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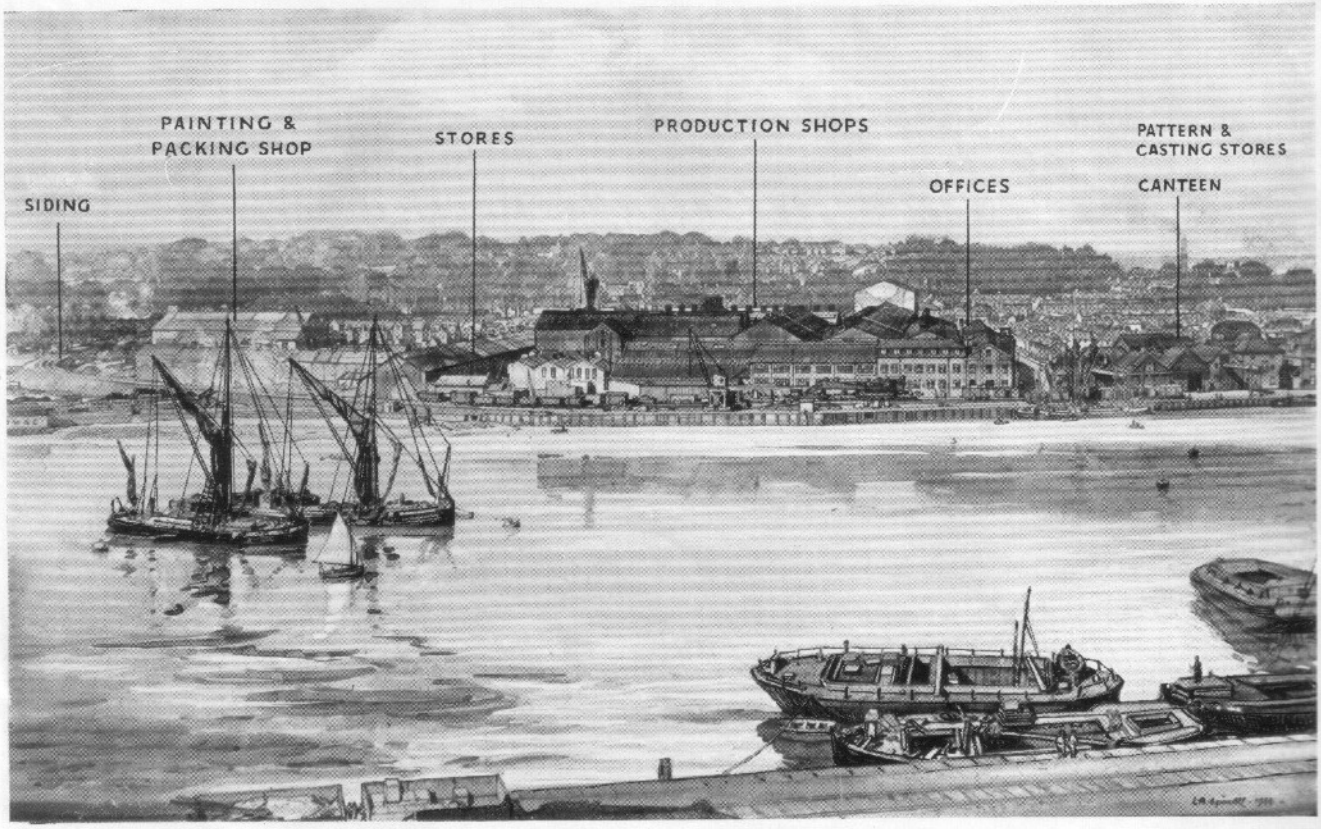

WATERSIDE WORKS, IPSWICH

From a painting by L. R. Squirrell

RANSOMES & RAPIER LTD.

ENGLAND

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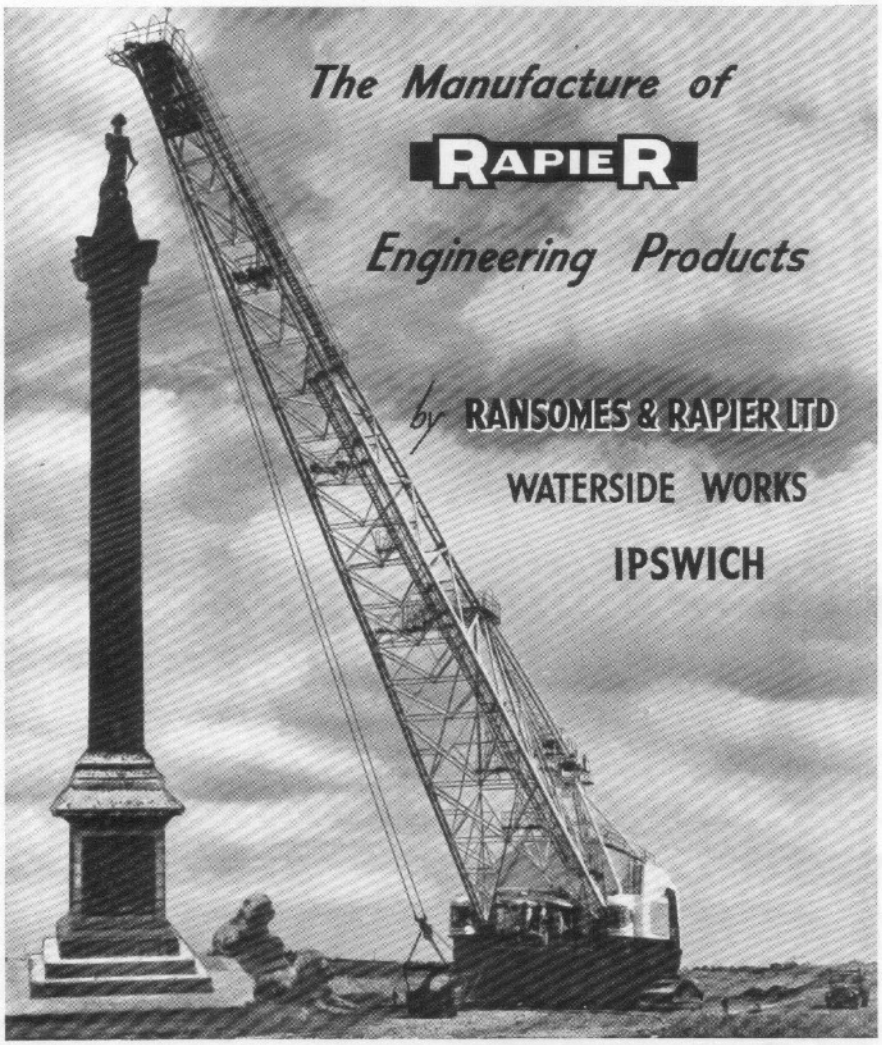


FROM their foundation, Ransomes and Rapier have set out to do two things: to provide the highest quality machinery both in design and workmanship and to make the 'family' at Waterside Works a happy one. Throughout the organisation it is recognised that the best salesman is the high standard of workmanship traditional at the works and the motto of the Inspection Department is "Never put up to a visiting inspector what you would not pass yourself." The proof of the wisdom of this policy is provided by the ever widening circle of satisfied users spread throughout the world. The family spirit started last century when the founder, Mr. Rapier, abolished the early morning start without breakfast and installed a workers' shelter where men could have their meals.

The Firm have pioneered many progressive measures, being first in the field with holidays with pay, the shorter working week, sickness benefit, dental treatment for the young and the overall incentive bonus designed to encourage the maximum output from the individual, whether on piecework or day work, and to allow everyone to share in the result. At a time when the output from Engineering is probably more important to the national well-being than that from any other sector of industry, proper understanding and collaboration between management and men is absolutely essential. To that end, since the early days of the war, each shop has had its own Consultative Committee whilst the Central Works Industrial Council is just about to celebrate its Silver Jubilee.

Mr. R. R. Stokes, the present chairman and managing director of Ransomes & Rapier Ltd., and author of the foregoing introduction, chose his parents wisely, for heredity and environment have made of him that rare personality—the outstanding business man with the detached and broadened outlook upon men and affairs that a resident university education and contact with the Humanities can give. Under his guidance the firm have more than doubled their personnel and increased turnover five-fold. Striking though these figures are, it is still more striking to be made aware of the influence throughout the organisation of the man responsible for them.

In recalling visits to firms for our long series of articles on British engineering and allied undertakings, Ransomes & Rapier stand out as one with whom we were repeatedly aware, as in no other, of the influence of the man at the head. In our many talks at Waterside Works with senior executives, foremen and men in the shops, the initials "R. R." were continually cropping up. At first we thought in all innocence that the letters referred to Ransomes & Rapier; but we soon found

we were wrong and that "R. R." was a person and a very live one. On hearing that "R. R." had decided this or that, or wanted something by a certain date, or had said that some desirable improvement must wait till more urgent problems were settled, we noticed that the speakers invariably imparted a feeling of confidence and acquiescence in the many decisions made by "R. R." It was soon evident that Mr. R. R. Stokes, in spite of his many obligatory periods of absence from the works, is constantly in touch with its affairs, has its many administrative and technical problems at his finger-tips and enjoys an astonishing loyalty on the part of the Company's personnel.

THE RT. HON.

R. R. STOKES,

M.A., M.P.

Managing Director of

Ransomes & Rapier Ltd.

since 1927

Member of Parliament

for Ipswich since 1938

An account of the early days and growth of Ransomes & Rapier Ltd. is admirably set out in detail in the Company's own publication, "Eighty Years of Enterprise". Our readers are referred to that work for the interesting story of how the Company branched out in 1869 from the firm of agricultural engineers known as Ransome, Sims & Head (Now Ransome, Sims & Jefferies Ltd.) with the intention of making railway equipment and building bridges. The original partners, R. J. Ransome and R. C. Rapier, were Victorian individualists, the former autocratically directing affairs from the seclusion of his ivory tower and the latter, nothing if not helpful to customers, publishing a catalogue containing data from which could be estimated the cost of a railway, with or without stations.

Running through "Eighty Years of Enterprise" is the emphasis upon individuality, ingenuity and an appetite for tackling the unusual. We reiterate these points here because today, if certain well intentioned but not too well informed writers are taken seriously, Britain will be in grave danger of becoming a land of conveyor belts and robot attendants, a pathetic grey shadow of American industrialisation. In years to come, when few countries will *not* be highly mechanised in their industries, survival for Britain will depend to a large extent upon ability to sell the skill of its technicians and specialised products of its factories, rather than consumer goods that every other country will be manufacturing. That Ransomes & Rapier identify themselves with this outlook will be apparent in the following pages. It has also been apparent from the days when they first turned their attention to the manufacture of sluice gates, right up till this mid-century in the building of the famous W1400, the world's largest walking dragline weighing 1,600 tons and (as our title illustration fancifully, but not misleadingly, suggests) tall enough to top Nelson's Column. This great machine installed by Stewarts & Lloyds Ltd. for ironstone workings near Corby, Northamptonshire, digs its own weight every hour of its working.

It is most significant that the Company have just recently been awarded a contract for the construction of sluice gates and operating gear for the Government of Irak. This £570,000 contract was secured in the face of stiff competition from German, French and Austrian firms. Ransomes and Rapier were the only British firm to tender, and the contract was awarded, not because the tender quoted the lowest price, but *because it offered the best design and quality of materials.*

This contract is for the Wadi Tharthar project, about one hundred miles north of Bagdad, and entails the construction of 17 barrage gates, each 40 ft span × 16 ft deep, and 28 regulator gates, each 40 ft span × 21 ft deep, complete with operating gear. Nearly 4,000 tons of material will be involved in their construction. All the work will be carried out at Waterside Works, Ipswich and will be shipped to Basra for Bagdad.

The Wadi Tharthar scheme will enable the flood waters of the River Tigris to be stored in a depression in the desert. During the low river season the stored water will be returned to the Tigris, increasing the supply of water for irrigation.

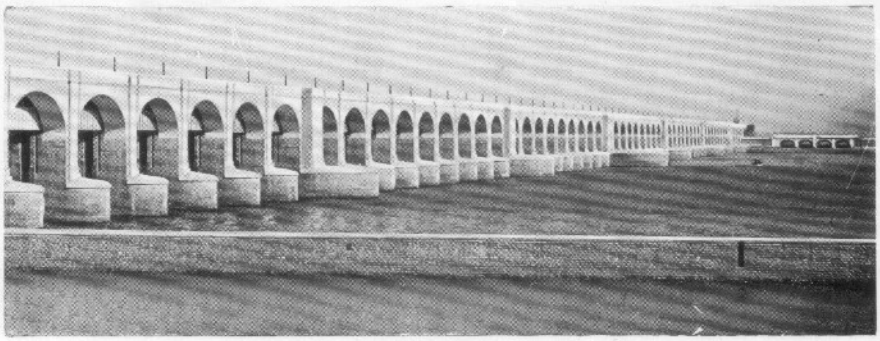
Many other projects for the Government of Irak have been undertaken by Ransomes and Rapier, notably the Habbaniyah barrage on the Euphrates, the Ramadi barrage and regulating gear, also on the Euphrates, and the Kut barrage on the Tigris.

Excavators of the magnitude of the W1400 are, of course, not seriously on the Company's export list, but one is being built for the Williamson Diamond Mines in Tanganyika which will have a working weight of 150 tons, and some of this size have already been sent to Australia.

The range of standard products includes machines made for stock, mainly petrol or diesel-engine water pumps, petrol or diesel-electric mobile cranes, concrete mixers of all sizes, including the now popular Truck-mixer for mounting on vehicles sent to Ipswich by the customer, and a full range of excavators other than the large walking draglines and quarry shovels (electric driven) built specially to customer's order.

Sluice gates and water control equipment for barrages, hydro-electric schemes and other big projects, have been the Company's main business for many years; moreover the firm built up a considerable reputation for railway equipment such as patent buffer-stops, turntables and steam breakdown cranes; some of the latter, including the sluice gates and other ironwork for the Kotri barrage in the west of Pakistan, are going through the works at the time of writing.

With this variety of heavy engineering products to offer, the ever changing picture of production in Waterside Works is not easy to portray, but a tour of the shops makes it apparent that engineering experience on one particular machine



SUKKUR BARRAGE ON RIVER INDUS, PAKISTAN

often proves itself to be useful where problems arise in the design of another. Variety in manufacture is naturally reflected in the choice of machine tools for the shops, these being mainly of general purpose types, supplemented by certain mass-production units where quantities justify their installation.

It is safe to say that over half of dispatches are for shipment abroad and of these the bulk are covered by mobile crane and excavator business, except of course when handling the occasional giant excavator or a big sluice contract.

Since 1945, excavators and mobile cranes have been in such heavy demand that an allocation scheme had to be implemented whereby 'hard' currency areas were given top priority over the sterling areas in any event, to support the Government's working policy. That scheme depended upon whether the machines were taken up by the overseas agents or not, which, in turn, left a 'pool' for other export areas.

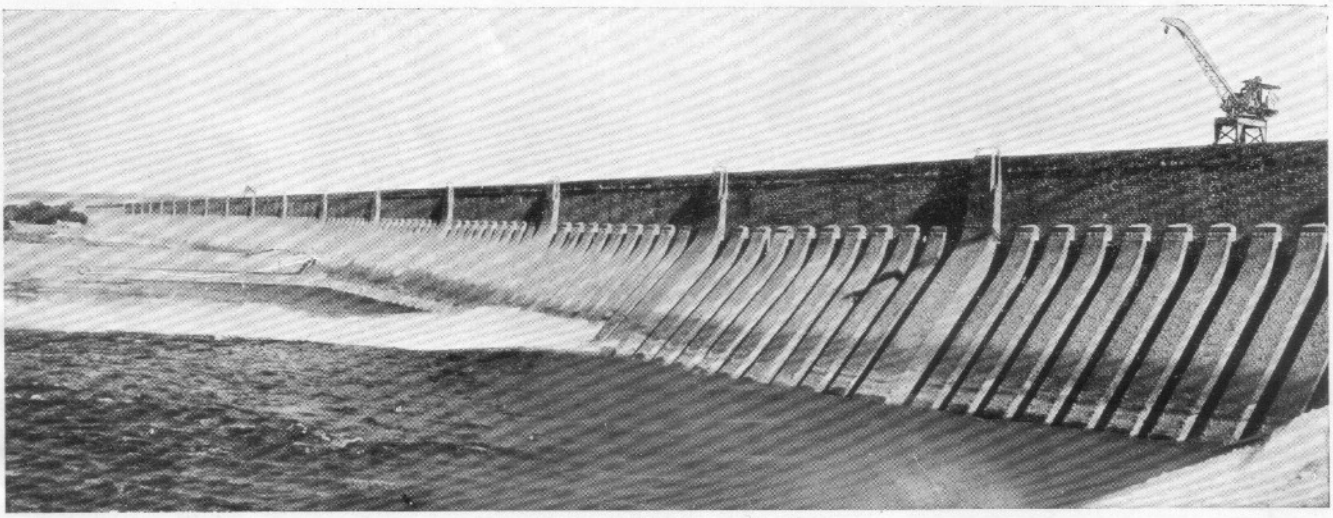
While the 'sellers' market' condition existed for excavators and mobiles in nearly all overseas areas, it applied also to a limited extent where concrete mixers and pumps were concerned; but against the coming of the 'buyers' market' the Company have kept a constant eye on the need for overseas tours (at director level) and, over the past few years, South America, South Africa, the Rhodesias and the North East have been covered, in addition to tours by specialists of India and Pakistan, the Malay peninsula, Siam, Australia and New Zealand.

Of the truly 'hard' currency areas visited, Canada has proved to be the most difficult nut to crack—mainly on account of the idiosyncrasies of users brought up under the wing of their American neighbour whose machines (excavators in particular) have different operational characteristics to our own; nevertheless, British excavator imports have improved steadily over the past few years.

The post-war seller's market brought with it much closer relations between Agent and Principal, and during the early boom period it was not unusual to have 100 or more overseas visitors at Waterside Works during any one quarter. Moreover particular care is always taken to welcome the sons or relations of users or agents willing to come to Ipswich for even a brief course of training and this has resulted in the Training Centre having a waiting list which includes lads of all nationalities.

