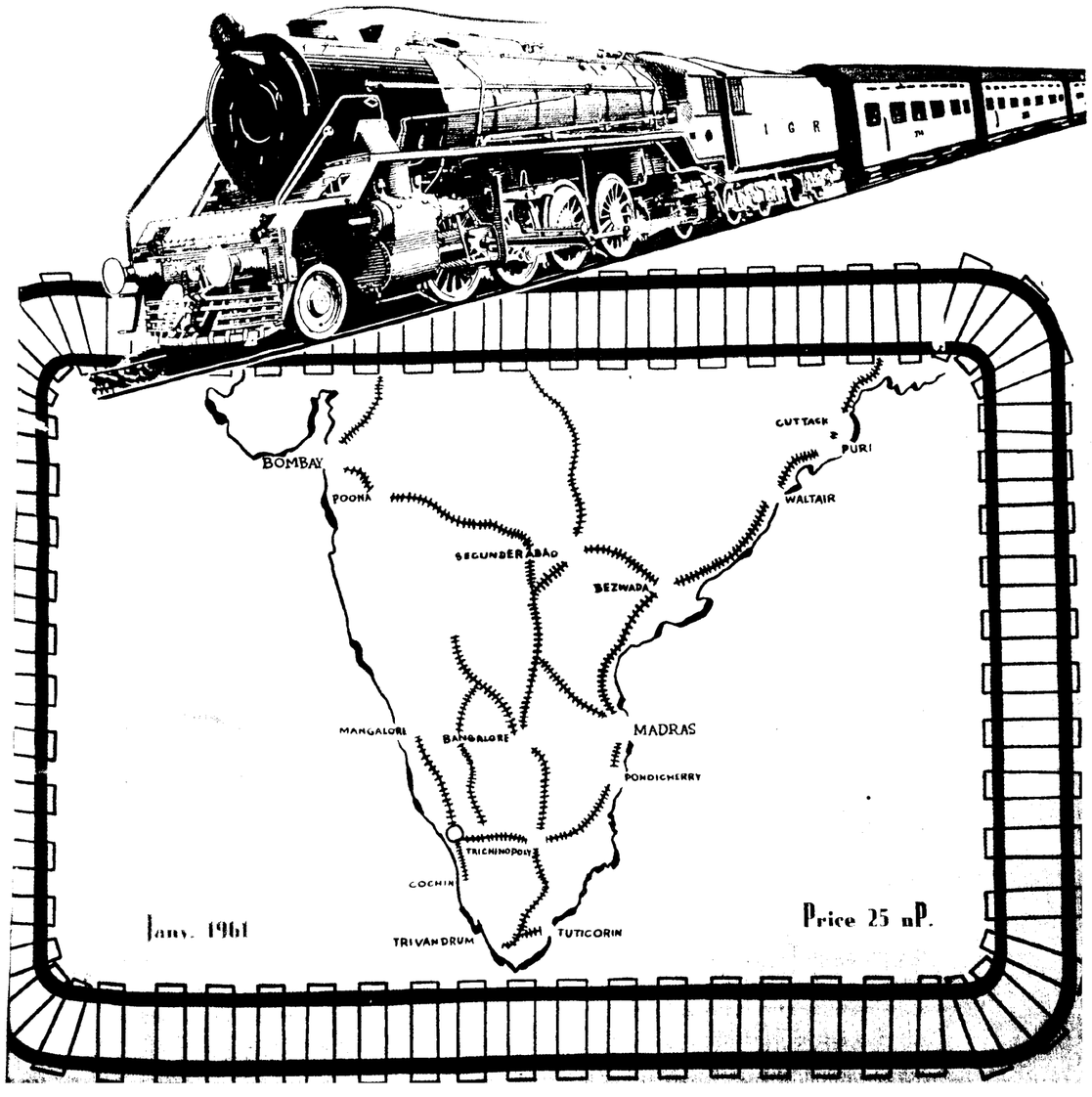
SOUTHERN RAILWAY

JANY — 1961

SOUTHERN RAILWAYS *Magazine*



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(Inserted in the interests of Travelling Public)

The Design and Development of Resilient Rail Mounting for Jointed and Long Welded Track

By O. H. Varga, M. Sc., A. M. I. Mech. E.

Great scope of systems employing rubber anchorage in all types of rail sleepers and rail foundations.

THE great success in recent years of resilient grip anchorage methods in concrete and other foundations for light and heavy industrial equipments by means of expanding sleeves of tough rubber and plastic materials, the Seetru Mounting Bolt being a particular example, has lead Seetru Ltd., of Bristol, England to undertake an extensive programme of design and development of rail mountings employing the same anchorage principle. The original purpose of this work was to provide a rail fastening for concrete sleepers, which are being used in ever increasing numbers all over the world, in which the inherent resilience of the fastening was to supply the essential degree of elasticity which is absent in concrete sleepers as compared with timber sleepers, and even steel sleepers. The work has lead to the establishment of a rail mounting principle, widely adaptable, and patented in many countries, which far beyond the original objective, is considered to provide a general solution for the many diverse requirements of technical performance and economy of installation and maintenance which a modern rail mounting system has to satisfy. The Seetru Rail Mounting principle is in fact applicable to every kind of rail foundation; concrete sleepers, timber sleepers and also steel sleepers, as well as to continuous concrete beds. One particular version of the system, the Wedge Clip Mounting has been designed to meet the very important special requirements of long welded track.

THE SEETRU RAIL MOUNTING PRINCIPLE

The Seetru principle is readily observed in the simple mounting employing steel sleeper type rail clips. This mounting was originally designed for 60 lb./yd. F. B. rail, but is applicable to other rail sections as well. A base plate is employed in one form or another in all rail fastenings according to the system, and is placed on the sleeper or other rail foundation with the interposition of a rubber pad. The base plate here is a simple forged steel slab with a centre portion sloping 1 : 20 to provide rail inclination when used on a horizontal sleeper surface. Where the sleeper surface is itself inclined, the base plate need only be plane. Two rectangular holes are pierced through the base plate on either side of the rail to allow the rail fixing bolts to pass through and to provide location and abutment for the tabs of the rail clips. The bolts are the so called Seetru Bolt 'M' type with threads uppermost, and it is to be noted that they perform the double function of tying the rail firmly to the base plate and anchoring the rail mounting assembly as a whole to the sleeper or rail foundation.

The shank of the bolt in the sleeper is surrounded by a tough rubber sleeve which in its uncompressed state can stop short of the bolthead, or may be moulded right over it. In any case, the bolt head is clear of the wall of the sleeper hole, and thus the rubber sleeves and the rubber pad between them effect complete mechanical and electrical insulation between the metal parts on the rail mounting and the sleeper. The bolt shank is seen to be formed with a shoulder which, when tightened, abuts against the bottom of the base plate, and thereby limits the amount of axial compression to which the rubber sleeve is subjected. This is a key feature of the Seetru principle and a number of important advantages flow from it. During the tightening down process, a positive stop is felt to the bolt movement when the abutment is reached, and the bolts is then given a final pull-up of arbitrary substantial force to tie the rail, base plate, bolts and clips firmly together into a comparatively rigid assembly. This assembly as a whole 'floats' in rubber, small vertical oscillations of the rail mounting relative to the sleeper being allowed under impact by deformation of the rubber pad and axial shear deformation of the rubber sleeves.

Above the shoulder the bolt is formed with a square on the shank where it passes through the base plate, and this prevents rotation.

The limitation of the compression of the rubber sleeve ensures that no excessive bursting stresses are set up in the sleeper, while the grip on the rail foot itself is in no way limited. The tightening down process is not subjected to any form of critical control and only requires straightforward robust hand pull-up. This is of obvious importance where there is little opportunity of long term training of large track laying gangs.

For economy of production the bolts are built up of two components, a stout forged shank with a head at the bottom and a female thread on the top, and a stud member with a central square to screw into the forged shank.

