region. The feeding points of the Super-Grid should be capable of absorbing (or exporting under seasonal conditions) loads of the order of 50 mW. Preliminary studies indicate that a transmission voltage higher than 220 kV may be necessary for the major portions of Super-Grid System for the southern region. The necessary studies and collection of data are on hand, and it might be possible to formulate detailed proposals during the Third Five-Year Plan period for implementation thereafter. There is no reason to doubt that the benefits which will flow from the integrated development of the power resources, backed by a Super-Grid transmission system will more than repay the capital investment.

Courtesy: INDIAN JOURNAL OF POWER AND RIVER VALLEY DEVELOPMENT



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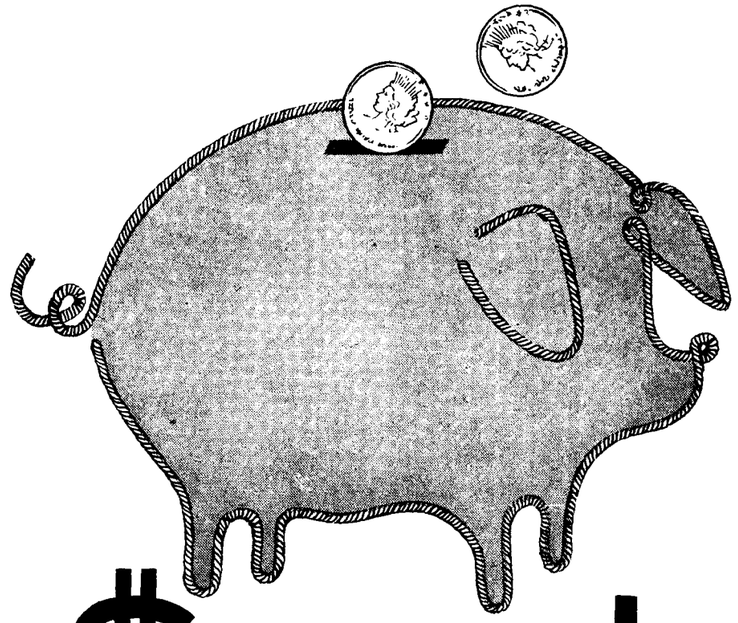

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