On the development side of the business it is fair to say that this has been seriously hampered by the seller's market, in as much as standardisation has been the order of the day; but mobile cranes in particular (8 and 10-tonners) with extra long or special jibs for ship's side work, are now popular and used extensively alongside the bigger and more expensive Portal cranes. Also large fork-lift trucks —of 12 to 18 thousand pounds capacity— are available now with a patent cantilever jib (additional to the fork equipment) so that the machine may be used for mobile crane duties.

These and the larger mobile cranes are now available with patent "Stokes Self-Steering" which embodies a simple device on the driving wheel—operated from the steering column adjacent to the seat—which relieves the driver of the effort required to handle a heavy crane often working over rough ground for extended periods in tropical climates.



THE FAMOUS ASWAN DAM ON THE NILE

Model River

A highlight of any visit to Waterside Works is the time spent watching the Model River at work. Several reasons are given to visitors for the existence of this fascinating contrivance, all of them quite plausible; but one suspects that it originated in the mind of a director whose love of model engineering happily coincided with his desire that members of the firm should see what Ransomes and Rapier sluice gates look like. It is a peculiarity of sluice gates that those who make them never see them assembled because they are much too big. Instead, the sluices are assembled on site and that means, not in Ipswich, but in Arabia, Brazil, Canada, Egypt, India, Pakistan, etc.

The model river, roughly fifty feet long with a 'tributary' at one side, is punctuated throughout its length with a series of different devices for controlling water.

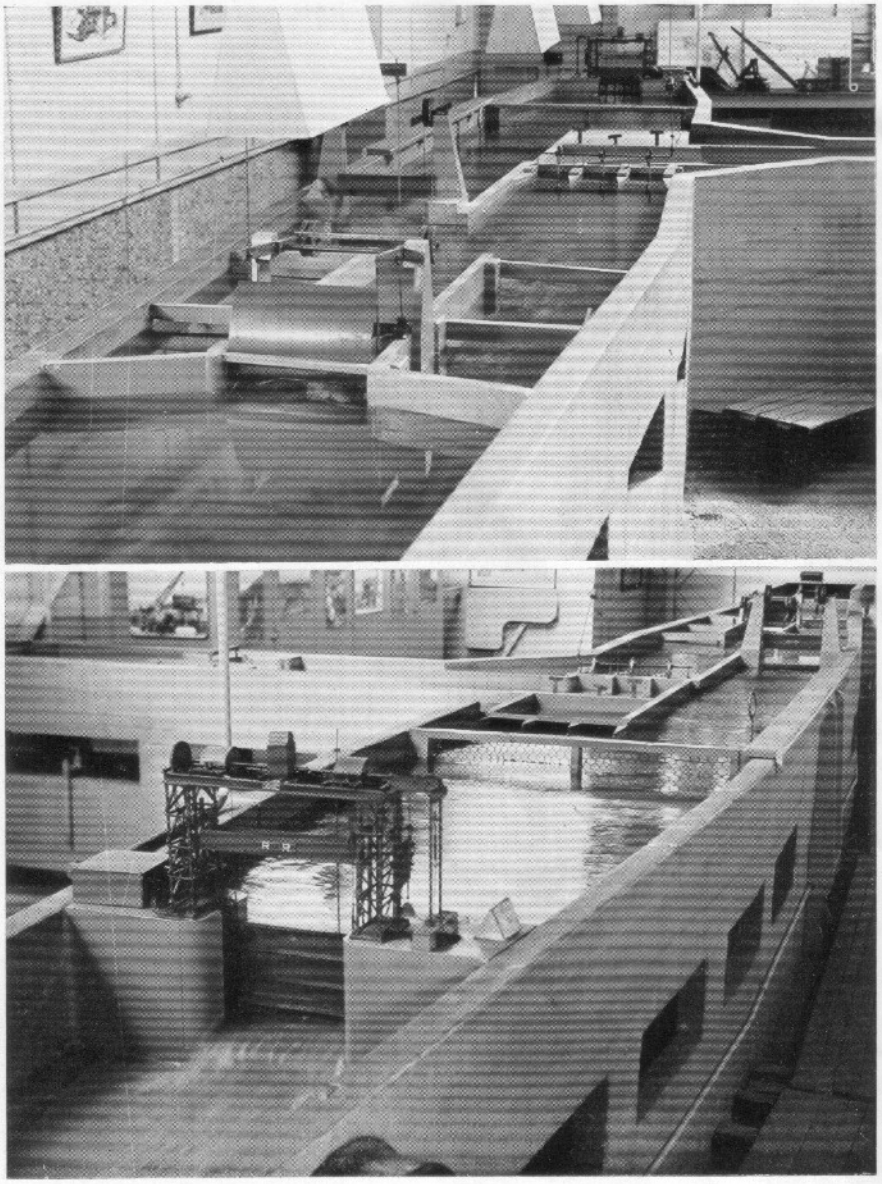
Water is pumped into an upper tank at one end and flows through the sluice gates to the other end, where it falls into a lower tank and completes the circuit through the pump once more.

First in order from the upper end is a Cycloidal gate which is used for allowing water to flow from land drains into a tidal estuary where it is important to keep out the tide when at a high level. Such gates close automatically when the tide is at a higher level than the land water and a very small head is sufficient to operate them.

The Radial gate, which is placed next to the tilting gate in the tank, provides an alternative method of maintaining a constant upstream level. This kind of sluice is operated by a float and is particularly suited to English rivers where a free fall on the downstream side of the gate is seldom obtainable. This gate operates satisfactorily even though at flood time the downstream water rises to a level almost equal to the upstream level.

The next model is of an automatic tilting gate suitable for holding up water on the upstream side to an approximately constant level, and arranged in such a way that the gate lowers and releases the water when it rises above a predetermined normal level. This is an inexpensive and effective type of gate for maintaining a normal level under conditions where the downstream water never rises above the sill of the gate.

In cases where it is not possible to make use of any of the gates already described for maintaining a constant water level, an electrically-operated vertical lift gate can be employed instead. An example of such a gate is shown at one end of the tank and is well illustrated in the second photograph. This model is controlled by electrical apparatus of the same kind as is in use in an actual sluice gate. The control gear is actuated by means of a float which is built into a chamber in the piers of the sluice and, when the water rises above a predetermined level upstream, the gate rises an amount which will enable the sluice to pass that amount of water which will maintain a constant level.



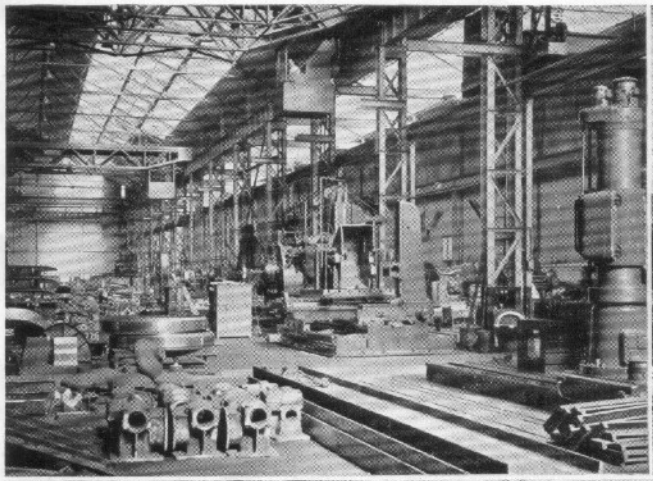
Figs. 4 & 5—Downstream and upstream views of the Model River which demonstrates the construction and working of the Rapier Cycloidal gate, Radial gate, automatic tilting gate, movable sloping weir and automatic electrically-operated vertical lift gate for constant water level.

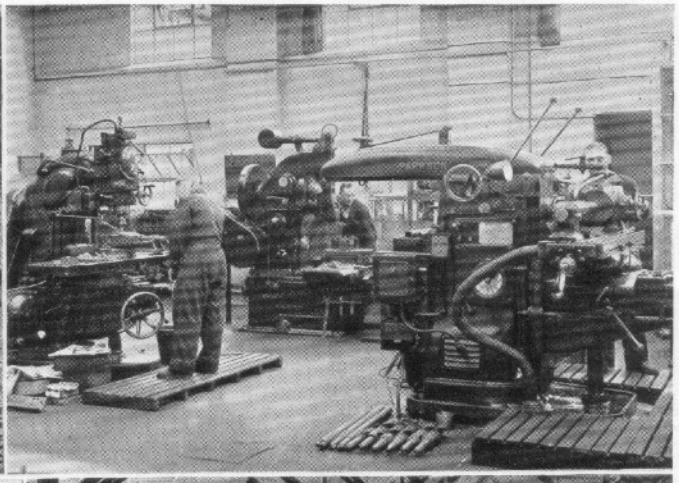
One other model which always proves of interest to visitors is a small movable sloping weir which allows water to flow over it in such a way as to cause what is called a standing wave to form on the downstream side. This sluice is used particularly in the Sudan for measuring the amount of water entering a small canal from a main canal. A gauge is fitted to the sluice gate which is in contact with the upstream water. Reference to this gauge enables the discharge over the gate to be determined within narrow limits, irrespective of the level of the water on the downstream side of the sluice. Thus a simple and effective method is provided for assessing the payment to be made by a farmer for the water he uses.

Although the model river is normally used for demonstration and educational purposes, it is occasionally modified to enable experiments to be made which often prove of assistance in designing sluice gates.

Fig. 6 (top left)—The main bay of the Heavy Machine Shop is 380 ft. long with a clear opening 35 ft. wide × 53½ ft. high. Cranes up to 25 tons capacity give a height of 30 ft. under the hook.

Fig. 7 (top right)—A corner of the Toolroom which covers 6,000 sq. ft. and is equipped with well laid out modern precision machine tools.





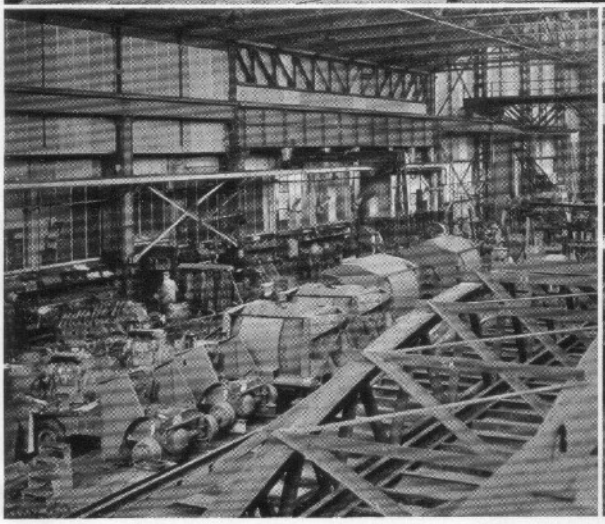


Fig. 8 (left centre)—Looking west along the Girder Shop which is 430 ft. long. The bay has a clear opening of 73 ft. wide × 35 ft. high.

Fig. 9 (right centre)—The Girder Shop seen from the west end where it adjoins the Erecting & Fitting Shop. Three E.O.T. Cranes are installed.

Fig. 10 (bottom left)—Part of the Erecting and Fitting Shop which is 430 ft. long. Of the same general construction as the Girder Shop seen in Fig. 8, its height is increased to 54 ft. for a length of 150 ft. from the far end.

Fig. 11 (bottom right)—A corner of the Mixer and Excavator Erecting Shop which occupies 25,300 sq. ft.

Works Management

About twenty years ago it was decided by the managing director that the functions of works management should devolve upon two separate officers, both responsible to the directors, the sphere of responsibility

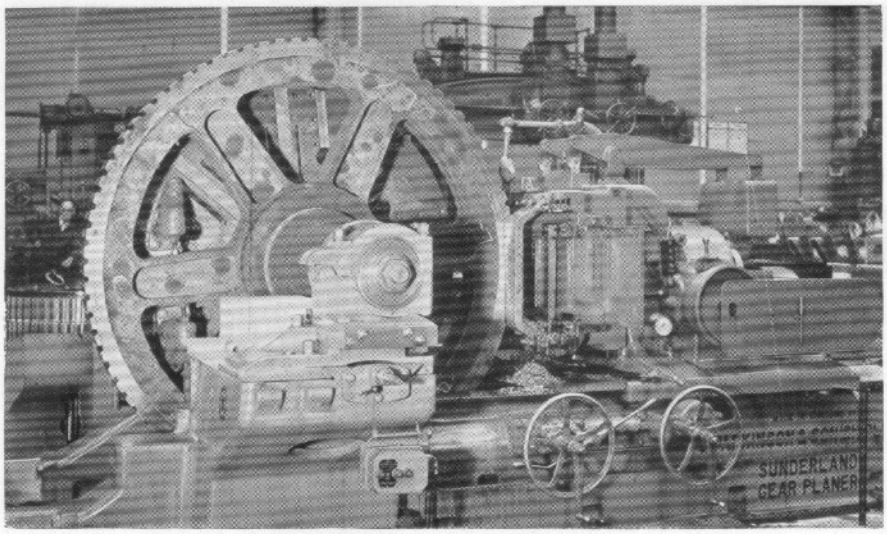


Fig. 12 (above)— A recent acquisition to the Heavy Machine Shop is this No. 27S "Sunderland" Gear Planer which generates gears up to 124 in. dia. × 15 in. face × 1 D.P.

of each being clearly defined, yet not invested with any idea of exclusive watertightness. One, the works manager, should deal with general administration and co-operation with other departments, while the other, the production engineer, covered the planning, progress and control of production techniques.

In view of the somewhat complex nature of production dictated by a multiplicity and variation of orders at Waterside Works (as described later in this article) this decision at Board level was undoubtedly a wise one. For its successful implementation, the right personalities for the two posts had to be found, or undoubtedly disaster would have occurred sooner or later in a split of this nature. The two persons concerned had to be capable of living more or less in each other's pockets, prepared to venture when necessary into the fringe of one another's territory, yet able to deal with contradictory requirements in an amicable manner.

It will be seen, therefore, that the set-up for works management is a little unorthodox in that there is no general manager. The organisation, covering the activities of something under two thousand people, is not too large to prevent much of the running of the works as a whole being done through personal contacts between heads of departments. Roughly speaking the day begins with a meeting of the works manager, chief engineer, production engineer, and a technical director, who go through the morning mail that concerns them, discuss particular points and settle general principles there and then.

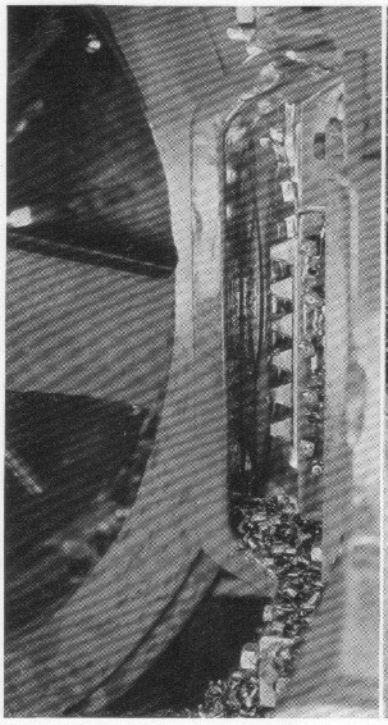


Fig. 13—Close view of the rack type cutter in action. To the left of the cutter is one of the two rim steadies carried from the cutter slide housing to support the wheel rim on both sides against thrust.

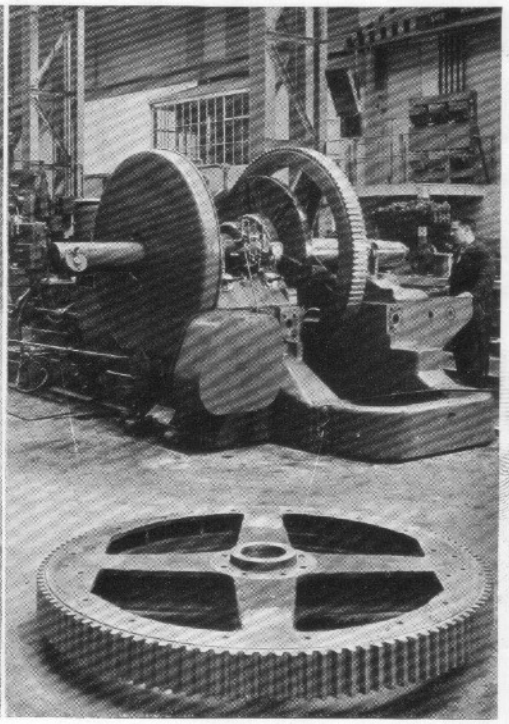
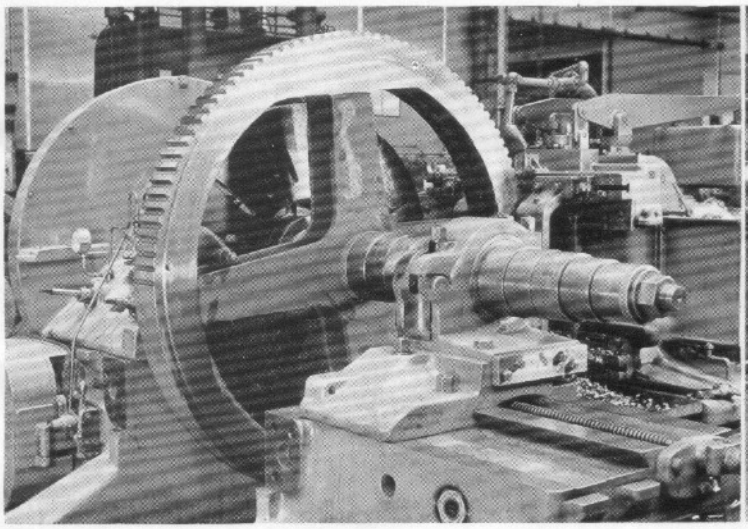


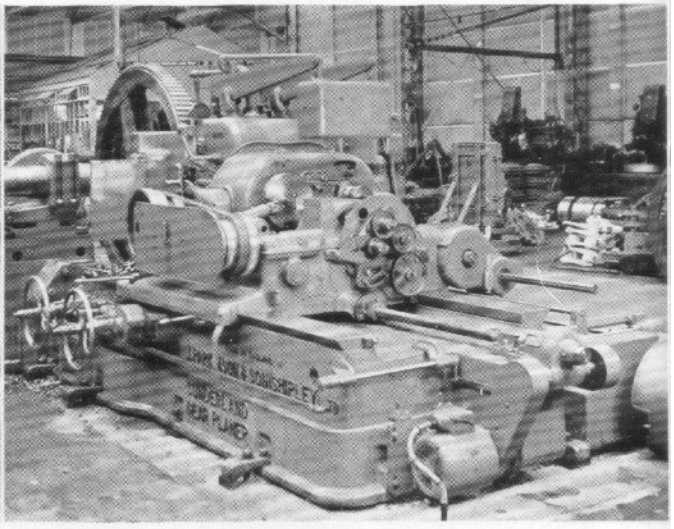
Fig. 14— General view of the No. 27 "Sunderland" with a generated cast steel gear 116 teeth × 1¾ D.P. × 5½ in. face in the foreground.