The firm "metal-to-metal" grip top and bottom of the rail foot ensures positive rail location, i. e. resistance against both creep and track gauge changes while the resilience of the mounting, as a whole, imparts to the track a great shock resistance. The freedom of the rail to undertake small undulatory movements relative to the sleepers is bound to reduce wear and abrasion of the sleepers, and disturbance of the ballast, and thereby to extend the maintenance free useful life of the track. This point is emphasised by the substantial track movements which are known to exist under moving trains, and which have been measured in the course of research work in Germany [1]. The elastic mounting of the rail reduces the accelerations which are imported to the sleeper, and therefore necessitates a comparatively gentle hold only in the sleeper, involving low stresses, while the location of the rail is assured by the firm, independent grip of the mounting on the rail foot.

The importance of the electrical insulation introduced by the rubber elements is obvious from the signalling point of view.

These results are achieved by the use of economical robust components and notably without the use of any carbon or alloy spring steel members.

DETAIL DEVELOPMENT OF COMPONENTS

The effectiveness of the Seetru Rail Mounting principle from both technical and endurance points of view has been established in the course of the last 6–7 years in extensive laboratory tests in Great Britain, Germany and Austria and on experimental tracks in Great Britain and Austria. It is clear that the principle of the system, i. e. rubber anchorage in the rail foundation and a statically separate 'hard' grip on the rail foot, can be achieved in a variety of ways with different types of components, and the work of the last 2 3 years has been devoted to establishing the best form of the various constructional elements of the system.

The limitation of the compression of the rubber sleeve is effected by a distance tube integral with, or spigoted into the nut member, and coming to rest against an abutment on the base plate after a predetermined compression travel.

It is the advantage of this arrangement that the thread is protected inside the sleeper, that the external contour of the fittings is very compact, and that standard industrial bolts can be used.

BOLTHEAD OR NUT CONTOUR MOULDED INTO RUBBER

The latest technique consist invariably of moulding (but not bonding) the rubber sleeve on to the metal part which it engages. Experiments carried out at the Civil Engineering Laboratory, Western Region, British Railways, by means of large Perspex models have shown that a special corrugated form of the bolt head or nut engages the rubber sleeve most smoothly, avoids localised high strains, and ensures ready extraction of the rubber sleeves after prolonged service, if so desired.

MOULDED FLANGES ON RUBBER SLEEVES

In the manufacturing cost of concrete sleepers the provisions which have to be made to take the rail fastenings play a very important part, and the plain cored through holes required for the resilient anchorages of the Seetru Mountings represent in fact the most economical provision of all the various methods under present consideration. To prevent the rubber sleeves from falling through the sleeper holes on assembly, they are often provided with moulded flanges on top, which can either be accommodated in moulded recesses in the rubber pads, or in shallow counterbores on the base plates.

RUBBER PADS

Pads of rubber or other resilient insulating material in one form or another are an essential part of the Seetru Rail Mounting System. Pads of numerous designs are being tried out at present in different parts of the world with the overall result that they are becoming more and more a standard part of the modern track. Again, the Civil Engineering Laboratory, Western Region, have constructed, according to a scheme of the authors, a comparatively simple

GOLDEN RULES OF CONDUCT FOR RAILWAYMEN

1. Do you plan your work daily? Get the more essential things done first and do not neglect the important ones sidetracting them to the fag end of the day.

2. Do not express casually careless opinion. Never venture forth an opinion unless asked for it.

3. Remember that most of our mental worries come either from trying to fight life hard or from trying to run away from life. Do neither.

4. Learn to accept people as they are, love them, respect them, praise them, encourage them, differ with them, but above all, learn the priceless art of give and take.

5. Cry neither for the moon, nor over spilt milk.

6. Accept the things that you cannot change; have the courage to change the things that you can, and possess the wisdom to know the difference.

7. Do not drive too hard a bargain with yourself.

8. Accept life as it is—its wonders, changes, disappointments, frustrations etc., etc.

endurance testing machine for resilient track pads for the rapid evaluation of their long term service performance.

Also, the strides being made at present in rubber and polymer science ensure that satisfactory materials can be compounded for long service track pads in tropical countries.

THE WEDGE CLIP RAIL MOUNTING

While of general validity, it has been particularly developed for use with long welded track, the introduction of which represents one of the great advances of modern track engineering. Both theoretical analyses [2], as well as comprehensive scientific tests carried out at the Civil Engineering La oratory, Western Region, have established a high torsional stiffness about a vertical axis to be one of the crucial requirements for a satisfactory rail mounting to be used in such track. The Wedge Clip Mounting possesses this property to a higher degree than any other.

While employing a resilient pad and sleeve as before, the rail foot is held in a powerful wedge grip between the sloping edges of the cast iron base plate and a long malleable cast iron wedge. There are thus no clearances whatever between the rail foot and the lateral faces of the base plate, and any torque about a vertical axis applied to the rail, is at once resisted resiliently by the sleeves in the sleeper, without any rotational rail slip, however minute. Also, for a given bolt load, the grip against creep exerted on the rail foot is more powerful than with any other system.

The distance tube inside the rubber sleeves enter and abut in jig drilled counterbores in the base plates.

SEETRU RAIL MOUNTINGS ON CONTINUOUS CONCRETE BASE

The principle of expanding resilient grip anchorage in concrete holes offers a reliable method of laying track direct on a continuous concrete bed. Apart from harbours, jetties, factory yards and bridges etc., this is of particular value in tunnels where the elimination of ballast reduces the headroom requirements. This can result in a very great saving in the cutting of new tunnels, while in existing tunnels it may make possible the introduction of overhead electrification for which there would be insufficient space otherwise.

Rubber pads lying direct on the concrete surface provide the essential resilience of the track, while two resilient anchorage sleeves are placed into drilled holes in the concrete surface. Rotary percussion pneumatic rock drills are used for this purpose in conjunction with vacuum disposal of the concrete dust. It has been found that a team of four men can drill 28 holes per hour, which is, of course, equivalent to seven sleeper positions.

A special base plate design is available which allows shimming up the rails by varying amounts to compensate for any irregularity of the concrete surface.

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Civil Engineering and Public Works Review. No. 639. Volume No. 54. October, 1959.

HUNGARIAN MINERS BEAT PRODUCTION PLAN

Hungarian coal miners overfulfilled their production plan by 2.4 per cent in the first six months of this year, Mr. Bela Biaha, General Secretary of the Mineworkers Union told the union's annual conference in Budapest. Other sections of mining also beat the planned figures—mineral mining by 17 per cent and ore mining by 9.5 per cent. Oil production beat the plan by 1.7 per cent. It was aimed to produce 4,100,000 tons more coal and 200,000 tons more oil than this year.

ALUMINIUM IN STEEL

By A Special Correspondent

ALUMINIUM in used in steel for two quite different reasons. On the one hand because of its high affinity for oxygen it is used as a "deoxidizer" for the molten steel during the deoxidation period following the oxidation refining period. On the other hand it is used as an alloying element which affects the properties of the steel to which it is added.

ALUMINIUM IN STEELMAKING

We know that steelmaking commences with a period of so-called refining treatment, the object of which is to rid the bath of oxidizable impurities introduced via the raw materials. At the end of this period, oxygen is left in the metal partly in solution and partly in the form of refractory inclusions.

If the molten steel were allowed to cool in this oxidized state, the shift of equilibrium occasioned by the drop in temperature would give rise to the evolution of copious volumes of carbon monoxide, sufficient to expel the liquid from the mould. Moreover, the density of the ingot would be low, with numerous blow-holes arising from gas bubbles which had been unable to reach the free surface of the liquid before being locked in by solidification. Again, the presence of numerous oxide inclusions would render the steel impossible to forge without cracking. It is thus essential to deoxidize to molten steel in a second operation, following removal of the slag formed during the oxidation period.

This "deoxidation" is not actually a direct removal of oxygen atoms from the steel bath; this could only be achieved by adding an element which forms a gaseous compound with oxygen, such as carbon, or by using vacuum, a process which is rapidly expanding in the manufacture of fine steels. This "deoxidation", in current processes, consists on the one hand in combining the dissolved oxygen with elements capable of forming with it compounds which are less harmful than iron oxide, and on the other in transforming existing iron oxide into other oxide compounds the presence of which is less unfavorable to the properties of the steel. The treatment must be carried out in such a way that the deoxidation products can rise to the bath surface and enter the slag, so as to leave in the steel only a minimum of inclusions.