The works manager then proceeds to the various commercial departments (Mixers and Pumps, Mobiles and Excavators) and clears up queries from customers regarding delivery of particular machines. In the case of a special order such as for a sluice or steam breakdown crane, the tendering department discuss the order with the works manager who checks up with the buying office on questions of delivery of essential steel castings, engines, boilers, etc., checks his future commitments on that particular product and gives a delivery date.

Being general engineers, Ransomes & Rapier are not primarily concerned with line or mass production. Work proceeds in batches of, at most, about 120 for small pumps down to 10 for mobile cranes. The manufacturing programme, apart from special orders, is built around pumps, mixers, mobiles and excavators, these being known as Standard Products. Each year's programme is normally agreed upon in the late summer or autumn of the preceding year. For this purpose the commercial department quote expected sales in the various categories and, from these figures, the production engineering department estimate the total production hours required to complete the programme. Should the total manufacturing hours required prove to be in excess of the available plant capacity, then steps are taken either to curtail the programme or seek outside help for some of the more overloaded processes.

The launching of the manufacturing requirements into the shops becomes the





Figs. 15 & 16 (above)—Views of the No. 27 "Sunderland" cutting a large cast steel gearwheel. In the right-hand view a cover guard has been removed to disclose the train of gears which elevates the cutter to its starting position after the completion of each cycle.

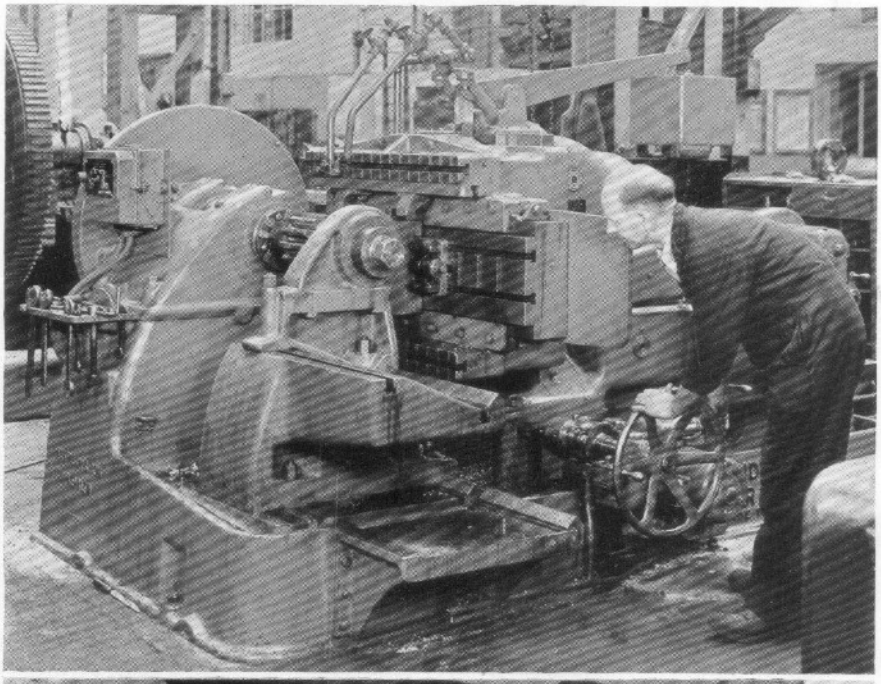


Fig. 17 (centre)—Generating teeth for a steel hoist pinion on a No. 19S "Sunderland" Gear Planer which accommodates wheels up to 56 in. dia. × 10 in. face × 1 D.P.

responsibility of the process planning office in which every individual item is rate-fixed, and from which the appropriate instruction forms are issued. This subject is dealt with in detail in a later section of this article.

Before the issuing of such information to the shops, all necessary drawings and specifications must, of course, be available through the designs department. At this stage the production engineering department co-operate to ensure that designs are within the capacity of the plant or, if beyond it, to investigate possibilities of outside sources of supply. An example of the latter arose with the building of W1400, the world's largest dragline, referred to earlier, and has arisen again with a second order for a machine of that size.

Quantities of particular items to be manufactured are fixed so that no batch is too small for economic production, nor so large as to occupy machines unduly to the detriment of the production of other items. Naturally, considerable compromise comes into the picture to correlate what the commercial departments want and what is, in fact, practicable.

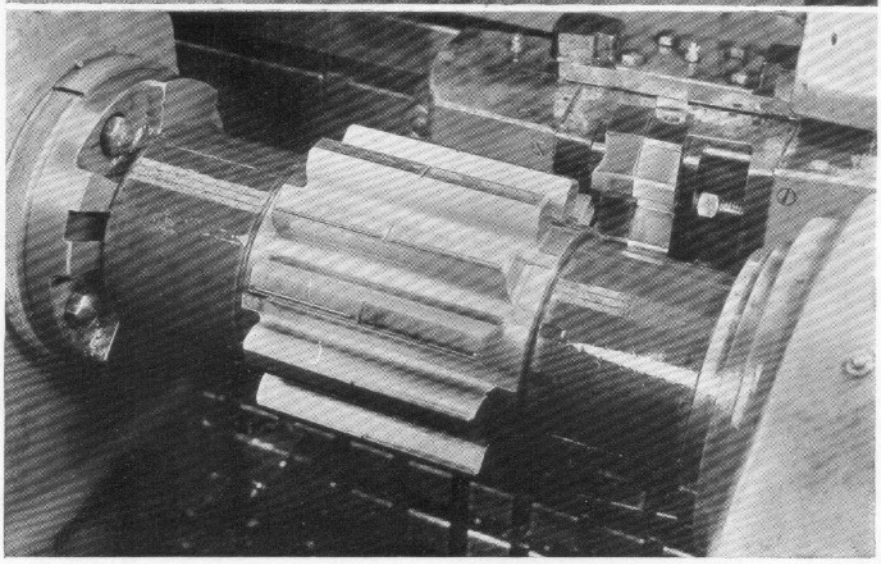


Fig. 18 (right)—Close view of pinion and double-acting cutter box holding two cutters placed back to back. One cuts on the forward stroke machining the bottom of the tooth space, and the other, taking a lighter cut, finishes the sides of the teeth on the return stroke.

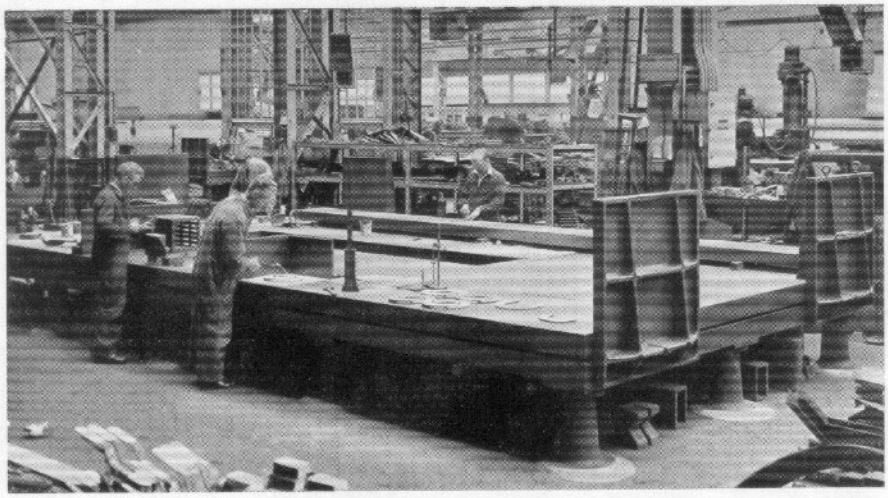


Fig. 19—Marking-off table, 28 ft. × 12 ft. with vertical brackets, in the Heavy Machine Shop.

of future orders, and the general trend of export and home trade are outlined for ultimate dissemination among the men in the shops. The works manager also summarises recent activities and pinpoints any production weaknesses.

Council members may raise any subject bearing upon works activities, providing that subject has been raised previously, but without settlement, through their appropriate shop committee. Here again wages are excluded from discussion. Any matter connected with rates of pay, and differences of opinion on the fairness or otherwise of piece-work rates is taken up by the shop stewards with the management in the normal machinery for avoiding disputes as agreed between the Employers' Federation and the Unions.

In order that the commercial departments and the directors be kept conversant

Fig. 20 (centre)—Part of the Heavy Machine Shop showing a line of vertical boring mills including a Richards 9 ft. × 7½ ft. double standard machine.

Broadly speaking the control of production in the shops is determined by a weekly foremen's meeting presided over by the works manager and attended by the foremen of all manufacturing and erecting shops. Also in attendance are the production engineer, assistant production engineer, progress office manager and the chief inspector. At these meetings the works manager obtains a comprehensive view of the current manufacturing position, particularly with regard to urgent batches of standard products and the progress of major orders. Foremen are expected to refer to any difficulties or delays they may be experiencing in their individual sections. The chief inspector gets news from the erecting shop superintendent of jobs nearing completion and warns outside inspectors as and when their services may be required. Other matters dealt with are: expediting initial processes of more important orders; material shortages or late deliveries, and design queries.

Meeting at irregular intervals there are also shop committees, each section's committee comprising the shop administration, the shop steward and works council members. These meetings are primarily useful as a means of removing shop grievances at the earliest possible moment. They have a two-way purpose in that they also serve for the dissemination of information from the management. The discussion of wages is outside the scope of these meetings.

At approximately bi-monthly intervals, with the managing director or a director in the chair, a meeting is called of the works council which is composed of elected members of each section of each shop. At these meetings the general policy with regard to future commitments, prospects

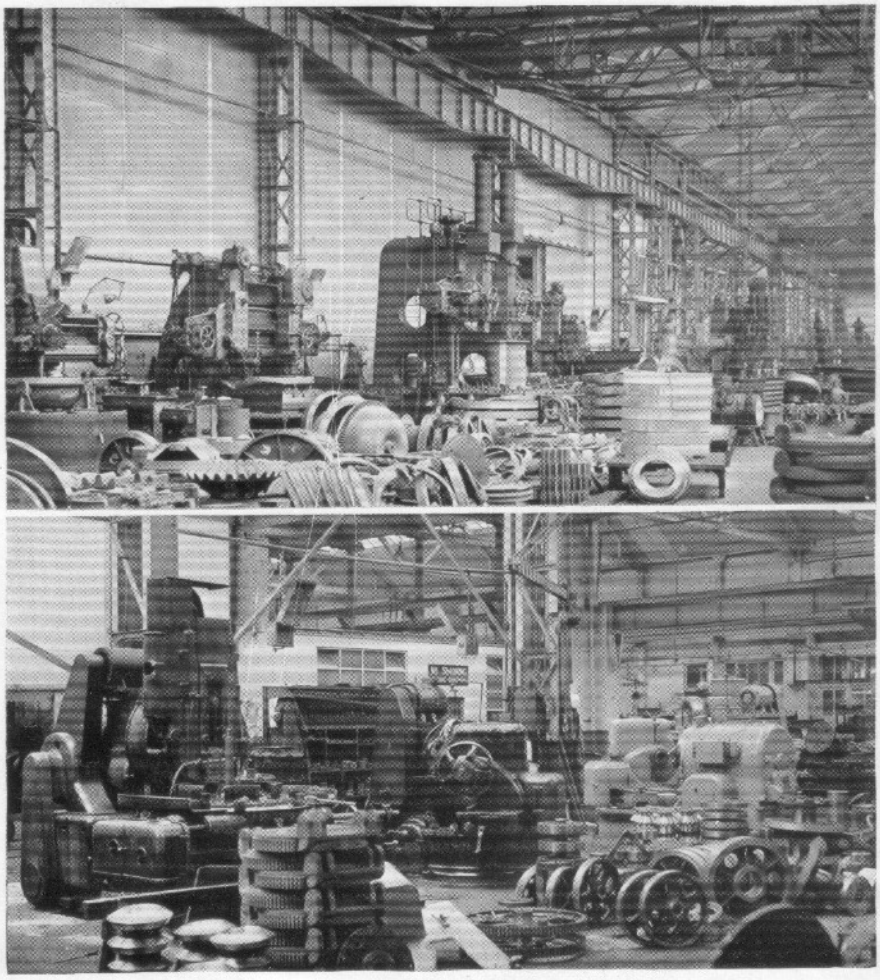
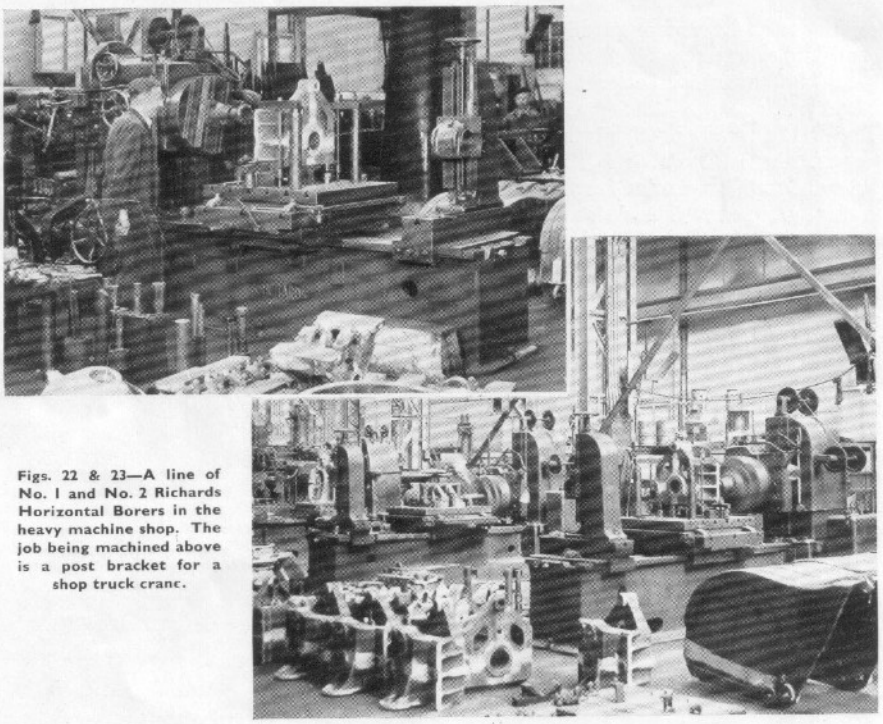


Fig. 21—Group of gear cutting machines for small and medium size gears in the Heavy Machine Shop.

with factory activities, the managing director holds a meeting with the whole of the works management, normally once a month. Future possibilities and probabilities are debated at the meetings, at which full discussion is encouraged within the limits of parliamentary language. In addition there is a weekly chart produced by the works manager's department showing the position of mobile and excavator programmes. A copy of this goes to the commercial department concerned, who can see when any particular batch has reached the erecting stage, when completed and when inspected. The departments and the directors, therefore, have a weekly running record of the position of the more important standard products.

Similar charts are also posted monthly in the shops in order to interest the men in the general trend of the firm's output. The same is done in the case of important sluice contracts involving anything from twenty to forty gates. It has been found that these charts give the men in the shops a tangible and easily understood link between



Figs. 22 & 23—A line of No. 1 and No. 2 Richards Horizontal Borers in the heavy machine shop. The job being machined above is a post bracket for a shop truck crane.

Fig. 24—Line boring the swivel bearings of cast steel digger buckets on a No. 5 Richards Horizontal Borer, wide bed model. The machine has a bed 18 ft. long.

their own individual efforts and the firm's production programme.

As far as is practicable the works manager makes a daily tour of each shop so that he has visual knowledge of what is going through. By this means he may occasionally spot errors, congestions or corners of inactivity; but more important, he is able thereby to maintain personal contact with the men on the shop floor who undoubtedly do appreciate visits from senior members of the staff.

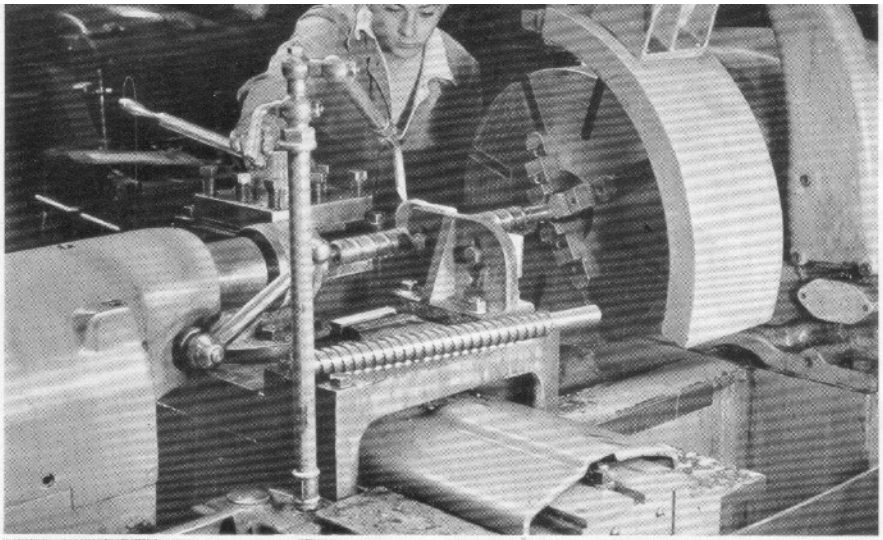
During his tour the works manager pays particular attention to the dispatch area. If there is any hitch he takes it up immediately with the dispatch department manager to ensure the quickest possible procedure with regard to finished machines, so that there is no undue delay between completion of testing, painting and dispatch. A portion of the works products goes away in barges, from a wharf alongside the works to ports of shipment such as London, Liverpool and elsewhere. Before the war a great deal of foreign shipment was done by motor-barge to Holland, and transhipment from there to ports in the east and middle east. Since the war everything has been shipped from British ports.

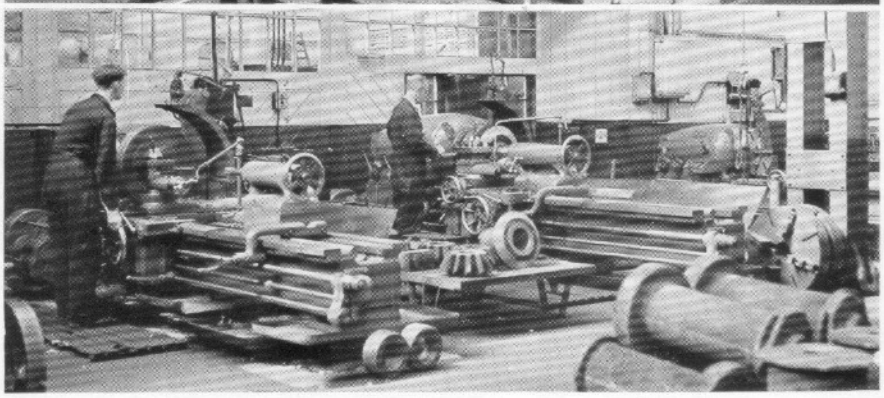
The works manager has no authority over the inspection department as the chief inspector is responsible direct to the managing director. This is eminently desirable because it by-passes the works manager's natural enthusiasm for speed, and provides the chief inspector with a mental environment conducive to giving

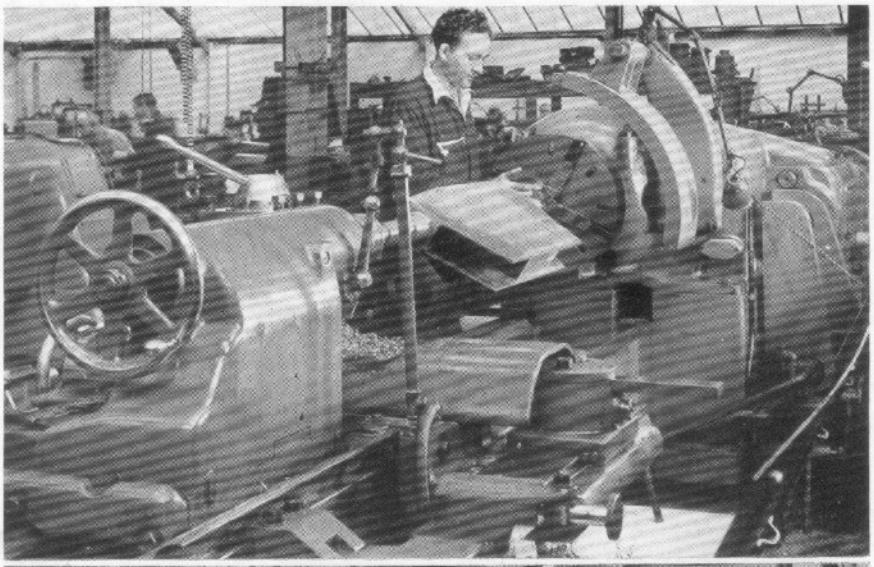
priority to quality before quantity. There is no doubt that today the customer expects better workmanship, better finish and a better article than he did twenty years ago. The whole trend in engineering is now towards the ideal and it is the constant policy of the Company to keep in the van of that movement. This does not preclude the possibility, however, of the works manager thinking that the pace of inspection might be stepped up occasionally. In such a case the matter would be put tactfully to the chief inspector, avoiding bringing any pressure to bear which might lead to skimped inspection.

Internal transport is a major problem which has become increasingly complex with the heightened tempo of recent years. In the manufacturing shops large loads are dealt with by electric overhead travelling cranes and smaller items are loaded in stillages and picked up by scooters with lift platforms. Outside the shops, transport of the larger pieces is by rail truck moved by the firm's own shunting locomotives and the pieces are handled on and off by a diesel crane.

A recent innovation is wireless control of the diesel shunting locomotives, the diesel crane and two mobile cranes. At the moment this is an experiment; so far it has proved extremely satisfactory, and there is no doubt that at the end of its four months' trial period, the equipment will be retained and its use extended to all the works mobile cranes. The great advantage of this scheme is that, having sent a crane out on to the wharf to deal with a certain load, instead of having to go out to discover when the job will be finished, the transport controller can ring up from his central office and ask the operator how he is progressing; or the man having finished a load, or in any difficulty, can ring up the controller and inform him. Wireless control has also been applied to one of the Company's lorries that runs around the district and has resulted in a substantial saving of time.







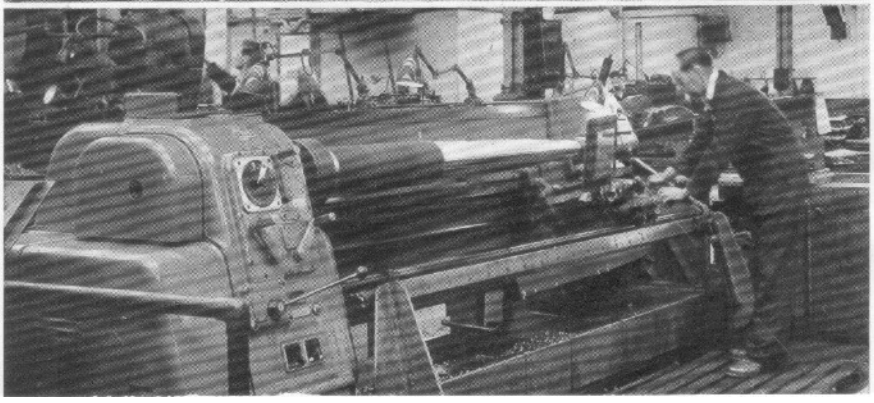


Fig. 25 (top)—Threading mixer discharge door screws on a 24 in. swing Lang centre lathe. The screws have a double start, ⅜ in. pitch × 16 in. long.

Fig. 26 (above centre)—Line of 24 in., 24/30 in. and 28 in. swing Lang centre lathes.

Fig. 27 (centre left)—Turning the journals of a fabricated steel gantry head sheath carrier on a 28/36 in. swing Lang centre lathe.

Fig. 28—A GF copying lathe is installed for repetition plain shaft production. Machine capacity is 14 in. dia. × 9ft. long.

Engineering Department

The Engineering department are responsible for the designs of all the Company's products, these falling roughly into the following section headings:

(1) Sluice gates and all water-control equipment.
(2) Cranes, including railway cranes, mobiles and fork-lift trucks, railway equipment.
(3) Contractors' plant, including tilting and non-tilting concrete mixers.
(4) Truck- and lorry-mounted mixers.
(5) Contractors' self-priming centrifugal pumps.
(6) Excavators.

There is also an electric section responsible for all electrical matters involved in the six categories listed above.

As mentioned earlier, customers' requirements may be subdivided into special orders and standard products. The former group invariably includes all water-control equipment (section 1) and railway equipment such as breakdown cranes, traversers and turntables (section 2). Standard products include ranges of pumps, mixers, excavators and mobile cranes.

Procedure in the department for a special product (such as a sluice) generally begins with receipt, from the customer's engineering staff or his consulting engineer, of a specification setting out the site's requirements and topographical data. This is passed to the engineering department and to the tendering and estimating department, and the latter prepare a design and estimate for the work involved.

Figs. 29 & 30—Two sections of the engineering department's drawing offices which have a staff of over sixty designers and draftsmen.

STANDARD PRODUCTS

Change Notice No. ..... Dated ..... Part For Group No. .....

Name of Part or Group .....

Type ..... Standard List .....

Group No. ..... is changed to Group No. .....

Item No.	do.	Item No. .....
Standard List	do.	Standard List .....
Sheet No.	do.	Sheet No. .....
Drg. No.	do.	Drg. No. .....

Can old be used in place of the New ? Yes No

Can new be used in place of the Old ? Yes No

Can old be used for Repairs ? Yes No

Copies to :—

DRAWING OFFICE Master Card ◇

SPARES DEPT. Record Card ◇

GENERAL STORES Record Card ◇

PRODUCTION DEPT. Standard Lists ◇

Rate Fixing Card ◇

Shop Instructions Issued ◇

JIG AND TOOL DEPT

BUYING OFFICE

The department concerned

Detail Changes & Remarks —

.....

.....

.....

.....

Pattern change Yes No Machining change Yes No

Reason for change :—

.....

.....

Change becomes effective on

Group No. .....
Standard List .....
Machine No. .....
Order No. .....

Tracing & Print O.K. [ ]

Change made by ..... Approved by .....

Fig. 31—The form used for recording changes on standard products is comprehensive in covering all change implications on one sheet. The sheet is quarto size.

In the case of standard products, of course, full information is already available in manufacturing departments and it is only necessary to ensure that this information is kept up to date when any changes are involved.

Should an addition to a range of standard products be contemplated, the various possible markets are first sounded, the sales staff generally advising as to what they consider are the governing requirements of the new model. The chief engineer then draws up a brief specification and an outline sketch embodying the salient features of the design, and passes them to the leader of the particular section concerned for elaboration. If the design lends itself to unit construction and can be broken down into sub-assemblies, this is done at any early stage and passed to leading designers in the section.

In preparing a special design, site conditions are given due consideration and, in particular, local characteristics such as temperature extremes, altitude, humidity, etc., are taken into account in the preparation of designs for electrical equipment and internal combustion engines, should these be needed.

Materials of construction have to be watched carefully as they can be affected from time to time by market conditions. For instance, quite recently when the supply of certain alloy elements was curtailed and nickel in particular was almost unobtainable, special molybdenum steels were advised in every case and this meant modification to the specifications of the steels normally used. Obviously, in considering standard products, the design and specification of various parts are governed by general requirements. Any special requirements such as, in the case of excavators, highly abrasive conditions existing where the particular machine is being used, may require a modification to the specification, and special castings ordered and supplied. But when special conditions of that nature arise, the sales or service department advise the design side and the necessary modification is passed through from the engineering department.

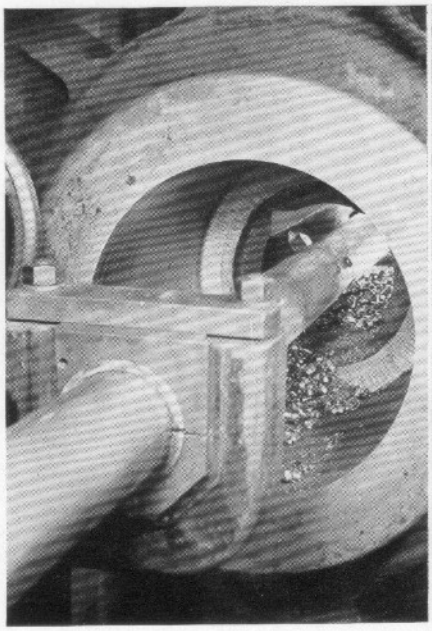


Fig. 32—Opening out a bored boss 8½ in. dia. to 8¾ in. square × 3 ft. on a planing machine. The part being machined is a cast steel main spur wheel for a Rapier W150 Walking Dragline.

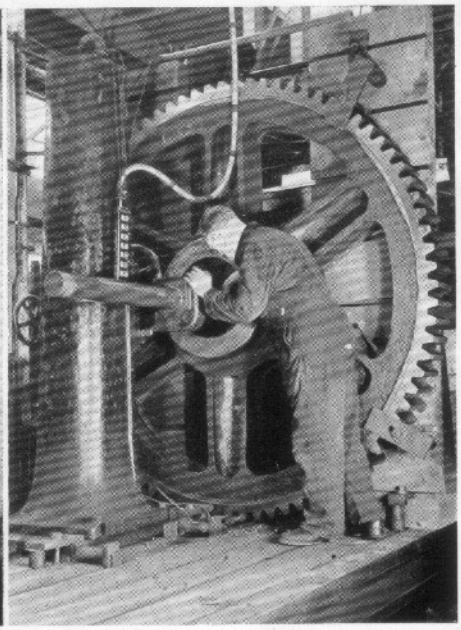
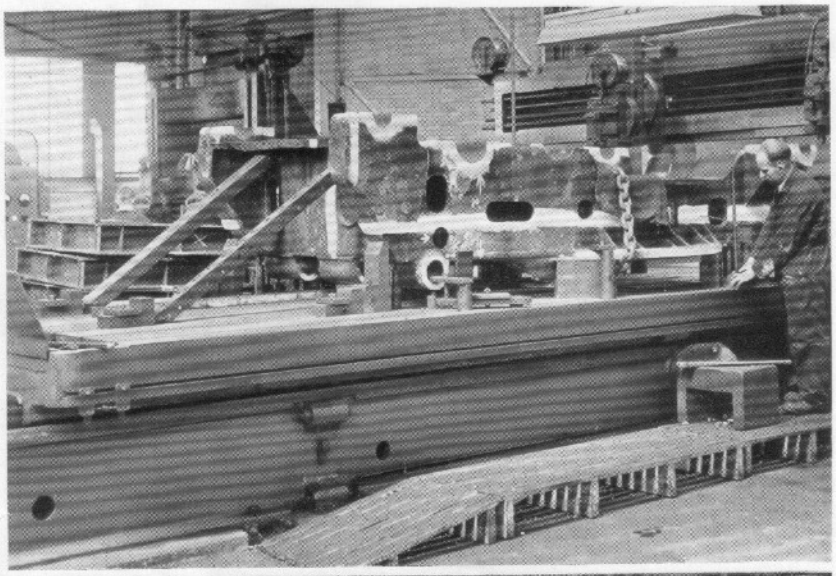
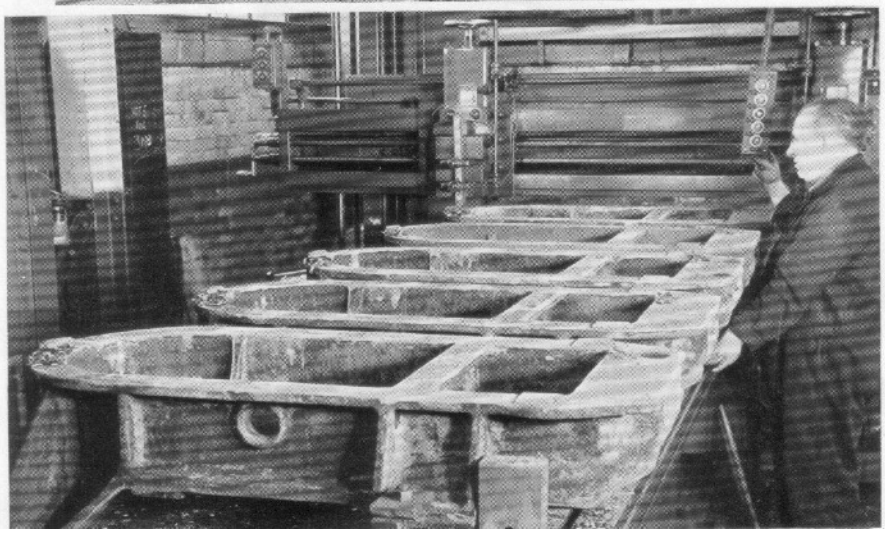


Fig. 33—General view of the set-up seen in Fig. 32. The boring bar carrying the tool is held in a chuck bolted to the planer cross-slide. The work, work support brackets and boring bar steady all move with the planer table as it reciprocates.





When an order results from an offer, the tender documents are passed to the appropriate section of the engineering department, who then prepare a final design, check all the figures and calculations, and proceed with all necessary arrangement and detail drawings. These are then traced and prints sent to the shops with manufacturing instructions.

It will be obvious that a great deal of accumulated knowledge and experience lie behind the evolution of any design of specialised engineering equipment such as is produced at Waterside Works. The famous W1400 walking dragline referred to earlier was a case in point and quite recently a design was completed for another walking dragline about half the weight of the W1400. For this machine eighty-seven full-size drawings were required to detail the boom alone.

Coming now to the organisation of the department, the incidence of responsibility is roughly as follows.

The chief engineer is responsible to the technical director and, in turn, he is

Fig. 34 (centre)—Setting up for machining a cast steel crawler base frame on an 8 ft. × 25 ft. planer.

Fig. 35 (left)—Batch planing five engine bedplates for Rapier 410 excavators. Material is Meehanite 'E'.

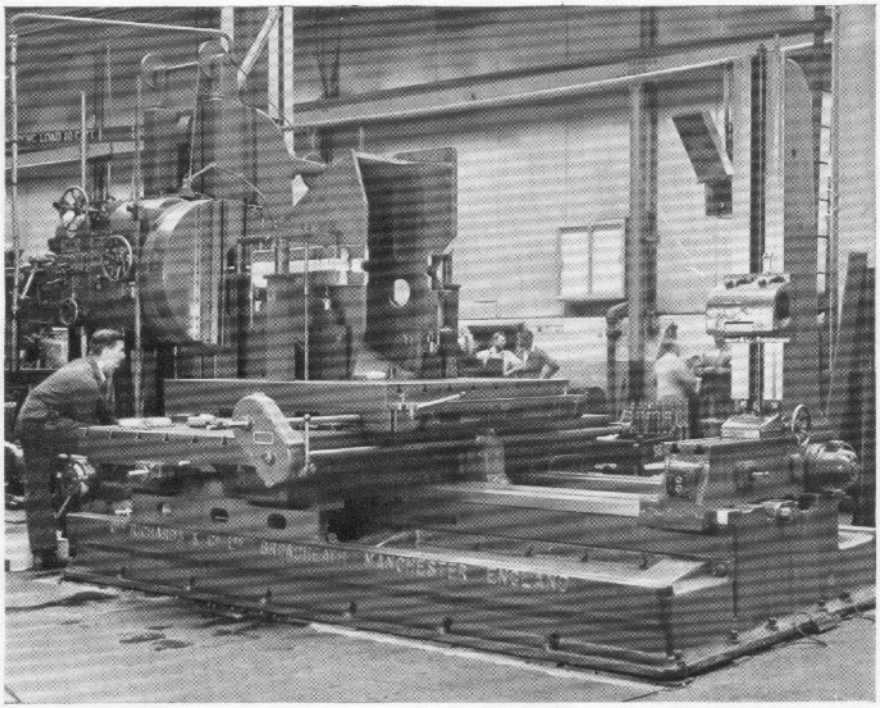


Fig. 36—General view of a Richards No. 5 PRT Horizontal Borer, wide bed model, in the Heavy Machine Shop, set up for machining a fabricated castor bracket.

responsible for the new design work in particular and the section leaders are directly responsible to him for all new designs. The assistant chief engineer is also the engineering department manager and, as such, is responsible for the day-to-day administration of the office, for modifications to design and shop service, sales queries, etc. The section chiefs are responsible to him for discipline and all daily routine matters. The section chiefs, or section leaders as they are sometimes called, have assistants, either one or two in each of the sections. In the case of the electric section, the senior there is virtually chief electrical engineer to the Company.