The elements most used at present are silicon and manganese. Aluminium has a greater deoxidizing power than aluminium, particularly in the presence of manganese, but whereas silicon and manganese both combine with oxygen to form molten compounds capable of rising to the surface, aluminium forms extremely fine particles of solid alumina, which remain practically stationary and form inclusions. Thus, aluminium is only employed as ladle or ingot-mould additions, after additions of manganese and silicon have already effected the bulk of the deoxidation. Such additions of aluminium, which are made gradually, make it possible to obtain a denser steel with fewer gas cavities or completely devoid of all gas evolution. Aluminium is often called a "sedative".

The well-known phenomenon of the ageing of mild steel involving changes in the apparent yield point, has a number of practical drawbacks; in particular, rimming steel sheets used for deep drawing applications are liable to ageing during storage. This is due to the presence of nitrogen in the steel. One remedy consists in adding aluminium in small quantities of the order of 4 to 8 lbs. per ton of steel. The steel is thus killed and rendered immune from ageing.

However, this is not entirely satisfactory, since when aluminium-killed sheet are deep-drawn they do not give such a good surface finish as rimming steel sheets. This observation has led to aluminium being replaced by vanadium, which since it also has a high affinity for nitrogen, also suppresses ageing but since it has a much less pronounced killing effect than aluminium makes it possible to produce a non-ageing rimming steel.

ALUMINIUM AS AN IMPURITY

Scrap can introduce aluminium into steel; it may be part of the scrap composition or it may originate from aluminium oxidized when the steel was made. We have just seen, moreover, that when steel is killed by means of aluminium extremely fine alumina particles are formed in the metal bath.

These inclusions affect the properties of the metal. They reduce the transverse properties of the forged or rolled steel. Since the presence of aluminium in a steel reduces its grain size, this element has a harmful effect on the creep of ordinary steels under load at elevated temperatures. Creep is also adversely affected by the effects of spheroidizing the cementite and of graphitization, the latter considerably reducing hot strength. Accidents have occurred with superheater tubes made from aluminium-killed steel. This harmful effect on hot mechanical properties is much less pronounced in the presence of silicon, manganese and molybdenum. These drawbacks must be borne in mind in discussing the useful aspects of aluminium additions, some of which have already been described, and to which we now return.

ALUMINIUM AS A GRAIN-REFINER

We know that when steel is heated above the Ac_3 transformation point, the austenite grain size increases with increasing temperature and heating time. This grain growth, although useful in moderation since it increases hardenability, also has the disadvantage that it causes embrittlement. Depending on the service conditions to be encountered, it may be required to produce moderately course grain in order to increase the depth of quenching or to maintain the minimum grain size to minimize embrittlement. There is therefore an advantage in being able at will to make casts which give a fairly coarse grain without excessive heating or casts which are highly resistant to grain growth.

Now the addition of aluminium makes it possible to regulate the grain size of a steel, or in English parlance to "control" the grain size.

In this way "grain-size-controlled" steel can be made.

Aluminium is capable of combining in steel, with oxygen to form alumina inclusions (Al_2O_3) and with nitrogen to form aluminium nitride inclusions (AlN). Depending on the oxygen and nitrogen contents of the steel, it will contain these two types of inclusions, and if there is excess aluminium this will remain in solid solution. Recent investigations by Jacques *Pomey* and Gilbert *Vigneron* have confirmed earlier hypotheses to the effect that it is only the aluminium nitride AlN which affects grain growth; neither dissolved aluminium nor alumina have the same effect. The hindrance to grain growth is a maximum when the nitride is fine and uniformly distributed.

The addition of small quantities of aluminium to steel, by producing a fine grain size, promotes resistance to welding cracking.

ALUMINIUM AS AN ALLOYING ELEMENT

We have seen that aluminium readily combines with oxygen to form alumina and with nitrogen to form nitrides. These properties are utilized in various types of steel, in the formation of nitrides for the surface hardening of the steel by nitriding, for the through precipitation-hardening of the steel, or for improving its scaling resistance by the formation of a protective film of alumina.

ALUMINIUM-BEARING NITRIDING STEELS

A recent article on the role of nitrogen in steel showed that it is possible to produce a very high surface hardness in certain types of steel by the action of a stream of ammonia at around 525°C. The steel composition must be such that it forms a surface layer of nitrides, of very high hardness and highly adherent.

Iron can form nitrides, but the action of nitrogen on carbon, steel extends inwards and the surface layer is very brittle. To produce usable steels it is essential to introduce alloying elements which limit the penetration of the nitrogen and reduce the brittleness of the nitrided layer; the most successful of these are chromium and aluminium. Aluminium nitride is stable to about 1 100°C, whereas the chromium nitride is only stable to about 900°C. Apart from this, molybdenum additions make it possible to supress temper brittleness which, without molybdenum, would be unpleasantly in evidence since the nitriding process involves very prolonged holding at around 525°C in an ammonia atmosphere; this temperature is in fact within the sensitivity range for temper embrittlement.

Nitriding steels are alloyed with chromium (about 1.5%), aluminium (from 0.45 to 1.3% depending on the grade) the molybdenum (around 0.35%).

PRECIPITATION HARDENING BY ADDITIONS OF ALUMINIUM

When an element which is in solid solution in a matrix phase at elevated temperatures precipitates on lowering the temperature, either as the element or as a compound with some other dissolved element or the base metal itself, it is possible to heat treat the alloy so as to obtain a hardening effect due to the

distribution of fine precipitate particles in the matrix. This treatment comprises first a solution treatment, involving heating to a sufficiently high temperature, followed by rapid cooling to prevent precipitation from occurring. The result is a solid solution unstable at room temperature, the breakdown of which is only prevented by the extreme slowness of the diffusion processes in the matrix which are required to form the precipitate particles. The alloy is then heated to a temperature sufficient to speed up this breakdown, thus bringing about the required hardening effect.

Two examples can be given of well-known materials which utilize this mechanism. Duralumin is a precipitation-hardened light alloy. The secondary hardening produced in high-speed steel on tempering after quenching is largely due to carbide precipitation at the tempering temperature.

Aluminium is one of the elements which can give rise to precipitation hardening effects.

PRECIPITATION-HARDENING NITRIDING STEEL

The addition of nickel to an aluminium-bearing nitriding steel of the type discussed above gives components of higher core strength than in the steel without nickel, by reason of hardening produced by precipitation of an aluminium-nickel compound.

There is an American steel, containing 0.2%C, 1.1%Cr, 1%Al, 0.25% Mo and 3.5% Ni, which after nitriding for 48 hours at 525°C has a tensile strength in the core of 80kg/mm², whereas in the absence of nickel the value is only 60 kg/mm². In accordance with what has been said above, quenching takes all the elements into solution and prolonged holding at 525°C causes precipitation hardening.

It should be pointed out that the nitrided case on this steel is somewhat less hard but also less brittle than in the absence of nickel.

PRECIPITATION-HARDENING HEAT-RESISTING STEELS

The addition of aluminium to nickel-base alloys produces hardening by precipitation of a fine and uniformly distributed intermetallic compound.

It was in France, in 1935, at the *Imphy* steel works, that Pierre *Chevenard* showed that simultaneous additions of aluminium and titanium increased the hot strength of austenitic heat-resisting steel of the 35% Ni—11%Cr type (A. T. V. steel, thus forming A. T. V. S. steel). This hot hardening process has become practically universal for nickel-base alloys, which are used in particular for gas-turbine blades and other components subjected to mechanical loads at high temperatures. The aluminium content varies between 0.5 and 3%, together with titanium in the same range. To produce the required precipitate distribution, one must start by taking the various alloys into solution in the austenite matrix, by heating to high temperatures in the range 1 050—1 150°C, followed by air-cooling, which is sufficient for all but the largest components to prevent any precipitation. The hardening precipitation is then produced by ageing for several hours at 700°C.

The hardening precipitates formed by aluminium comprise the intermetallic compound Ni Al. Optimum strength coincides with the formation of this compound, as can be demonstrated by examination under the electron microscope.