Apart from a few ancillary workers, such as spare-parts book illustrators and technical clerks, amounting to about half a dozen, the personnel are almost without exception engineers of at least Higher National Certificate standard. Mostly, they have been recruited from the Company's own trained apprentices, coming to the engineering department in the last year of their apprenticeship. The intake of the department is roughly three to six per year.

Issuing drawings and information to the shops for a special job first involves listing every individual item on what is called a 'chromo' sheet, nine copies of which are sent to the production department for distribution to the shops. The sheet records the routing of each item through the shops.

In the case of standard products, the jobs are broken down into assemblies and sub-assemblies, each sub-assembly carrying a group list on the drawing. This group list includes every item on the sub-assembly, right down to the smallest split pin. The group lists are then printed in the usual direct photographic printing machine and about thirteen or fourteen copies of these are issued to the shops through the production department who are also supplied with a heading sheet outlining the total groups required. The production department then uses a multiplier for the batch requirements, and a chromo is then made in the production department to enable the order to be fulfilled in the shops.

All changes on drawings are covered by change notices (Fig. 31) so that all departments are advised. When a change on a part affects its interchangeability, a new part number is taken out to guard against the possibility of spares being sent out in the field which would not be interchangeable with those being replaced.

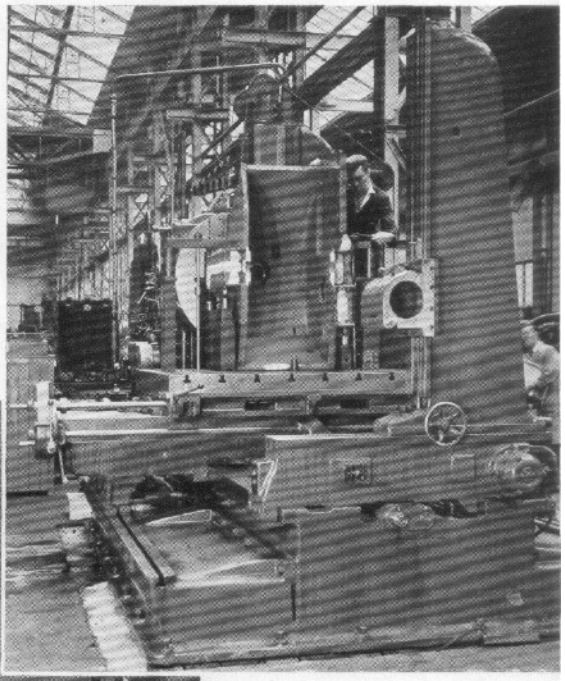


Fig. 37 (right)—End view of Richards No. 5 PRT machine showing extended bed to carry the special large revolving table and supporting main table.

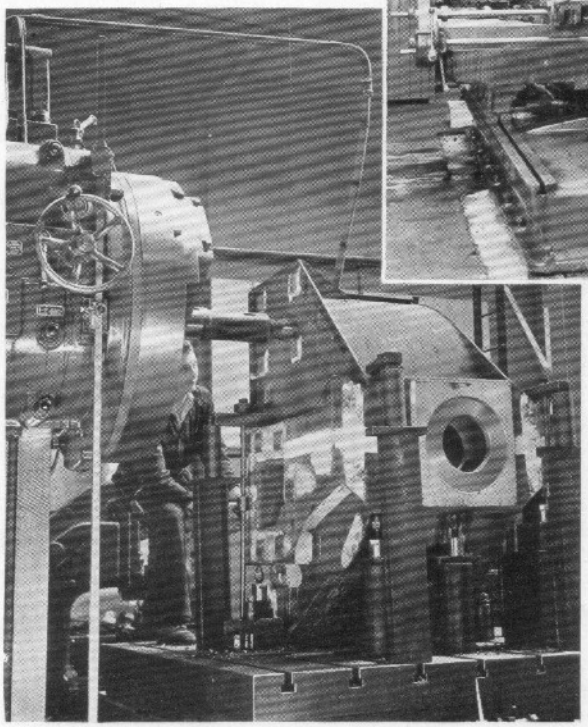


Fig. 38 (left)—Spotfacing locating pads on the castor bracket which has been turned 90 deg. with the revolving table from the position shown in Fig. 36.

Figs. 39 & 40 (top)—Pre-planning board, embracing a year's output, covers four divisions each 15 ft. × 4 ft. deep. Works sections are arranged vertically and weeks horizontally. Chart records bulk hours, not times for individual jobs.

Fig. 41—Part of the shop loading chart which is really an elaboration of the pre-planning chart shown above, but records job times in detail. The chart is in the form of a continuous sheet which is wound in on a roll by the handle seen bottom left.

Production Control

As Ransomes & Rapier products fall into two main groups—standard products and special orders—production planning is naturally influenced by this demarcation and the volume of work involved under each heading.

Standard products, forming the major part of the programme and being of a repetitive nature, are the easiest to plan. Special orders (sluices, breakdown cranes, traverses, etc.) obviously present more difficulty, as designs often vary so widely from previous manufactures as to preclude the possibility of accuracy in any long-term forecasting. This difficulty is not so serious as it might be, however, as the percentage of specials in the total output is relatively small.

The programme as presented to the production department therefore consists of standard products and special orders based on the latest sales information, plus estimated requirements for spares. Presented annually, this programme is analysed by production engineers in terms of man-hours, the total being related to the works' maximum available capacity in terms of both plant and labour. Machine tool purchases and labour requirements are guided by the information thus obtained.

Following this preliminary investigation, each order is plotted as man or machine hours on a pre-planning board (Figs. 39 and 40) which is large enough to cover a twelve months' programme. The pre-planning unit, which was designed and

REQUISITION FOR STOCK ORDER.

DATE.

Authority required to { Order Steel, etc. and/or manufacture } To start in Shops ..... For completion by .....

Steel Castings wanted by ..... Crawler Pads .....

Material " " .....

Electrics " " .....

Engines/Couplings " " .....

Wheels and Tyres " " .....

Chains " " .....

In Stock	Sets	In Hand	Sets
		Steel Castings and Material	Sets
		Mass Parts	Sets
		Mass Parts (Steel)	Sets
		Electrics only	Sets

Average Sales

Manufacturing Period

Authorised for Production Department ..... Date .....

Passed by Engineering Department .....

Passed by Managing Director .....

Fig. 42—The "Requisition for stock order" is a quarto sheet originated by the production department and seeking authority for manufacturing units of machines for stock.

produced at the works to suit the Company's special requirements, consists of four boards each 15 ft. long × 4 ft. deep, on which are represented all the manufacturing shops, each section being allocated a code number and letter.

The sections are arranged vertically, the depth of each section being proportional to the maximum plant capacity. Time is arranged on a horizontal scale divided into fifty weeks, each week being sub-divided into 44 hours. The programme is plotted on the board by attaching strips of paper whose lengths represent the requisite numbers of work hours. Where insufficient man-power is available to run the plant fully, strips of white paper are attached to the board. This gives a clear picture of the labour position at a glance. When the load is in excess of available labour, a red line is drawn on the white strip, showing clearly where extra labour is required.

The estimated number of man-hours which will be needed to deal with spares orders is blanked off in a separate colour. The programme is then plotted on the space not already allocated. Any overload thus found is recorded automatically and, as steps are taken either to increase capacity or sub-contract the work, the resulting decrease in hours is subtracted from the overload figures. Overload figures are a highly variable quantity owing to the fluctuations in the balance of products.

It should be appreciated that only the bulk hours involved in each section are considered at this stage, and that so far there has been no consideration of individual items.

Having fixed the manufacturing period of a job from the pre-planning board, a requisition (Fig. 43) is sent to the buying office for the purchase of materials, the date of origin depending, of course, upon the delivery position. The pre-plan should be consolidated far enough ahead to cater for whatever the delivery position is; in other words, the outside supplies position largely governs the extent of future planning.

Production Department to Buying Department *Date* .....

Order No. ..... Particulars .....

List No. .....

Please arrange for receipt of Material and Bought Goods on the undermentioned dates

	Date	Remarks
Plates and Sections		
Steel and M.I. Castings ...		
Engines or Motors		
Sundries		

Signature .....

Fig. 43—The first step after planning the production of an order is the issue of a requisition for material to the buying department. The form measures 7½ in. × 4½ in.

A "chromo", on which are listed all the items required for any particular order, is then passed to the rate-fixers. In the case of a new job, each item is rate-fixed and processed in detail, and jigs and tools are ordered. Close co-operation exists between the rate-fixers and jig and tool designers and where difficulties are encountered with jigs and fixtures, the processing is arranged to suit the jigs.

Where standard products are concerned, except in cases of new designs, the process sheet will be already in existence and the chromo can then by-pass the rate-fixing staff and be dealt with immediately by a team of girls who multiply the standard times by the quantity required and type the master sheet from which job cards are produced.

At this stage, before the completion of the job cards on the duplicating machines, the process master sheets are sent to the shop loading chart where each separate item is loaded to the shops. This is a paper chart (Fig. 41) on which the man-hours are blocked off in pencil after factorising the time allowed on the sheets according to the latest piecework earnings of the section.

Absenteeism, inter-departmental orders, replacements, etc., are reported back from the shops and are allowed for on this chart.

Having put the start and finish dates on the master process sheet, the job cards (Fig. 44) are made up and issued to the progress department.

Each card on receipt in the progress office is passed to a calculating machine and the number of hours on the card *debited* to the appropriate section of the works. On completion of the operation, a red progress card is returned to the office, to release the card for the next operation and the number of hours *credited* to the section. A credit and debit balance of the shop position relative to the shop load chart is therefore constantly maintained.

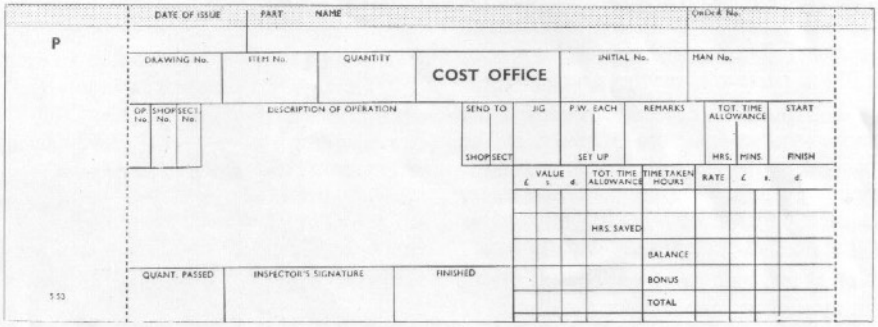


Fig. 44—Cost office copy of 9 in. × 3½ in. job card. Other copies go to time office and the shops, these being colour-coded along the top edge for easy identification.

Should any section become seriously overdue for any reason, such as sudden changes in personnel or insertion of breakdown orders, similar action is taken as when dealing with pre-plan overload.

Before releasing a job to shop loading, which usually functions about 4 to 6 weeks ahead of starting date, all special material requirements are covered by sending the material form to stockyard. Standard sections are kept in stock and are dealt with on a maximum-minimum stock basis.

responsibility for good workmanship and correct assembly of the unit parts lies with the shop supervisors.

Material inspection is done as the material comes into the shops for cutting up, etc. A check is also kept by the scrutiny of test certificates which are sent in by the material suppliers. Reliance must be made, to a large extent, on those certificates, as the quantity of material coming into the works is so large that it would be quite uneconomical to inspect every piece as it came in.

Foundry material comes under the control of the works chemist and he is also responsible for keeping a check on the quality of the castings produced by that department. The conformance of castings to drawings is checked as the parts are on the setting-out tables in the production shops.

The checking of machined parts is done with the usual gauges and jigs. These are issued to the shops by a tool and gauge store and the toolroom staff are responsible for their accurate and correct settings.

In the assembly shops, the pressure testing of castings and fabricated pressure tanks is carried out under the supervision, and to the satisfaction, of the inspection department, before assembly. Also, when the final assembly is ready, it is tested to see that it conforms to the output performance required of it.

Pumps are each tested for output under actual working conditions on a special rig embodying suction and delivery tanks so that the pump output for varying conditions of delivery head may be measured

Inspection Department

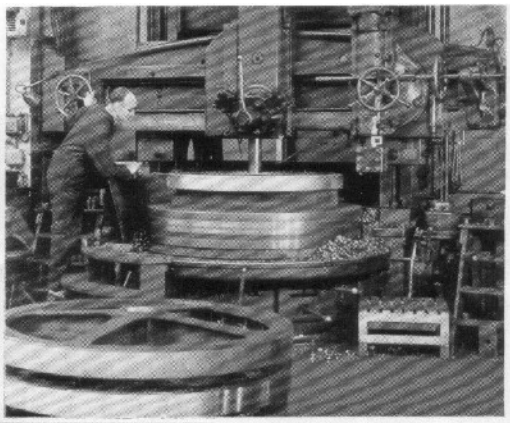
The inspection department is responsible for shop and line inspection; also for the inspection and testing of finished products. The department, for this reason, is in two parts to cover those sections.

Shop and line inspection is carried out during the manufacture of parts, at the machine or the place of fabrication, and is the responsibility of a number of inspectors in each department who are responsible to the head inspector in the department.

Final inspection and testing are carried out by staff personnel under the control of the chief inspector, and it is part of their duty also to attend on visiting inspectors when the latter come either for progress inspection or to test and inspect the finished product. Shop and line inspection is mainly responsible for accepting or rejecting the work in the course of production, and also for its correct fabrication in the shops dealing with structure assemblies.

Any question of suitability of a part, when a defect is discovered, rests either with the head inspector in that department or the chief inspector for a final decision. The support and co-operation of the shops' supervisory staffs of the various departments are encouraged to assist the inspection department and ensure the production of good-quality products. In fact, in the assembly, fitting and erecting departments

Figs. 45 & 46—A Rapier 4142 Heavy Rock-Digging Shovel undergoing tests after assembly. The 3½ cu. yd. bucket is carried on a 34 ft. boom fitted with a special trip motor and barrel. Ward-Leonard D.C. variable voltage equipment controls the electrics.



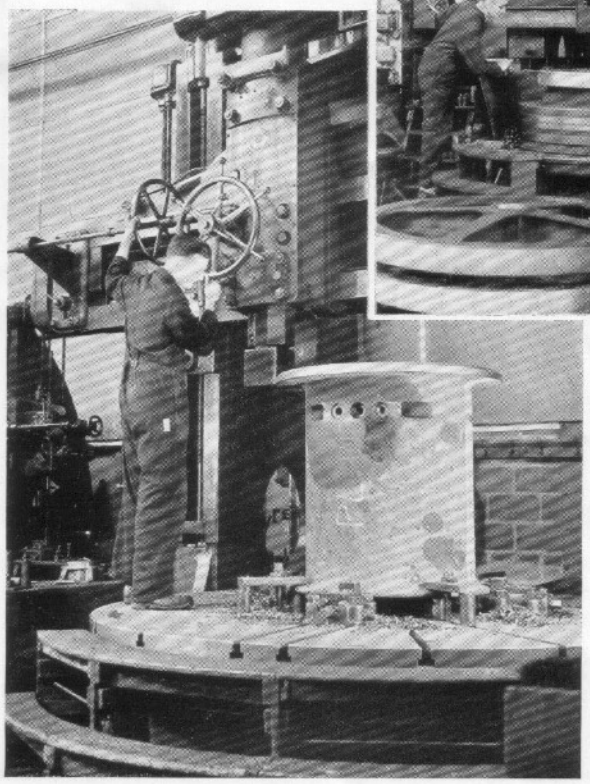


Fig. 47 (above)—Machining 54 in. dia. × 6 in. cast steel excavator rotate rack on a Richards 5 ft. × 3½ ft. vertical borer.

Fig. 48 (left)—Setting tool to flange of hoist drum barrel for a walking dragline on a Richards 9 ft. × 7½ ft. vertical borer. Material is Meehanite "A" stress relieved; tungsten carbide tipped tools are used.

accurately. Concrete mixers are also tested individually to see they function properly and that the assembly and finish are up to standard.

The testing of the mobile cranes is fully comprehensive and thorough. Each machine is individually tested under load conditions, for proper performance of speed and proper functioning, and compliance with the specification for the machine. Excavators are tested under actual digging operations, except for the larger sizes which are tested with a loaded bucket. The sluice work which the firm constructs cannot often be inspected as a whole, and so it is done in component part assemblies. Operating gears are tested actually under loaded conditions to details given by the engineering department. This amount of work naturally calls for a fairly large department for inspection work.

For line and inspection work in the machine shop there are fourteen inspectors and one head inspector. Each looks after his particular section of the shop, where he inspects the work during and after the part is completed off the machine. This gives some control at the points where mistakes may occur and where they can most easily be rectified.

It also discloses bad castings, defects which are uncovered during the machining operations, and these are then, in the case of steel, sent back to the makers for replacement if too bad for any repair work. The repair of steel castings, especially gears, has to be considered very carefully as any welding has a tendency, as is well known, to distort the wheel, and only minor defects are put right by this method.

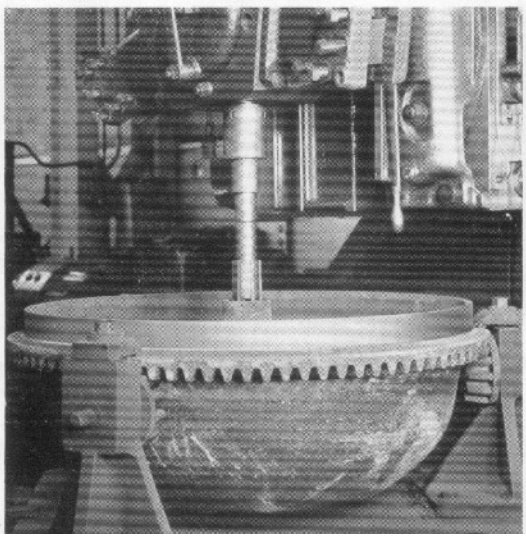
In the constructional shops, the girder work and similar assemblies are continually under the eye of the inspector in that department. In structural and fabricated work done at Waterside Works tolerances are much finer than is usual, because often a certain amount of machining has to be done afterwards and the larger limits cannot be allowed, as too much would be removed in the final machining.

All micrometers and gauges used in the manufacturing shops are kept in the toolstore attached to the machine shop. The accuracy of these gauges is set and checked by the toolroom. It is the tool store's responsibility to see that they are correct, or to return them to the toolroom for rectification when necessary.

Outside inspection is not frequent as many products go abroad and, even at home, work is often erected by the customer; but where it becomes necessary to send out erectors, the work is either finally checked over by a well-experienced member of the erection and service department who carries out the testing and handing over to the customer; or, if necessary, this work is done by an inspector from the staff side of the inspection department. In the case of outside firms manufacturing for Ransomes & Rapier, inspectors are sent out to them to see that the work is being done correctly.

Fig. 49—Boring the boss of a Meehanite 'E' concrete mixer body end.

Fig. 50—36 in. duplex vertical mill machining cast steel crawler sprocket while setting up is being done for a hoist and brake drum.



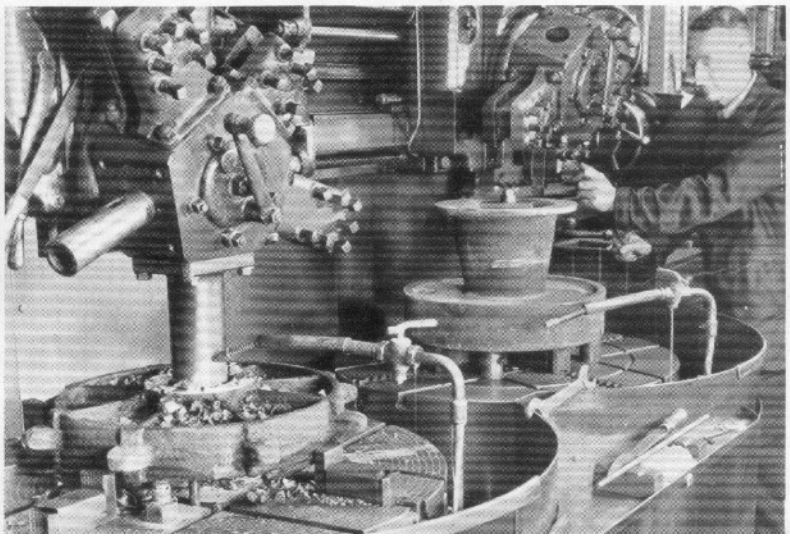


Fig. 51 (above)—Butler 18 in. stroke Super Shaper engaged on machining m.s. latch plates.

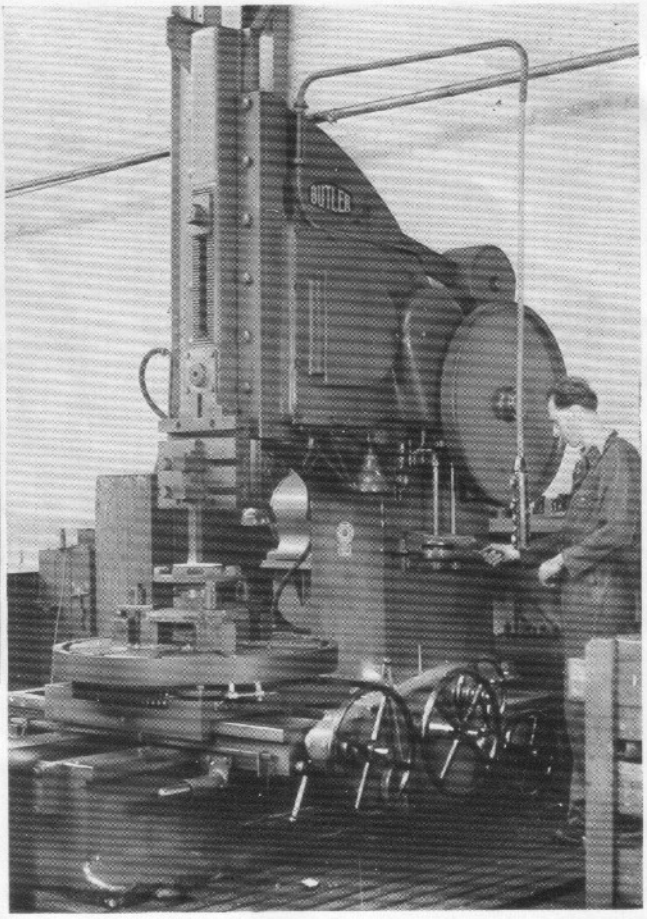
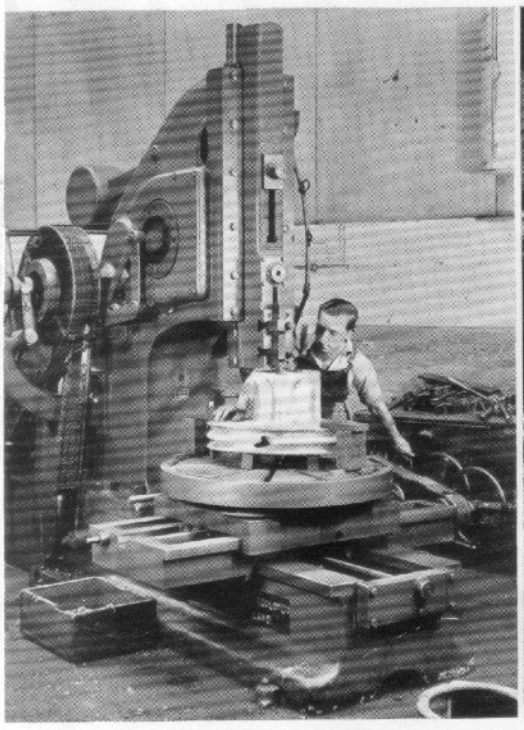
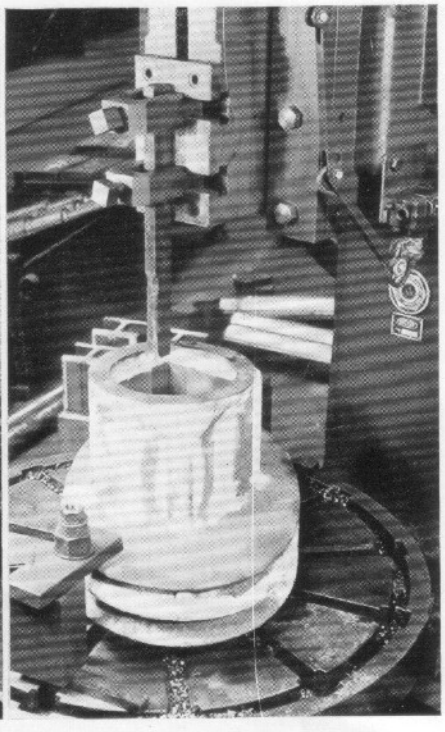


Fig. 52 (right)—Slotting internal 3½ in. square × 9 in. deep through cast steel sliding clutch on Butler 21 in. stroke Slotter.





Figs. 53 & 54 (above)—General and detail views of opening out bore of near side cam (Mechanite 'E') to 6 in. square × 14 in. deep on Butler 14 in. stroke Slotter.

At present in production are two large excavators, a W600 and a W1400. Parts of these are being done by two firms in the north of Britain and will require the attendance of an inspector at frequent intervals to see that the work is going on correctly and if the quality is acceptable to Ransomes & Rapier. In the case of the W1400 which is now working at Corby, monthly visits were made both in the construction of the component parts at the steel makers and also at the steel erection firm.

When the machine got to site, it was the responsibility of the inspection department to approve the correct alignment of the gearing which was put on to the machine for the first time, and the setting, in relation to the other gearing and the superstructure frame, of the bridge girder across the machine which carries the walking gear.

The final testing of Rapier products is done to British Standards requirements wherever these apply and a certificate is made out by the department and signed by the chief inspector on an official form for the customer's records and use.

Personnel Management

The personnel department is responsible for the engagement of all hourly-rated labour. Full particulars of applicants are recorded in an interview book for future reference. If an applicant is engaged, the particulars are entered on a starting form which is passed on to the foreman who will be in charge of him. This form then goes to the time office for wages record purposes before being returned to the personnel office for filing. A Kardex record is kept of all on works payroll, including personal particulars as well as a complete record of a man's standard rate of pay throughout his period of employment.

The department also controls the Apprentice Training Centre, in which there are generally up to thirty apprentices receiving instruction. There are two full-time instructors, one who looks after the general planning of the apprentices' programme, including lectures and their bench-fitting experience, whilst the other looks after their training in metal machine operating. (See Figs. 55 to 59 below).

Apprentices remain in that department for six months, two months on the fitting benches and four months on the various machines, such as lathes, milling, grinding, shaping, slotting, drilling machines, etc. During that time they receive lectures from the various departmental heads on the work carried out by their departments.

A lad having passed through this department should have a good idea of the organisation and the seniors and responsible officials to appeal to should information have to be sought from their sections. Talks are given on accident prevention, the Company's various products, works interests, working drawings; also the micrometer and vernier. Apprentices are, moreover, fully instructed as to works rules, time records, wages, costing and storekeeping.

All apprentices are given the opportunity of attending the Ipswich School of Technology for one day each week with pay and their attendance records are closely watched. Special attention is paid to correct enrolment at the session commencement, when all are asked to complete a questionnaire on the courses they intend taking. They are expected to attend regularly the evening classes included in their courses. At the present time upwards of 70 per cent of those under 21 years of age are attending.

Apprenticeships are under competitive conditions, the best lads having the best opportunities. Quarterly reports on their conduct, interest and work engaged on,

APPRENTICES' SCHOOL

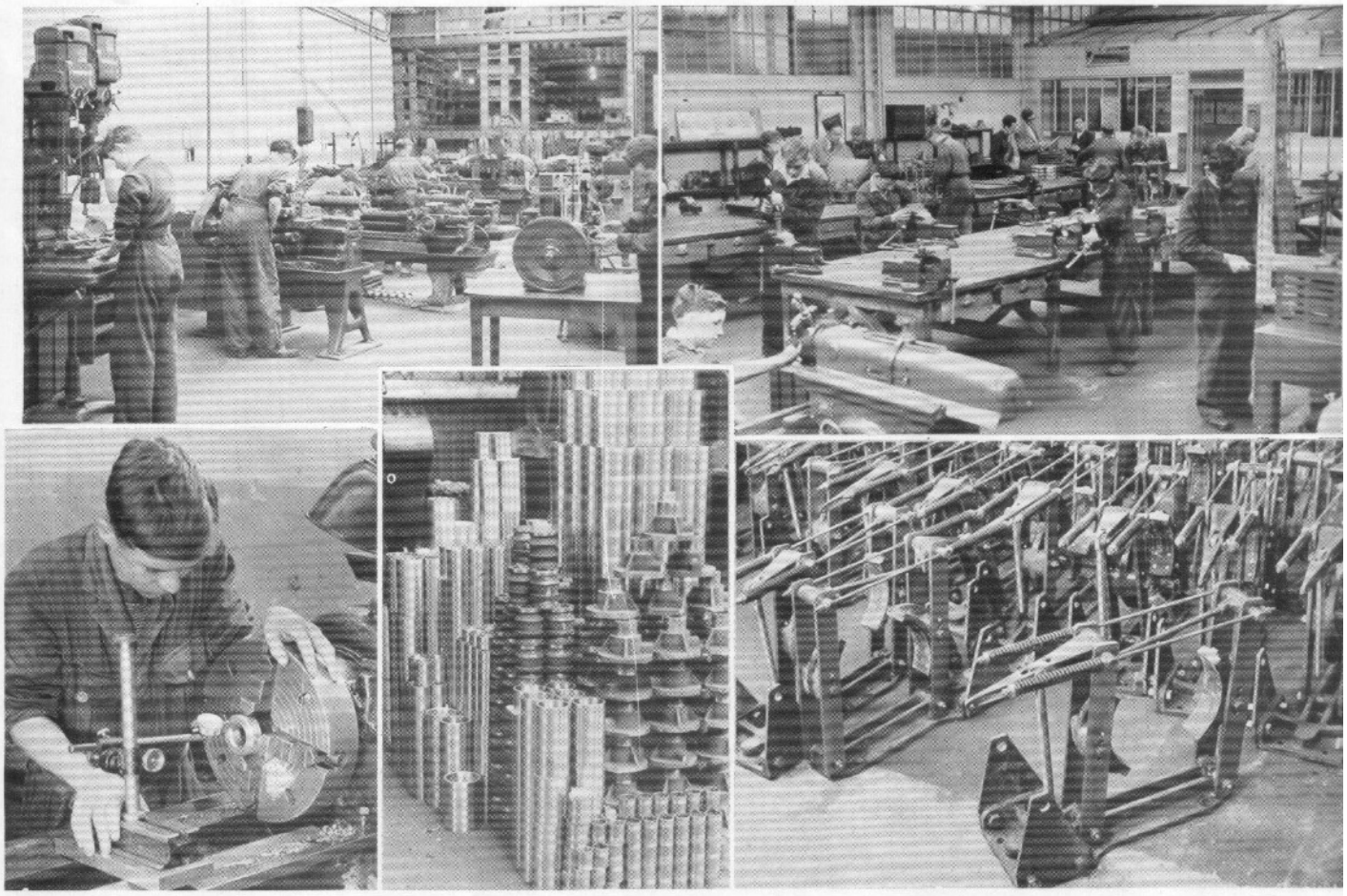


Fig. 55 (top left)—First year apprentices at a 2-spindle drill and a line of centre lathes.

Fig. 56 (top right)—At the fitting benches in the Apprentices' School.

Fig. 57 (bottom left)—A test in setting; re-centring a screwed bush in an independent 4-jaw chuck of a Lang screwcutting lathe.

Fig. 58 (bottom centre)—A variety of turned work produced by first year apprentices and absorbed into production.

Fig. 59 (bottom right)—Fitting and assembly work exemplified by batch of Lewis brakes for mobile cranes.

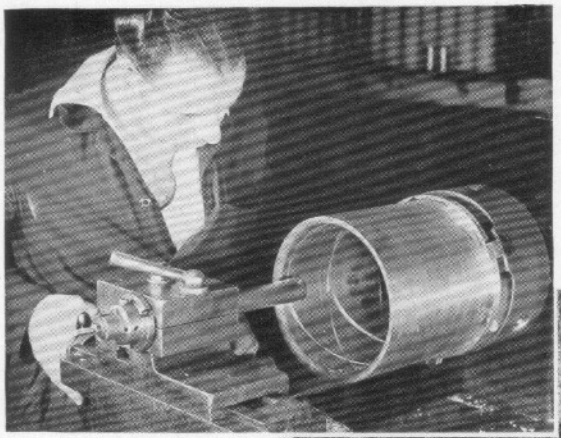


Fig. 60 (left)—Cutting oil grooves in 8½ in. dia. bore × 9 in. gun-metal bush.

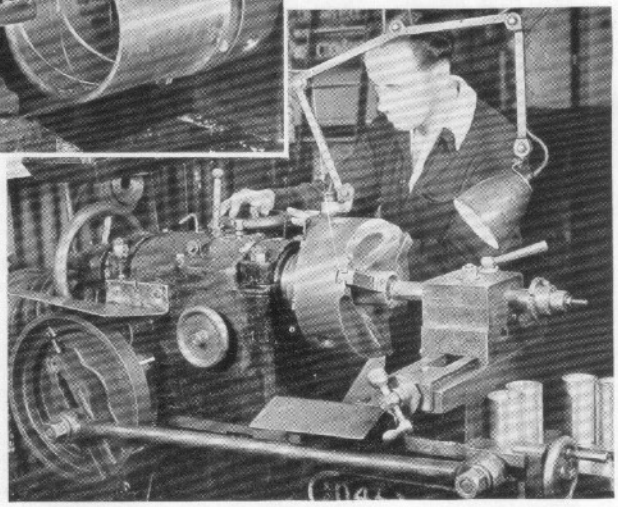


Fig. 61 (right)—General view of grooving machine designed and built at Waterside Works. The machine has nine speeds and variable stroke. Work up to 18 in. long can be accommodated.

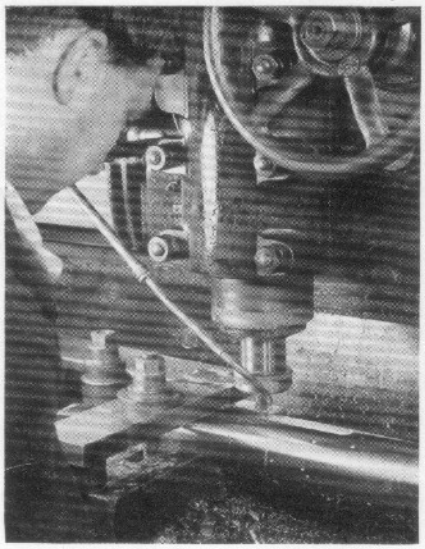
also their timekeeping, are sent into the personnel office by their foremen. These are entered on an apprentices record card together with examination results and yearly reports from the School of Technology. This information enables the department to grade each lad according to his qualifications.