ALUMINIUM VERSUS CERTAIN TYPES OF CORROSION

Some additions of oxidizable elements have the paradoxical effect of preventing oxidation in steel. If the oxide of the element has a higher density than that of the steel itself, there will be formed on the steel surface under the action of an external oxidizing medium a layer of oxide which will be put in tension by contact with the metal and will either crack or become detached, leaving the metal surface exposed to the medium. If on the other hand, the volume of the oxide formed is greater than that of the metal producing it, i. e., if the density of the oxide is less than that of the steel, and if in addition the compressive strength of the oxide is adequate, there will be formed on the steel surface a sound layer of oxide which is impervious to the oxidizing gas and thus protective. Oxidation of the metal will be arrested.

Aluminium fulfils these conditions for protection against continued oxidation. It has thus been used to increase the scaling resistance of steel.

Simultaneous additions of chromium and aluminium to steel give rise to alloys with very high resistance at

extremely high temperatures. Particular reference can be made of ferrous alloys containing 20% Cr. and 5% Al. or 30% Cr. and 5% Al, which are used to manufacture resistance elements for electric heaters used up to 1 250 and 1 300°C respectively.

These alloys have a high electrical resistivity, of the order of 130 to 140 microhm/cm²/cm, practically constant up to about 1 300°C, which is an excellent property in heater resistance wires.

The improved scaling resistance of this type of alloy at elevated temperatures, compared with Fe-Ni-Cr or Ni-Cr alloys, is unfortunately offset by extreme brittleness after prolonged service above 900°C. The reason for this is that the high chromium and aluminium contents suppress the allotropic transformations of steel; the alloys remain ferritic to melting point, so that it is impossible to prevent grain growth, culminating in the extreme embrittlement of the material. The handling of these wires after they have been in service for some time requires every precaution being taken.

A further drawback in this type of alloy is its low mechanical strength at elevated temperatures, which is such that the wires must be supported to prevent stretching under their own weight.

Moreover, contact between the protective oxide film and any siliceous refractories is harmful to the elements; if they are to be used in contact with furnace refractories, the latter must be of the alumina-base type. This type of alloy has a very good resistance to hydrogen sulphide.

Certain fuels and petrols contain vanadium pentoxide, which is extremely aggressive at combustion temperatures; the addition of aluminium to a stainless steel renders it resistant to this type of corrosion. A 23% Cr.—10% Al steel has twice the resistance of an austenitic 25 Cr—20 Ni steel.

To economize in the "strategic elements" nickel and cobalt, use has been made in the U.S.A. of an Fe-Al-Mo alloy containing 16% Al and 3% Mo; this alloy has a good high-temperature oxidation resistance and quite good hot strength properties.

These high-aluminium alloys are difficult to make by ordinary methods. Vacuum steel-making, which is expanding rapidly, greatly facilitates their manufacture.

The addition of aluminium to low-alloy steels confers resistance to certain types of chemical corrosion, as demonstrated by *E. Herzog* in his thesis.

Addition in small quantities to a 4% Cr. steel improves its resistance to marine atmospheres, as regards general corrosion and pinpoint corrosion.

The addition of small amounts of aluminium to low-alloy Cr-Mo steels improves their resistance to H_2S. This finding led to the discovery of *Pompey* steel, used for the tubework at *Lacq*, where the hot gases contain large amounts of H_2S and are very aggressive.

MAGNET STEELS OF THE Fe-Ni-Al TYPE

In 1932 it was discovered by the Japanese worker *Mishima* that additions to iron of between 15 and 35% nickel and between 8 and 15% aluminium greatly increased the coercivity (to 600 oersted against around 75 for the classical 6% tungsten magnet steels); the remanence remained at useful levels (5,000 to 8,000 gauss).

The high coercivity of this type of alloy was found to be due to the presence in the ferritic matrix of particles of an ordered phase, designated x', and containing Ni and Al. In general, any structural heterogeneity or machanical heterogeneity produced by stresses will cause an increase in coercivity, the minimum value for any alloy being reached when it is in the most homogeneous condition possible. In any case, it had already been observed with the old 6% tungsten magnet steels that an increase in the quenching temperature, by increasing the amount of residual austenite (non-magnetic phase) increased the coercivity.

The extremely high coercivity of the Fe-Ni-Al alloys would thus be due to the stresses set up by the difference in specific volume between the two phases x and x'.

The heat treatment of this type of alloy, like that for precipitation hardening, involves heating to high temperatures (around 1 150°C), followed by quenching to produce a solid solution of low coercivity; subsequent heating for long times at an intermediate temperature (around 500°C) produces the high-coercivity structure.

The modern magnet alloys of this type also contain additions of cobalt, titanium and copper.

ALUMINIUM AS A FERRITE-FORMER

Ferrite-former is the name given to an element which tends to favour the presence of the low-tempera ture body-centred cubic alpha form of iron and to oppose the formation of the high temperature face-centred cubic structure, so that a sufficient content of such an element will entirely suppress any allotropic transformations in the iron up to the melting point. This effect is produced in the low-carbon high-chromium steels in particular, which are known for this reason as "ferritic steels". Aluminium is an alloying element of this type; above 1% of aluminium, the Fe-Al alloys are ferritic up to the melting point. The addition of austenite stabilizers (carbon and nickel in particular) opposes this tendency and thus increases the amount of ferrite-former required to suppress transformation.

This property of aluminium is utilized in certain stainless chromium steels to prevent the hardening which may at times prove troublesome, particularly in welding, where air cooling may give rise to cracking. This effect can be obtained in a steel with 0.15%C and 13.5%Cr, by adding 0.1 to 0.3%Al.

[Courtesy: "Les Aciers Fins & Speciaux Francais"]

India on the threshold of Steel Revolution

India's determination to achieve a production target of 6 million tons of steel ingots by the end of 1961 was described as 'courageous' by some pessimists at home and abroad. But the determination has been crowned with success belying all echoes of alarms. All the three new steel plants were commissioned during 1959 and it can be safely predicted that a capacity of 6 million tons of ingots would have been created by the end of the Second Five-Year Plan in 1961. Considerable expansion programme of the existing steel plants at Jamshedpur, Burnpur and Bhadravati was also completed in 1959.

A large reserve of trained personnel is being created to man the plants. The expansion of the steel processing industry is receiving due attention. India is also adopting recently developed techniques such as high top pressure operation in blast furnaces and sintering for increasing production.

A new plant to manufacture tool and alloy steels will also be set up at an early date.

The Government of India have taken steps to encourage the development of small iron, steel and re-rolling units in the country simultaneously with the establishment of large integrated steel works. More than 20 scrap-based electric furnaces were working so far. A solid foundation has thus been laid for rapid industrial advancement in the country.

The blast furnaces that started production in 1959 produced 1.5 million tons of pig iron upto October 1960. More than 100,000 tons of pig iron has already been exported.

Eight firms have been licensed for setting up small pig iron plants. Of these, two—one at Coimbatore in Madras State and the other at Barbil in Orissa State—have gone into production.

In view of the necessity to plan for a further capacity of 200,000 tons to 500,000 tons of pig iron to be able to meet the requirements by the end of the Third Five-Year Plan, Government has decided to revise its earlier decision and to license pig iron plants to a capacity of about 100,000 tons a year each.

As a result of increased production, larger supplies of billets were available to the re-rolling industry, which stepped up production from about 680,000 tons in 1959 to 572,000 tons (upto August) in 1960.

A still higher target of 10 million tons of steel ingots has been envisaged in 1965 by the expansion programmes of the existing steel works and by setting up a new steel plant at Bokaro in Bihar.

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HUNGARIAN MINERS BEAT PRODUCTION PLAN

Hungarian coal miners overfulfilled their production plan by 2.4 per cent in the first six months of 1960 Mr. Bela Blaha, General Secretary of the Mineworkers Union told the union's annual conference in Budapest. Other sections of mining also beat the planned figures —mineral mining by 17 per cent and ore mining by 9.5 per cent. Oil production beat the plan by 1.7 per cent. It was aimed to produce 4,100,000 tons more coal and 200,000 tons more oil than 1960.

confers resistance to certain ...