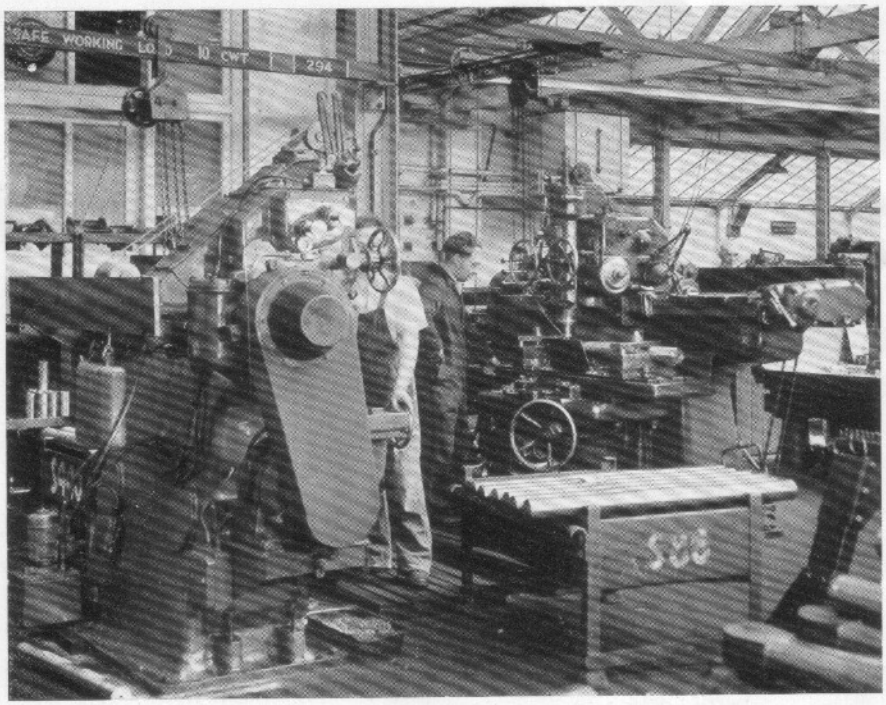
An annual review takes place for choosing six apprentices as candidates for premium awards.

A vote is taken of all apprentices on these six candidates at an annual general meeting to determine who is the best sportsman, and this vote helps in choosing the two best boys of the year. The apprentices' vote is not the final factor, but it is taken in conjunction with their reports on workmanship, scholarship and other general particulars placed before the director who makes the final decision after interviewing them personally.

Engineering training at Waterside Works is on a very wide basis and products are so varied that those who do well, especially those who have successfully passed through the Ipswich School of Technology, are well equipped for obtaining good junior technical posts at the end of their apprenticeships. For that reason the Company stand to lose a number for employment elsewhere. Under good competitive conditions such as these they are also better equipped for going abroad than those trained for mass production techniques.

Apprenticeship winners are given experience in all departments including technical design, and the runners-up almost equal. Apprentices obtaining the ordinary National Certificate of the Institute of Mechanical Engineers are qualified for at least four departments and this also applies to the City & Guilds Intermediate Certificate. Those going beyond this standard to the Higher or Final Certificate are put to a greater number still. Quite a number of the students attending the Ipswich School of Technology obtain their Higher Certificates. Bonuses are paid weekly to apprentices who win them.





Figs. 62 & 63—Milling 1¼ in. wide × 5¾ keyways in 3 per cent nickel steel drumshafts and the two Richards Type VK Vertical Slot Drilling and Keyway Cutting Machines which do the work automatically.

In addition to the Incentive Bonus that applies to hourly-rated workers (which is based on the average piecework earnings and payable proportionately to apprentices) there are Proficiency Bonuses payable to all lads who reach a high enough standard in their foreman's estimation as regards timekeeping, general conduct and interest in their work, and who receive the sanction of the Works Manager. These bonuses won over a period of three months are payable weekly for the following three months. Badges are worn by the winners and it is understood that bonuses can be immediately stopped by a foreman should there be any misbehaviour or irregularity. It is evident that a very high standard is reached because of this bonus system, since between 65 and 70 per cent win them.

Post-graduate apprentices are accepted and an all-round training similar to that mentioned above is offered. They generally spend a fair proportion of their time in some technical department towards the end of their two- or three-year apprenticeship. Annually, training is provided for a good number of students during the long vacation. At the present time quite a cosmopolitan group is at the works including two Germans, two Iraqi, one Italian, one Spaniard and one Ethiopian. In addition, two have come from English public schools. The period for this training is approximately eight weeks.

The canteen staff comprises two joint manageresses with the necessary staff for catering and maintaining the canteen hall and garden. Besides a total of 350 main meals daily, quite a number of snacks are served as well as teas for overtime workers and those on night shift. Bulk tea is made in the canteen, taken to the shops on trollies and served to the men at their places of work. Tea has to be served so that all workers can have it within the ten minutes allowed. For easy serving the tea is brought round in insulated urns of two gallons or less.

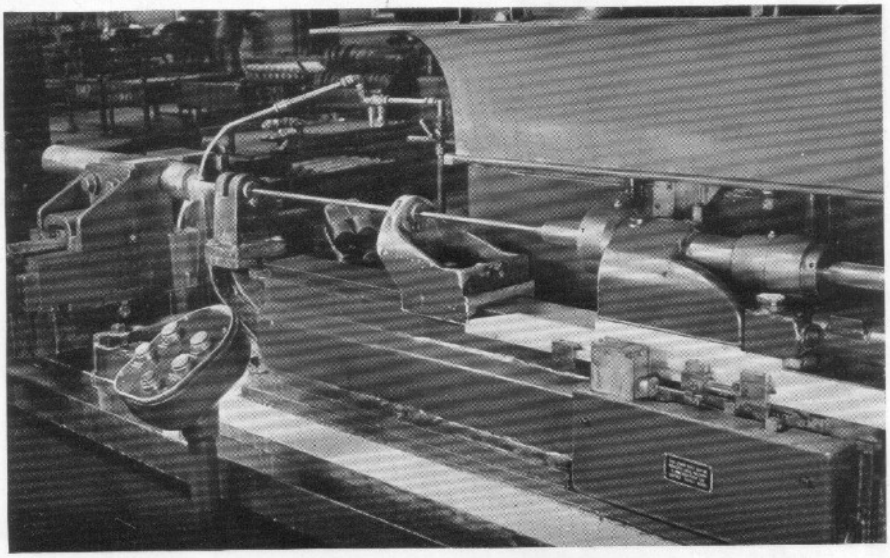


Fig. 64—Working at 490 r.p.m. and .064 in. per rev. feed, this Archdale deep hole drilling machine is drilling a $\frac{1}{4}$ in. B.S.P.T. tapping hole 12 in. deep in a short steel shaft.

The staff of the personnel office is headed by the personnel manager who also supervises the staff in the first aid room, the canteen and also the patrolmen, lodgekeepers and others responsible for security throughout the entire premises day and night.

Workers under eighteen have an advantage over the adults of paying a cheaper rate for the main meal of meat and two vegetables, the same costing eightpence as against one shilling. This is done to encourage the right sort of eating by the juniors of the works. Good well-cooked meals, with fresh vegetables, fruits and whole-wheatmeal bread are served, and also the highest standard of cleanliness is maintained in a well designed and comfortable building.

The department tries to keep in touch with workers when absent. Even if away a long time, their names are not crossed off the works books unless the department are

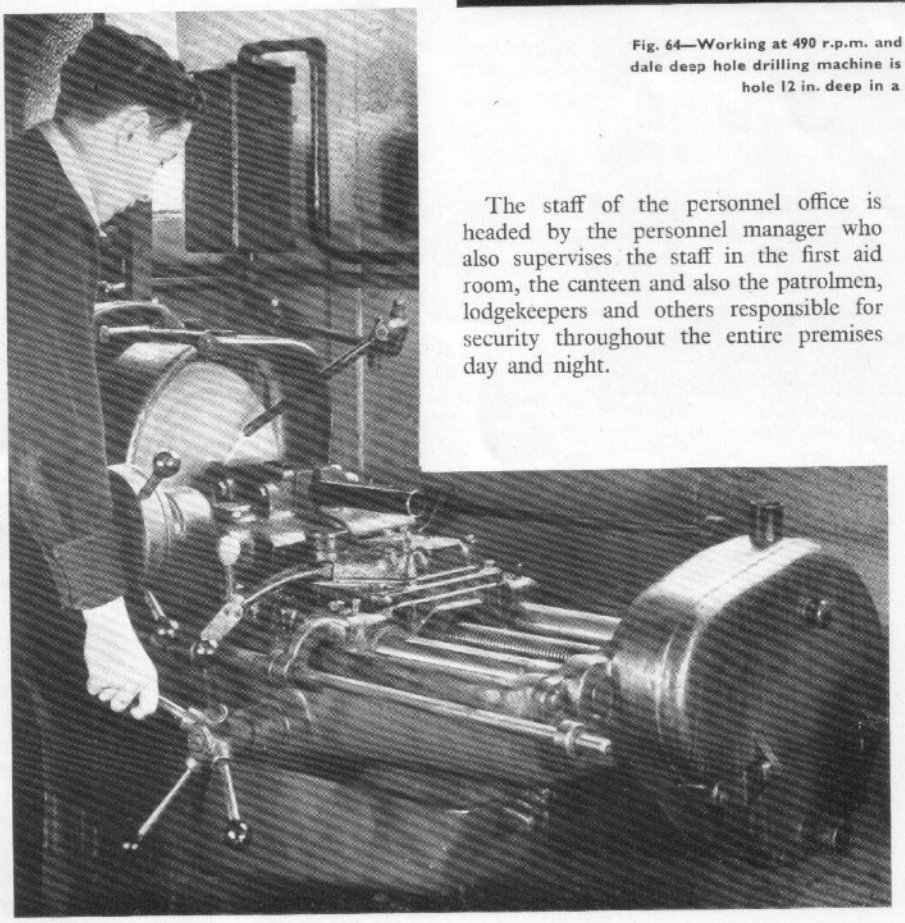
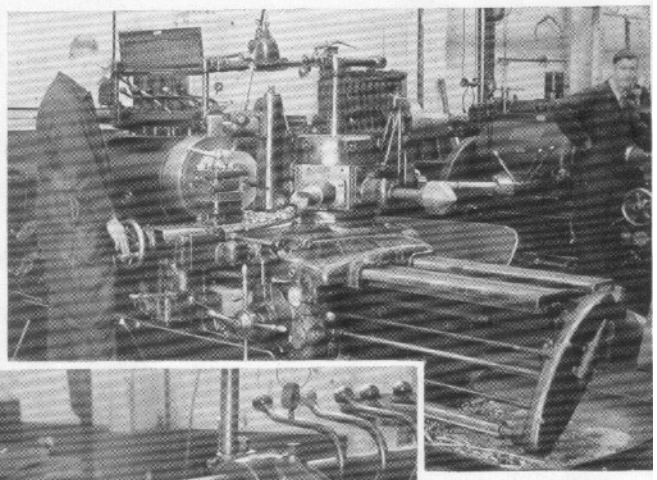


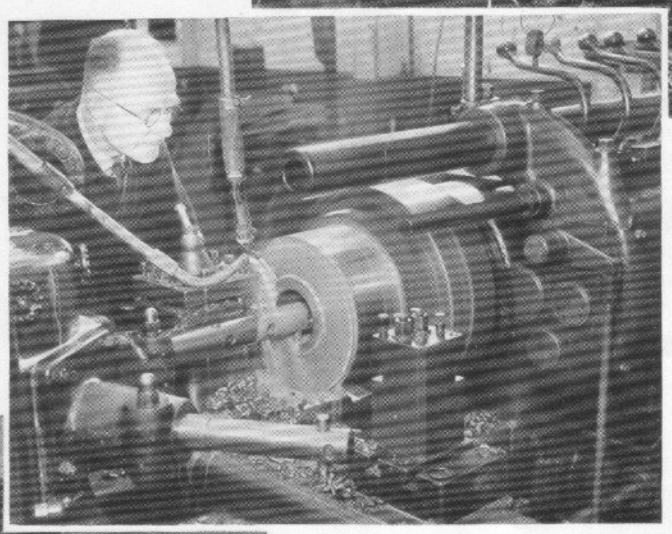
Fig. 65—Tubes up to 4 in. inside dia. and bolts up to 3 in. dia. are screwed automatically on this No. 4-3 'Kenco' Screwing Machine.

officially notified that they will not return. This contact is maintained so that if it proves at all possible to give assistance or advice, an opportunity to alleviate any trying conditions is not missed. There is an Appeals Sub-Committee of the Works Industrial Council which helps to administer the small funds that are available for distribution and they also decide what works collections should be made for local and national charities.

The first aid room is open with a state-registered nurse in attendance during all working hours, providing there are at least one hundred workers on duty. Although Ransomes & Rapier are heavy engineers it is not a legal obligation to make such provision for that small number; but the management think it worth while.

A medical officer is in attendance one full morning session per week. This gives workers an opportunity to consult him on their health problems in addition to works injuries. This advice can be obtained with a minimum of inconvenience and loss of working time. This is of great value and it is evident that the section is run on right lines as the number of those making use of the facilities offered is quite high.





Figs. 66 & 67 (top & centre) —General and close views of machining a 'D' steel hoist pinion blank 12¼ in. dia. on a Ward No. 10 Combination Turret Lathe

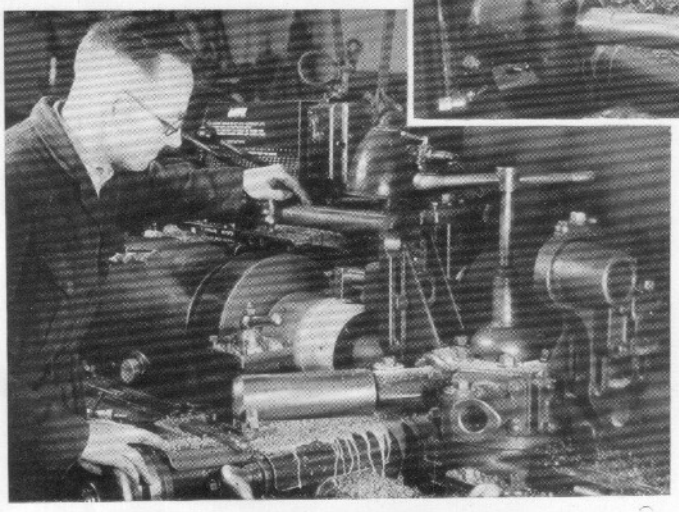


Fig. 68 (bottom)—Facing, boring and turning gunmetal bushes on a Ward No. 7 Combination Turret Lathe. Work is gripped on riser, while rough boring and turning are done simultaneously at 294 r.p.m.

There is a sickness benefit scheme which applies to the waiting days as well as to the National Health Insurance benefit days (providing absence is covered by a doctor's certificate). The amount payable is greater on the waiting days than the remaining period. Benefits vary according to whether the employee is under or over 18 years of age and according to his length of service. Benefits begin after employment of six months, a greater amount being paid to those with a service record of five years or more.

In addition to the staff contributory pension scheme, pensions are generally paid on a non-contributory basis to hourly-rated workers who have been employed at the works twenty years or more. The weekly payment varies according to the length of service and applies only on retirement.

Present total personnel of the firm is 1,810, which includes the London office. A comparatively small night shift is worked, the men alternately working day shift and night shift with a fortnightly change. The number of men on the night shift is limited by the shortage of skilled men available with the necessary experience for the class of work required. The night shift hours are a little unusual in that they are linked up with the day shift finish of 5.30 p.m., working until 3.30 a.m. Monday, Tuesday, Wednesday and Thursday, whilst Friday's night shift commences at 4.30 p.m., finishing Saturday morning at 1.30 a.m. This set of hours is preferred to the more normal night shift of 10 p.m. to 6 a.m. by most of the workers who have their own means of transport or live near to the works. The finish of 3.30 a.m. and 1.30 a.m. gives them the opportunity of getting to sleep before normal daytime noises begin and also enables them to take the mid-day meal with their families, which is a matter of real economy.

Absenteeism, as shown by the following figures, has improved considerably since the end of the war. In 1946 the percentage total absenteeism of the planned production hours of the whole works was 6.8, whereas in 1952 this had dropped to 4.4. Absenteeism due to sickness included in the above figures in 1946 was 4.2 and fell in 1952 to 3.0. Accidents in 1946 amounted to .6 and in 1952 to .45. Absence with leave in 1946 was 1.1 and in 1952 .75. Absence without leave, which includes lateness, in 1946 was .9 and was

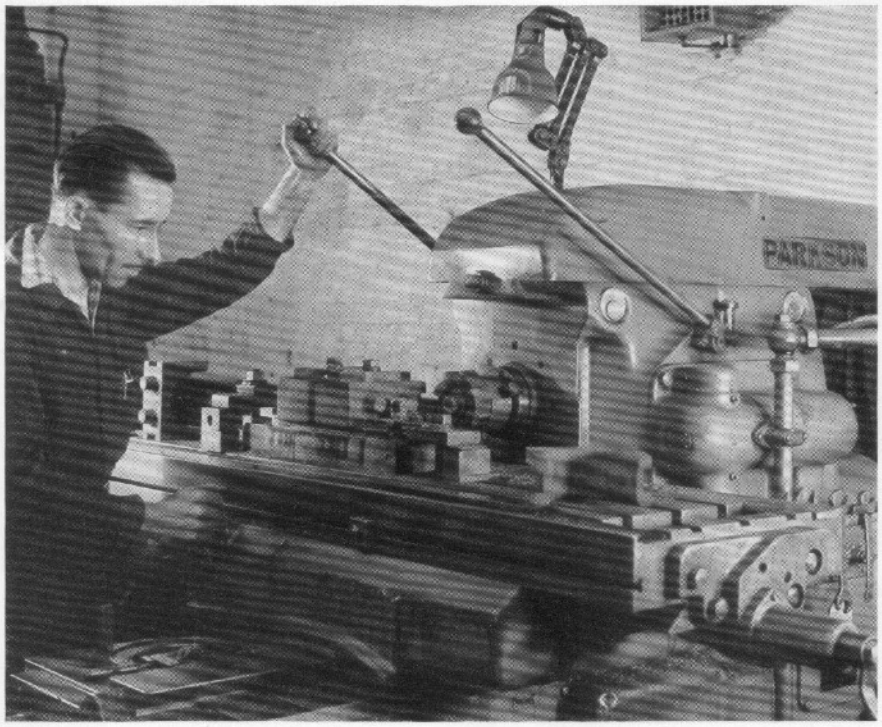


Fig. 69—Milling Meehanite 'C' axle spring pads in pairs in a special jig on a Parkson 3N Plain Miller. Work is finished in one cut at 1½ in. per min. traverse.

down in 1952 to .2. The higher figures relating to 1946 were, of course, largely due to war fatigue. Improvements in workers' conditions since that time of severe strain, and the management's interest in reducing voluntary absenteeism to a minimum in the interest of maximum output have had the desired effect. Workers have responded as the figures show.