CZECHOSLOVAK TRANSPORT

To an advanced industrial country such as Czechoslovakia, transport is of vital importance. The rate of Czechoslovakia's economic growth imposes a rising load on the country's transport system, especially on freight and passenger transport both by road and rail, which increases from year to year. It suffices to state that overall industrial output has grown by more than 300% during the past 10 years; moreover, in the sector of heavy industry, where the demand on transport facilities is particularly heavy, output grew as much as three-and-a-half times during the period cited. Understandably enough, the task of adjusting the transport services to meet these requirements has not been an easy one. In comparison with 1948, the rail, road, and shipping services carried 260% more freight /reckoned in tons/ in 1959, while the number of passengers in trains and state-controlled bus services grew almost two and a half times during the same period.

This dramatic growth of transport output was made possible by the systematic guidance applied under the State plan to the development of all transport services, which was governed by the principle that each service should be assigned those tasks which it could master most economically. The necessary pre-requisites for purposeful direction and control of the transport system on such a comprehensive scale were created by the nationalization of all public means of transport in 1948.

The backbone of the Czechoslovak transport system are the railways. A railway network of considerable density and relatively even distribution ensures suitable connection between all important economic centres. The total operational length of the railways is 13,125 km, i.e., there are 100 km of rail track per each 1000 sq. km. of territory. In freight transport, the railways at present account for more than nine-tenths of the total transport volume in terms of ton/kilometres, and for 60.5% in terms of tons carried. Cargoes sent by rail are predominantly long-distance bulk goods. The greatest intensity in goods traffic is in the east-westerly direction, a circumstance arising out of the elongated shape of the country and from the distribution of raw material sources and industrial centres.

In terms of railroad output, Czechoslovakia has moved up into the ranks of the most highly advanced states in the world. Of particular significance in this respect is the high traffic intensity—i.e. the degree of exploitation of the traffic capacity of the line—in Czechoslovakia. Thus, to give only one example, the intensity of train traffic on the Praha-Česká Třebová line is among the highest, if not the highest, in the world. Again, the average weight of goods trains in Czechoslovakia testifies to the economical use made of rolling stock by the Czechoslovak railways. In the past year, the average gross weight of freight trains was 979 tons, of transit goods trains 1200 tons, and of electric trains as much as 1439 tons. Peak loads are often higher, trains of over 2000 tons being no exception.

As regards passenger traffic, the average number of train journeys per citizen of Czechoslovakia is about 46 each year. Fares, moreover, are very low, and over two-thirds of passengers avail themselves of the benefits of reduced workers' or students' tickets. A feature introduced by Czechoslovak Railways, which is unique in the world, are the passengers' cultural centres which have been established at 120 of the most important railway stations.

In terms of economic significance, the public road transport service is second only to the railroads. With the sole exception of urban services, road transport is operated exclusively by the national corporation known as the Czechoslovak automobile Transport Service /ČSAD/. In the past year, this organisation's road haulage output was 115 million tons of freight, the average hauling distance being around 17 km. Aside from the ČSAD system, freight haulage is effected also by the trucks of production enterprises, though this concerns for the most part short-distance haulage for technical purposes rather than commercial transport. In tons carried, this form of factory haulage accounts for about twice the amount carried by ČSAD trucks. All freight haulage by road in the Czechoslovak Republic is controlled by so-called road transport direction centres which are distributed evenly throughout the territory of the state. The most important task of these centres is to ensure that vehicles carry two-ways loads on all trips exceeding 50 km.

A very dense network of bus services provides connections among practically all towns and villages in

Czechoslovakia. With an annual passenger total of more than a milliard persons, the bus services represents the most widely used form of public transport. Last year, the total number of passengers carried by ČSAD buses exceeded that of the railways by 430 million persons.

Not the least important section of the Czechoslovak transport system is river transport. Even though the proportion of goods carried by river boats accounts for less than one per cent of the national freight total in tons, and for about 4% in ton/kilometres, the waterways are of considerable importance especially in regard to Czechoslovakia's foreign trade. There is a fairly sharp differentiation as to the character of goods carried along the various waterways: raw materials are imported into Czechoslovakia via the Danube, while the Elbe, Vltava, and Oder serve the export of finished products to the ports of Hamburg and Stettin. Passenger traffic by river boats, on the other hand, is of subsidiary significance, in the main only a matter of pleasure trips in the immediate surroundings of the capital.

Following a temporary period of stagnation between 1949 and 1954, caused by the policy of discrimination carried out by a certain western state, air transport has advanced rapidly in recent years. Czechoslovak Airlines planes now connect almost all the capitals of Europe, and fly as far afield as Egypt and India, with the opening of more long-distance routes planned in the course of this year. Czechoslovak Airlines /ČSA/ were the second airline in the world to introduce scheduled services provided entirely with jet planes. During recent months the Czechoslovak fleet of passenger planes has been further enlarged by the introduction of the four-engined IL-18. This year's passenger total carried by Czechoslovak airplanes flying under the code letters OK will attain the figure of 680,000, or almost seven times as much as in 1948.

In addition to scheduled airline services, wide use is being made of non-scheduled, so-called aerotaxi flights. The Czechoslovak Super Aero and Morava L 200 aircraft for several passengers make daily trips between some hundred airfields throughout the country.

The most recent branch of the Czechoslovak civil air services is the use of aircraft for fertilizing crops and combating pests from the air. In the current year, the planes of the Agrolet corporation are to care for 600,000 hectares of land. Airplanes have recently been introduced also into geological survey work.

In the coming years a substantial increase is foreseen in the output of all branches of the transport system both as regards freight traffic and expansion of passenger services. The Third Five-Year Plan for the advances of Czechoslovakia's economy specifies targets for the transport services which include the attaining of a freight output by the public freight haulage service of 484 million tons, and 66.5 milliard ton/kilometres by 1965. The railways and public bus services are to carry a total of almost 2 milliard passengers.

In order to make possible the most efficient and economical fulfilment of these targets, high priority is to be given to the rapid completion of technical reconstruction in all branches of the transport system.

In rail transport, there is to be a decisive increase in the number of electric and diesel-electric locomotives available, and the electrification of main lines is to be completed so that by 1965 electric traction will account for 5% of the total rail transport volume and diesel-electric traction for 23%. On a number of main lines the permanent way will be reconstructed so as to carry increased axle loads and automatic security facilities will be introduced in stations and along the line.

The output and quality of road transport will be favourably affected by the expansion of the fleet of vehicles and substantial increases in the number of bus trailers. The total length of dust-free road surface will be doubled, and the first section of a national motor highway, cutting across the territory of the state from Prague to the eastern frontier and linking up with the international highway system, is scheduled for completion.

The river fleet is to be augmented by new motor-driven freight boats for the purpose of increasing the proportion of the motorized boat capacity to 25%. Steam-driven vessels are to be almost entirely withdrawn from freight haulage. The length of navigable waterways is to be extended and navigation conditions improved as a result of the planned completion of new dams on the rivers Vltava, Elbe, and the Vah in Slovakia.

Modernization and technical reconstruction in the sector of air transport are to comprise the completion of the new runway system and air terminal control buildings already under construction at Praha airport, as well as the construction of other important airfields. The Czechoslovak airlines fleet will be augmented by several dozen new aircraft, including long-distance airplanes of large passenger capacity.

SCHAERER—LATHES

By An Engineering Correspondent

SCHAERER-Lathes are built since about 60 years. Today the programme includes Universal Lathes, Production Lathes with automatic working process, Semi-Automatic Copying Lathes, and special attachments for non-circular copying, particularly glass-molds and cam-shafts of Diesel-Engines and similar machines.

The special feature of the SCHAERER-Lathe are the underslang saddle guideways, arranged in such a way that they are well protected against damage by swarf. Their Vee shape guarantees that a permanent oil film is maintained. This ensures a long life for guideways and extra-ordinary resistance against warping. If high pretensions are made, these guideways even may be supplied as hard-chrome steel gibs.

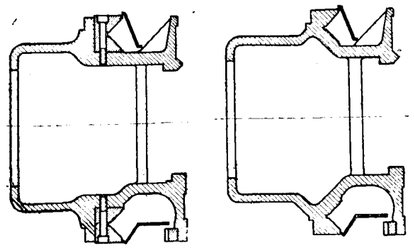
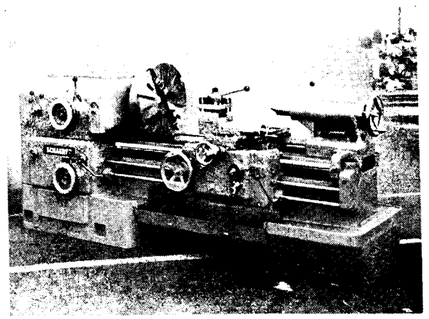
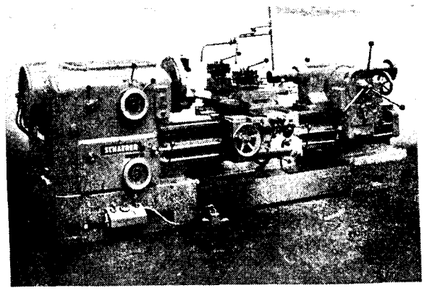


Illustration of SCHAERER-Guideways. At the top normal execution, at the bottom hard-chrome gibs.

Furthermore the SCHAERER-Lathes are characterised by their large drive capacity in comparison to the height of centres, by their important speed range (universal lathe = 1 : 200), and by their various special equipments. Regarding the SCHAERER Lathe Programme, it's easily possible to choose production lathes being particularly economic and suitable for special operations. As to the universal cutting, the SCHAERER Universal Lathe is fitted with all equipments, capable to execute a great range of work. As shown on the photos, the machines possess but some control elements in order to facilitate their operation. The quick change control lever is used for the rapid setting of all standard metric, inch and module threads as well as for the feeds. Settings can be read instantaneously from the control drum. Neither tables nor calculations for machine regulation are necessary.



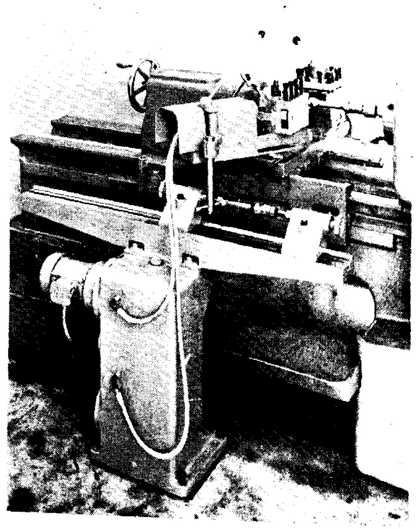
SCHAERER-Lathe in standard execution, centre height 320 mm. drive capacity 20 to 30 H.P.



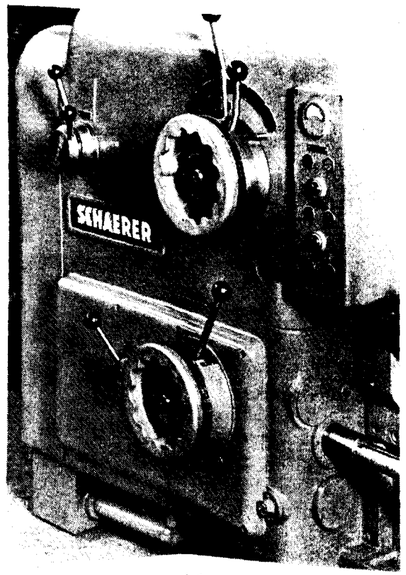
SCHAERER-Lathe, 320 mm. centre height, with twin slide and one independent front and rear cross slide, boring tailstock, and pneumatic chucking attachment.

Today SCHAERER-Lathes are installed in leading factories throughout the world, where high precision and great cutting capacity is required.

The Hydraulic Copying Unit "SCHAERER-PROFILE D9", suitable for fitting to lathes of all



Copying Unit " SCHAERER-PROFILE D 9 " suitable for fitting to lathes of different types.



View of main drive and feed box. Setting of speed, feeds, and threads by hand wheels.

types, is remarkable, too. This copying unit distinguishes itself by its high accuracy. In all cases, where special copying lathes will not pay—because of the low output capacity—SCHAERER-Lathes with hydraulic copying attachment are prefered.

The blocks illustrated will give an impression of large manufacturing programme and the variety of application possibilities of SCHAERER-Lathes. They are well-known in the whole world.

PELS Straight Sided Crank Presses

Satisfy all claims for technical perfection. They are built in three different series, i. e.

type PIKs mainly for stamping, cutting, and shearing purposes, of small operational capacity and high speed,

type PIK for a wide range of operations and small table area,

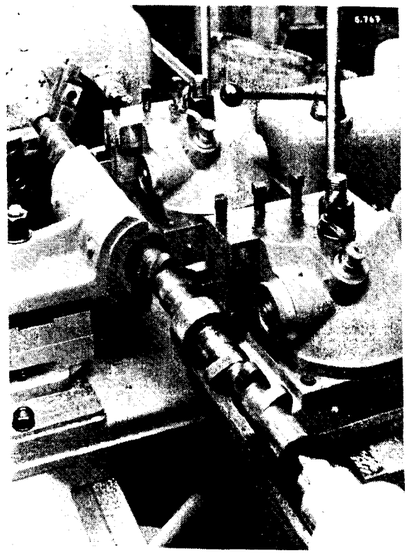
type P2K for a wide range of operations and big table area, for press powers of from 100 or 125 tons respectively up to about 1000 tons.

Presses of types PIK and PIKs have single point suspension, those of type P2K double point suspension.

The press frame consists of bed, header, and uprights fabricated of heavy steel plate and stress relieved after welding. These components are joint by welding to form a single-piece body, or, in the case of presses above 250 tons and with large table area, by preloaded steel tie rods. The boxshaped components are properly stiffened by ribbings to increase their strength against dynamic stresses. Both the uprights are made of folded plate sections with welded-on tension plates and allow to provide openings to make the tooling accessible from 4 sides.

The ram slide is also welded of heavy steel plate and its boxlike shape stiffened by adequate ribbings. It is guided by long adjustable prismatic gibs along the 4 inside borders of the uprights. The vee gibs of the small size crank presses are abjustable and fitted to the ram slide, while those of the bigger size presses are mounted to the uprights. The adjustable gibs are armed with plastic foil, the

opposite ones of special quality cast iron. The weight of the ram slide and partly that of the tooling is balanced by compressed air cylinders. A reversible electric motor actuates the ram slide adjustment transmitting its power through a gear to one or two threaded spindles which are guided in cylinders. Accordingly, only axial pressure stress is put on these spindles. The ram slide adjustment way is limited in



Copying of cams of a Diesel engine camshaft with 2 hydraulic copying slides.

both directions by limit switches. In case the ram sets on tool parts during the adjustment operation, the drive of the regulating gear will be automatically stopped by a safety device.

To protect the tooling and to safeguard the press against overload, an oilhydraulic overload safety device can be fitted. A pressure pad below the small ends of the connecting rod can be adjusted by preloading to any desired load within the admissible range of pressing force. A pilot lamp mounted on the control panel flashes immediately the adjusted press power has been reached. When the predetermined pressing force has been exceeded by 20%, the overload security cuts off the press automatically.

In case overloading takes place within the range of before 40° before lower dead center, the press drive will be automatically declutched. The ram slide is then to be brought to top position in the reverse direction. Will the press, however, be overloaded in a position closer to the lower dead center, the crank drive will continue its way through the bottom center with blocked ram slide. Only during the return of the connecting rod, the ram slide will again be carried along and stopped in the topmost position.

Sometimes, a mechanical overload security in the place of the hydraulic one may be sufficient. It works on the principle of measuring the elongation of the press frame or of two tie rods diagonally opposite to one another.

The press is fitted with a detachable bolster plate, which will get Tee slots for tool fixing. In accordance with conception adopted on principle for all PELS Straight Sided Crank Presses, the press has cross shaft drive. The crankshaft liable to bending and breakage, has been omitted. In its place, gear wheels with cast-on eccentric hubs running on fixed wheel pins in closely mounted gearings form the crank drive.

The complete drive is arranged inside the head of the press. The flywheel and the first driving shaft run in roller bearings, all the high speed wheels have helical gearing assuring an almost noiseless operation of the complete drive. By mounting the flywheel on a hollow shaft bearing flanged to the press body, the driving shaft rotating inside the hollow shaft bearing is completely relieved from flywheel weight and belt pull.

The single disk friction clutch has given full satisfaction for a good number of years. It is electromagnetically controlled and actuated by compressed air. The friction blocks can be exchanged without any considerable dismantling work. Also, the single disk friction brake is electromagnetically controlled, released by compressed air and rapidly and dependably engaged by spring pressure. It is designed for very high operating frequencies, the renewal of the friction blocks takes little time.

The press is controlled by an electromagnetic two-hand safety engaging gear. A selector switch allows three settings :

1. *inching*,

   by pressing down the push button, the ram slide can be moved up or down over short bits of the stroke, the ram remains in motion as long as the key is kept pressed.

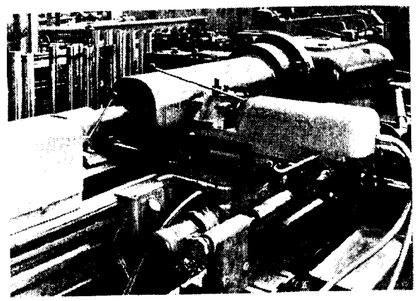
2. *single stroke*,

   by actuating the switch-on key during the down stroking of the ram slide, the latter performs a full stroke cycle and remains stopped in top position.

3. *continuous run*,

   after engaging the press works till it is stopped by pressing a switch-off key, the ram slide returns to top position.

During "single stroke" and "continuous run", the ram slide can be stopped in any position by pressing an emergency key. The ram slide movement is indicated by the hand of a dial in the control panel. In the right side upright, a cam shaft with 10 cam disks will be installed, out of which 6 cams are available for the synchronous control of the transport and working movements, when the press is inserted in a production train.

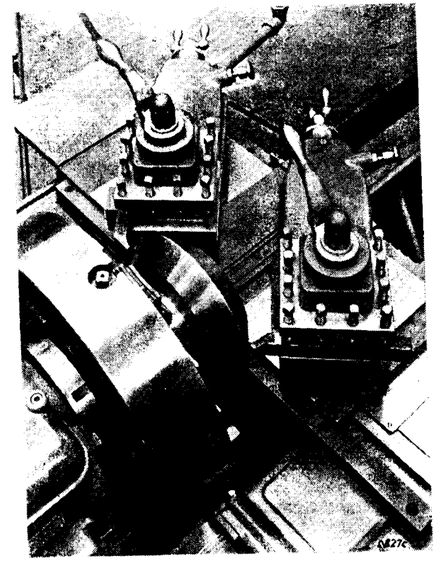


Copying of a four-edge mold with the hydraulic non-circular copying unit.

In the ram slide a number of knock-out bars are incorporated brought into action by adjustable stops on both sides of the press headpiece.

A flywheel brake stops the flywheel within abt. 15 secs. after switching off the motor.

The press is equipped with the so-called cascade circulation lubricating system. Thereby, the lubricant is pumped from a tank in the press bed through filters and two pressure adjustable distribution lines to the sliding faces, bearings and gear wheels. The quantities can be regulated by time switches with impulsing device. The oil flowing from the lubricating



Machining of a taper with twin slide and power traverse.

points is caught in the headpiece, the overflow is conducted over connecting rods and ram slide back to the collecting tank. In case of failure of the lubrication, the press is automatically stopped, while a pilot lamp flashes on the control panel.

Particularly marked lubricating points are fed in the usual way by hand guns.

To avoid accidents during continuous run of the press, we recommend to instal light barriers in the front and at the rear of the press. Strip lights are fitted inside the press opening on both uprights to improve working conditions. The headpiece with the press drive can be made accessible by inspection platforms and ladders.

It is also possible to instal a pneumatic drawing cushion in the press bed, either of the uncontrolled type, or of the controlled type with control slide and electrically regulated stroke adjustment.

IWK Hydraulic Self-contained Straight Sided Plate Shaping and Deep Drawing Presses

These presses are built with a maximum press power of from 160 up to 1000 tons. They are either single acting, for ordinary shaping, stamping, flanging, beading and pressing work, if necessary equipped with hydraulic cushion or ejector, or double acting with downstroking blankholder.

The press body consists of bed, header and uprights, these parts fabricated of heavy steel plate are stress relieved after welding. They are joint by welding to form a monobloc press frame, or in the case of presses above 315 tons and with large table area, by preloaded tie rods of steel. To make the uprights specially resistant against transversal and torsional forces and dynamic stress, they are made of folded steel plate reinforced by ribbings and welded to form box shaped bodies. The bolster plate of forged steel is screwed on to the bed and has Tee-grooves for tool fixing, a centering hole and an arrangement of holes for the drawing cushion pins.

The ram slide being rigidly fixed to the piston shaft is a welded boxlike structure and extremely resistant against bending and twisting forces. It is guided by 4 prismatic gibs along the 4 inner borders of the uprights. The guide gibs are adjustable, they allow to work with the smallest possible clearances guaranteeing a high degree of accuracy. Its bottom surface bears Tee-grooves and a centering hole. In accordance with capacity and table breadth of the press, a number of knock-out bars are fitted inside the ram slide, their movement can be regulated by spindle stops on both sides of the press frame. The press power is exercised on the ram slide by one or two pistons, their cylinders are mounted inside the header. Oil pressure below the piston disk effects the return movement of the ram slide.

Moving below the ram slide and guided along the same 4 gibs as the ram slide, the blankholder is pressed down by 2, or, in big size presses, by 4 cylinders, the return movement being effected either by 4 adjustable spindles or by 2 separate push back cylinders. The blankholder can be coupled to the ram slide by bolts, the press power of all downstroking cylinders acting jointly.

The blankholder satisfies all demands in regard to self-adaptable downholding. The central opening is reduced by annular plates forming part of the tooling. The guide gibs are adjustable. During the drawing operation the downholing pressure is maintained by oil escaping from the annular space below the main piston and can be infinitely varied.

All the cylinders for ram and blankholder are made of cast steel and have a polished interior surface. Long guide bushes for the piston shafts are fitted, the cylinders are sealed by multiple packings with bilabial rings of wear resisting synthetic material.

The pistons, whether of the disk type or the plunger type, are made of chilled cast iron of high surface hardness or high quality steel. All differential disk type pistons bear bronze guide rings and packings to prevent leakage from one cylinder room to the other and dropping of the ram during a standstill of the press.

Below the bolster plate the hydraulic cushion is fitted. Piston or pistons and pressure platen are rigidly fixed to one another. The pins standing on the pressure platen and penetrating the bolster bear the drawing cushion ring clamping the rim of the blank during the drawing operation against the annular face of the die. A special pressure regulating valve is fitted to the cushion. Generally, the cushion works as a passive one, during the downstroking of the ram it is pressed down by means of the pressure pins and follows the ram again on its way upwards till its upper adjusted position is reached and the top of drawing cushion ring and drawing stamp lie in the same plane. During active work the drawing cushion is controlled by a slide connected to the electromagnetic controls, it can then be used as ejector or for reverse drawing.

The operative oil pressure is produced by a multi-piston axial pump with dependable capacity regulator. In the place of the formerly common slide valve for distribution, a reversing control system is employed offering the advantage of a smooth reversal of the ram movements in the stroke end positions.

The capacity regulator varies the stroke of the pump plungers in relation to the pressing resistance. Rising resistance reduces the pump output, the motor input remains thus practically constant. The motor drives the pump by a flexible coupling. The pump works without valves or packings and owns its convenient lubricating system regulating the lubricating

pressure in accordance with the load put on the press.

The press power of ram, blankholder and drawing cushions can be varied within wide limits. All adjusted pressures are to be read off on the gauges jointly fitted to the manoeuvring board. The pressure regulating valves we employ have an uncommonly wide range of adjustment.

In accordance with the respective height of tooling and drawing depth, the ram slide stroke can be confined at liberty in chosen top and bottom positions. In this way, it is possible to realize for every stroke cycle the shortest and most economic lengths of stroke. Any exceeding of the maximum stroke length is impeded by solid stops.

When performing punching or trimming operations intermediate pieces are put on stops making the ram slide or blankholder to set on them immediately the punch has broken through the material and avoiding any percussion in the hydraulic system.

On the manoeuvring board fitted to the right side upright are arranged, beside the pressure gauges, the push buttons and an emergency switch, up to 3 selection switches, one for selecting the desired operation cycle: "inching", "single stroke" or "continuous run", one for switching on and off the drawing cushion or putting it on active or passive operation, and one for connecting or disconnecting the backside control panel.

"Inching" is mainly used when setting or trying out tooling. When "single stroke" has been selected, one complete stroke cycle will be released. By a time-log relay the ram slide can be kept for a short predetermined period in the bottom position. This is particularly important for coining work. Once the press has been regulated for "continuous run", the succession of stroke cycles will go on till the press is stopped. The duration of the feeding will be determined by the time-lag relay for the top position of the ram.

To protect the operator against accidents, we recommend to instal two hand; two men or four men safety controls, light screens or electric interlock guards. Light screens are automatically switched off during ram return and feed periods.

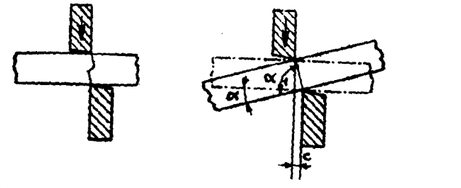
In order to catch the ram and blankholder slides while downstroking in rapid motion, before they set down on the material, an electromagnetic guide motion slide is closed and the descending slides braked by turning the pump back to its central position. At the end of the return stroke, the ram slide is braked too.

Oil filters are provided to keep the circulating lubricant clean and to protect it against the effects of deterioration by ageing. If operating conditions demand it, oil cooling or oil heating can be fitted. These are thermostatically controlled.

Due to the excellent finish of all components, the minute deflection of the press frame and the perfect parallelity of bed, ram slide and blankholder, work-piece sizes can be most accurately held and maintained. Owing to this fact, to the rigidity of the press and to its oscillation-free working, tool life is uncommonly long.

PELS Billet and Slab Shears

Billet shears are wanted for high numbers of cuts and uniform evenly cut surfaces on the sections as they can be obtained by sawing. Billet Shears which cut on the diamond, usually do not allow to achieve uniform cuts with perfect rectangularity and free of burrs and core protrusion, without blade changing when cutting steel of different composition and a tensile strength of from 55 to 140 tons/sq. in. The reason for it lies in the bending of the off-cuts during cutting which produces obliquely cut faces. The smaller the tensile strength, the more oblique the cutting plane. This inconvenience was tried to be removed, already in former years, employing so-called up-clamping devices, they did, however, not give full satisfaction, as the up-clamping forces were too small.



CUTTING WITHOUT CLEARANCE

CUTTING WITH CLEARANCE ANDANGULAR FEED

At this new PELS billet shears, blade beam and up-clamping device form one pincer-like system. The design is protected to IWK by patent rights in Germany and foreign countries. Due to the high

downholding pressure and an up-clamping power proportional to the cutting force, the face of the off-cuts shows the properties mentioned below. No supplementary mechanical power or working capacity is needed for up-clamping.

This new type billet shears works with simple rectangular blades. They produce almost square off-cuts with negligible deformation and without core protrusion. The shears is designed in such a way that the up-clamping device cannot impede the cutting operation. The big number of cuts to be obtained with this shears gives a comparatively high efficiency.

The advantages of the newly developed PELS Billet Shears are focussed and explained below:

(1) High production figure by automatic working. The working cycle is automatically performed by the new PELS billet shears. Having engaged the roller table drive, the inserted billet is fed into the machine, knocks against the back stop and releases the cutting cycle, causing in quick succession clamping down by the downholder, withdrawal of the back stop and cutting. After throwing out the off-cut and stopping the blade beam in the upper dead center, the cutting cycle is repeated. It is not necessary to engage the shears by hand each time the material is put against the back stop. Hand operating will unavoidably cause time losses and rejects when the wanted exact length of the off-cuts has not been maintained.

While the idling speed of the shears of 315 and 630 tons shearing force are 28 and 26 per minute, the production figures vary with the off-cut length. Considering idling times, the number of cuts will be abt. 12—15 with an off-cut length of say 4"—5", and 5—7 per minute when the off-cut length is 20" approximately. The output figure in tons per hour is consequently increasing with the length of the cut pieces.

When cutting on the diamond, loss of time occurs owing to bent billets which impede the performance of the cutting operation and require readjustment of the downholder. Such disturbances are unknown for shears with horizontal blades, because the billet can be turned on the roller table and put on that one of its four faces on which it lies almost flat.

(2) Outstanding quality of cut. The excellence of the cuts depends on a conveniently big upclamping force, on the correct selection of the clearance between upper and lower blade and on the predetermined cutting rake, i. e. the angle between blades and severing plane vertical to the billet axis. If upclamping force is lacking or insufficient, the material when cut will be bent, torn or curved. The horizontal clearance between upper and lower blade edges must be regulated in accordance with the height of the section and the quality of the material, as a rule the clearance amounts to some 7 to 10% of the height of the section.

A sketch shows the actual conditions. Cutting without clearance gives a broken face. If the billet, when being cut with the required clearance, is fed horizontally, the cutting plane in the billet runs obliquely, as shown by the dotted line. In order to achieve a square cutting face, the billet is to be introduced with a slight inclination.

Experience teaches that proper cuts can be obtained, when cutting on the diamond, provided.

(a) the blade is relief-ground over the ful breadth of the material, what is obviously feasible for one section only.

(b) the Vee-shaped edges of the blades mus have an angle of more than 90°, th correct size of the angle depending on th elongation of the material. This mean cutting on the diamond can be achieve just for one section of material of certain quality. Already slight deviatior from that section or differences as to th elongation cause improper cuts. In cas the rounding-off radii of blade and bill do not coordinate, a burr or even a co projection will be squeezed out which rather an unwanted impediment during further transport. This formation

burr or core projection is generally the rule for cutting on the diamond, because it is practically impossible to adapt the blade section to the varying rounding-off radii of the billet.

(3) Off-cuts to close limits. From automatic cutting performed by the PELS Billet Shears with upclamping device and backstop result off-cuts with unusually close longitudinal tolerances, since the shears engages immediately the material contacts the backstop. For billet shears, which are not started by means of the backstop, generally far bigger tolerances must be admitted for the off-cuts.

(4) Simple blade shape. The shape of the blades for the new PELS Billet Shears is rectangular. For square steel bars, the upper and lower blades are, as a rule, interchangeable and possess 4 cutting edges each. Contrary to this, cutting on the diamond demands a special set of blades, and further more with relief-ground backs for different qualities of the material, if properly cut faces are to be obtained.

Nevertheless, off-cuts produced by cutting on the diamond show rather varied cut faces. The face on the remaining billet gets nearly always curved, while the opposed face on the off-cut becomes concave, besides, it shows an obliquely severed face due to lack of upclamping.

The curvature on the face on the remaining billet is sometimes that big, that the upper blade cuts into it forming a nose, which is undesirable and demands eventually to be removed in an additional operation.

When cutting round sections of low tensile strength, also the new PELS Billet Shears has to be equipped with relief-ground profilated blades. Due to the most effective upclamping device, however, proper and square cuts will be achieved. Extreme core projection and forming of a nose on the cut face by the upper blade —as mentioned above—will certainly not occur.

(5) relatively rapid blade exchange by effective measures. The backstop and the downholder of the PELS Billet Shears are pivoted on hinged in order to change the blades with ease and to change the shears from smaller to bigger billet sections. Once the personnel have got accustomed to this work, they will take 20 to 30 minutes to perform it.

The blade clearance, too, can be rapidly set, owing to the special design as described above, simply by inserting or removing shims under the lower blade.

The obvious advantages of the new PELS Billet Shears lie in the high quality cuts that can be obtained, the accuracy of the length of the off-cuts, the high effective output and the easy maintenance.

STEEL SMELTED IN RECORD SPEED

Tashkent iron and steel mill named after Lenin has reported a record speed for steel smelting in small tonnage furnaces in the USSR — 5 hours 20 minutes. At the same time it obtained 13 tons 100 kilograms of steel per square metre of the furnace floor, which is 100 per cent above norm.

The Uzbek iron and steel mill was built after World War II and is a firstling of the Soviet Central Asian Steel Industry.

The record feat was carried out by steel-makers Shirali Khamrakulov and Nikolai Krasi.