Accident prevention is promoted by the personnel department through the foremen who are responsible departmentally. The Company support and send representatives to meetings of the local Industrial Accident Prevention Group. There is no committee formed for safety matters only; but items concerning that side of the workers' welfare are raised at the Works Industrial Council meetings and also at shop committee meetings. When an incident concerning safety occurs, it is thoroughly looked into and all concerned are brought into consultation. This is done to get improvement wherever possible. The information is circulated to other departments that might profit by it.

In view of their expanding business, the Company are particularly anxious to obtain good apprentices. High-grade diversified engineering requires a greater proportion of skilled workers than most engineering set-ups. In fact skilled adult workers at Waterside Works amount to one-third of the adult hourly-rated workers, whilst the semi-skilled exceed that. A few skilled occupations are available to the semi-skilled worker after long-term training and experience under upgrading or dilutee conditions that have been the general practice in the past or have been agreed to by the interested parties. Under conditions that are considered correct in the industry, better semi-skilled machine operators are encouraged to take on more highly skilled work from time to time. Quite a number are registered as dilutees.

Records concerning labour turnover are kept and analysed quarterly, helping the management to look out for necessary improvements. These show the numbers leaving owing to such reasons as: financial difficulties, to obtain higher wages, for employment nearer home, returning to previous employment, leaving the town, unable to work night shift, personal reasons, health retirement, or deceased.

To encourage and develop the better apprentices, four are sent annually to the Outward Bound Trust Schools at Aberdovey and Burghead. The Company are also associated with the Meehanite Training Group and send some of the best moulding and patternmaking apprentices and laboratory assistants for additional experience and tuition to their school at Butterley, Derby. Fitting and erecting apprentices are offered, whenever possible, outwork experience and are sent to help on the Company's stands at trade exhibitions.

Fig. 70—Squaring the ends (12.500 sq. and 8.500 sq., both plus or minus .0005 in.) of a walking shaft for a No. 150 Excavator. Capacity of machine is 12 ft. high × 18 ft. travel.

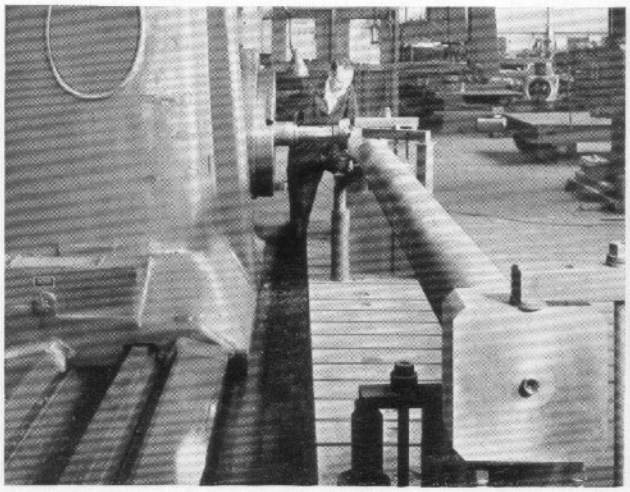
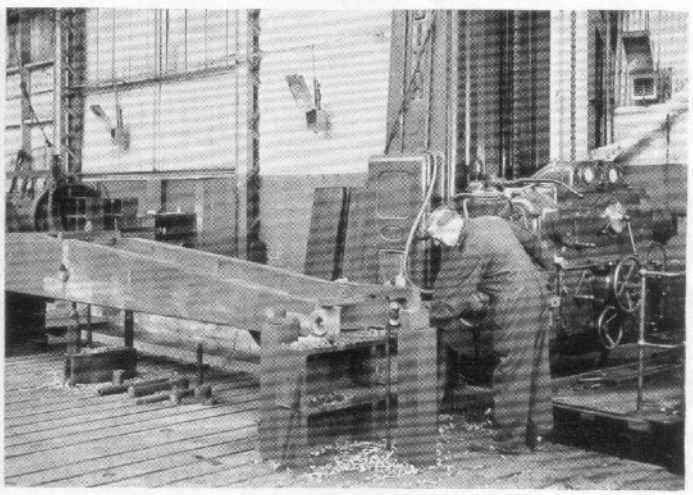


Fig. 71—Drilling and backfacing fabricated steel boom for a No. 423 Excavator. This Asquith 6 in. spindle horizontal borer takes work up to 9 ft. high × 25 ft. long.



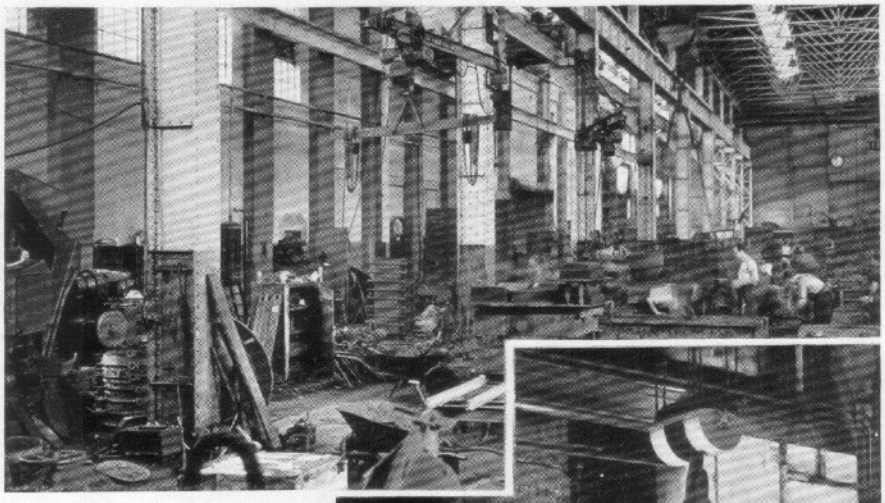


Fig. 72 (top)—Main bay of the foundry is 37 ft. wide between columns × 34½ ft. high × 246 ft. long. Overhead cranes have capacities of 25 and 10 tons with 25 ft. lift.

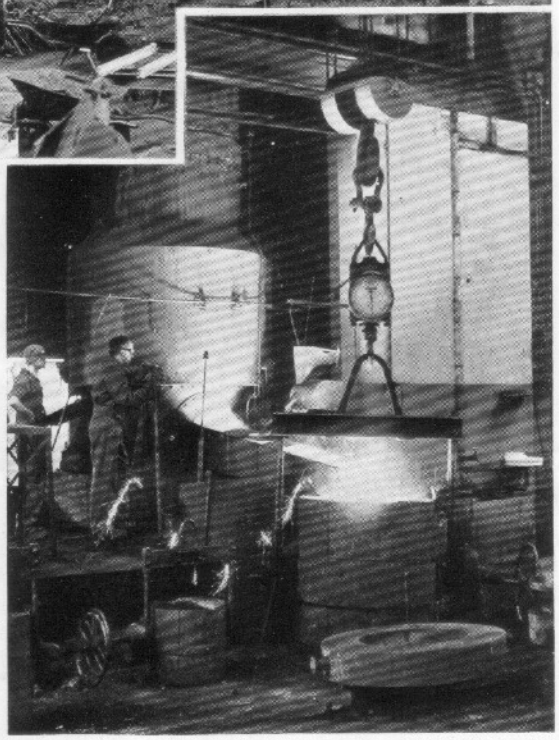


Fig. 73 (right)—One of two cupolas producing Meehanite metal under strictly controlled conditions of temperature and analysis.

main bay of the shop there are also two 5-ton jib cranes, two 2-ton electric hoist blocks, one 30-cwt. hand crane, and two 1-ton electric blocks. There are also a 3-ton derrick crane at the scrap break-up, which is outside the foundry, and a 1-ton overhead crane for serving the small cupola.

Molten metal is supplied by two main cupolas, one producing 3 tons of iron per hour and the other 4 tons per hour. Serving the machine moulders there is also a small cupola which produces 25 cwt. per hour. Total output is 50 tons of castings per week, this yield of castings being 73 per cent of metal melted. Besides the melting equipment there are three large core ovens for drying moulds and cores, and one which is used for stress-relieving the castings.

In the brass foundry there is one furnace with a 600 lb. crucible, and one furnace which takes a 400 lb. crucible. Output from this foundry is 2½ tons of non-ferrous castings per week, which include gunmetal, phosphor bronze, and aluminium.

In the main shop there is a Pneulec turnover moulding machine which takes a box 3 ft. 6 in. × 2 ft. 6 in. up to 18 in. deep each part. Adjacent to these there are smaller moulding machines of 'Coleman's' manufacture which take 18 in. × 22 in. boxes, of which there are two,

Fig. 74 (below left)—Mould of a sluice groove showing assembly of top and bottom halves. Bottom half contains cores to give correct shape of part and cores are surrounded by controlled runner system to exclude any particles of dirt.

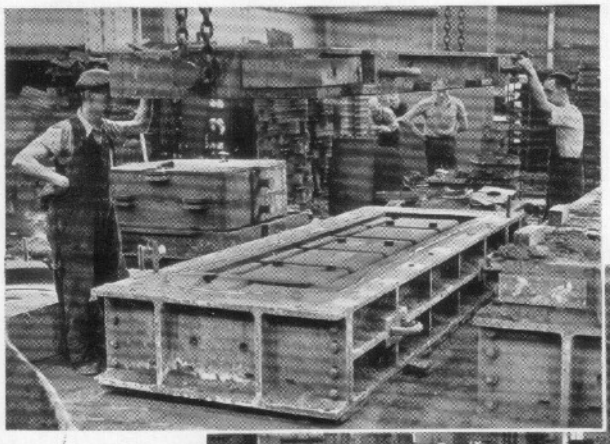


Fig. 75 (right)—Pouring for the sluice mould seen above.

Foundry

The main foundry consists of a building 264 ft. long by 72 ft. wide, with a small adjoining shop which is used for machine moulding. Also adjoining the foundry are the sand reconditioning plant, stress relieving oven, core drying oven, brass foundry, and metallurgical laboratory. Foundry personnel include the following: skilled hand moulders, machine moulders, fettlers, crane drivers, cupola hands, slingers, moulding box fitters, clerks, apprentices and students, core-makers and machine core-makers, including one completely blind operator. In the brass foundry there are two hand moulders and one machine moulder. Administration of the foundry is the responsibility of the foundry superintendent, with the assistance of a chief metallurgist, foundry foreman and three charge-hands.

Materials handling equipment comprises one 25-ton, one 10-ton, and one 5-ton overhead travelling electric cranes. In the

Fig. 76—Part of the bench side of the pattern shop which covers 6,750 sq. ft. The pattern store, an additional building, occupies 5,200 sq. ft.

and two Coleman machines which take 12 in. × 12 in. boxes, one of which is used in the brass foundry.

To serve the whole of these departments, there is a laboratory whose particular responsibility is sand control, metal processing, and the making and testing of test bars; also the analysis and testing of all kinds of metals used throughout the firm, including steel castings.

The weight of castings produced in the main foundry varies from a few pounds up to seven or eight tons. This is the general run; but, from time to time, special castings up to fourteen tons have been made with the facilities outlined above.

As only high-grade irons are used in Ransomes & Rapier products, the iron foundry produces Meehanite metal exclusively in three grades, A, C and E, giving castings of 14 to 28 tons tensile. Hot metal is produced under scientific control, with every ladle poured being tested as to its suitability for the job in hand.

All metal is subject to chemical and physical tests to ensure conformance with the specifications. The two main cupolas are of the continuous melting type with rates of 3 and 4 tons per hour respectively (Fig. 73).

Moulds are prepared so that the metal enters at the correct rate of pour and embody a controlled runner system which ensures that particles of dirt, etc., are trapped. Sand used is carefully controlled for moisture and strength so that it will not be washed away during the running of the hot metal.

The scrap as well as the heads, risers and runners are segregated into various heaps and used to re-melt to produce further castings. These have to be kept into various grades so that the close control demanded of Meehanite metal is kept by the laboratory. The figures for the scrap are taken by people quite outside the foundry area, and while the average in moulding shops runs to about 4-5 per cent, the average scrap for twelve months at Waterside Works is rather less than 2 per cent.

Fig. 74 shows the mould of a sluice groove. Sluice grooves are cast in quantities and have to be very true to pattern, and of first-class metal. As will be seen in the photograph, the mould is more or less made from a block pattern and the inside and the outside are both cored out.

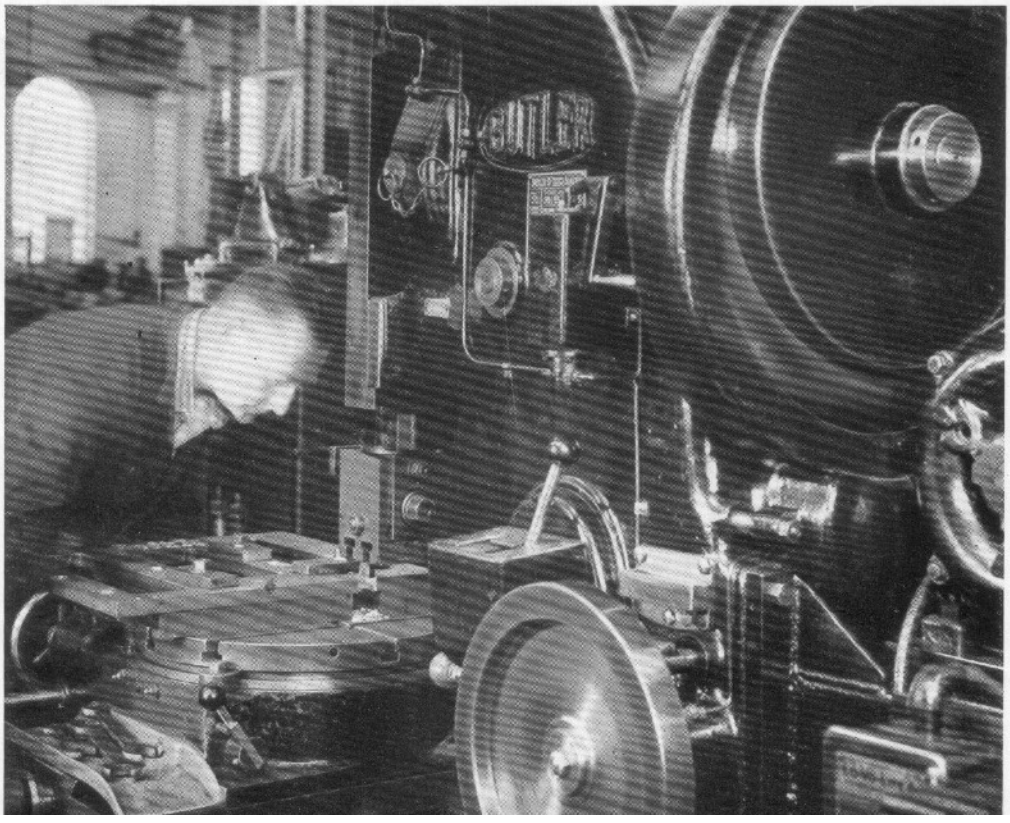
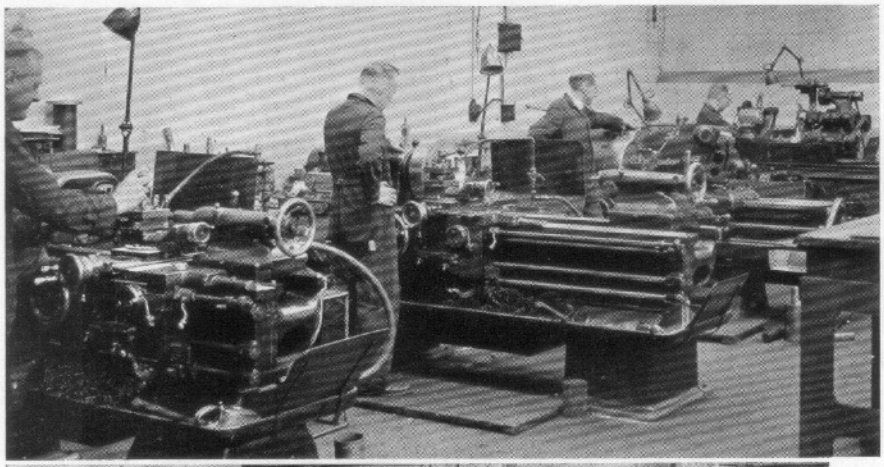
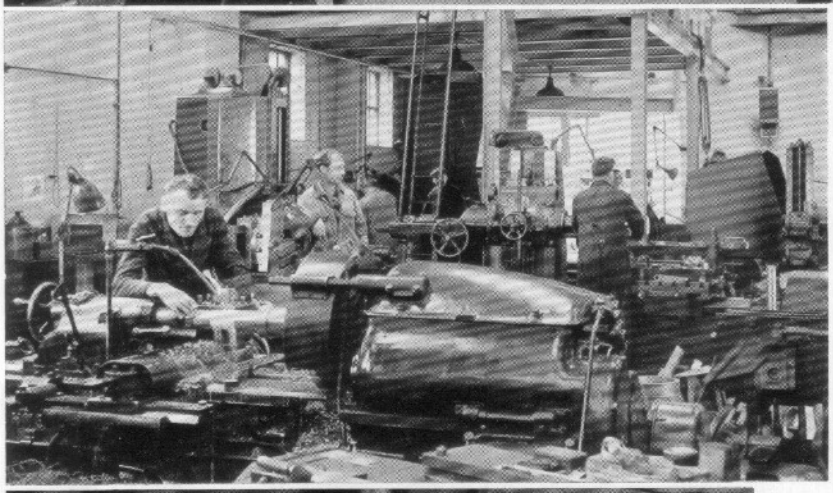


Fig. 77—Profiling a jig plate on a Butler 8 in. stroke High Production Slotter in the toolroom.

This is because of rather an intricate design which is not easily mouldable. Huge quantities of these sluice grooves, which vary in weight from 25 cwt. up to 2½ tons, have been made in the past. As will be seen by the photograph, special boxes have to be made for these particular grooves to ensure the use of a minimum amount of sand consistent with giving good castings.

Fig. 78 (top)—Line of centre lathes and a Churchill Universal Plain Grinder in the toolroom.





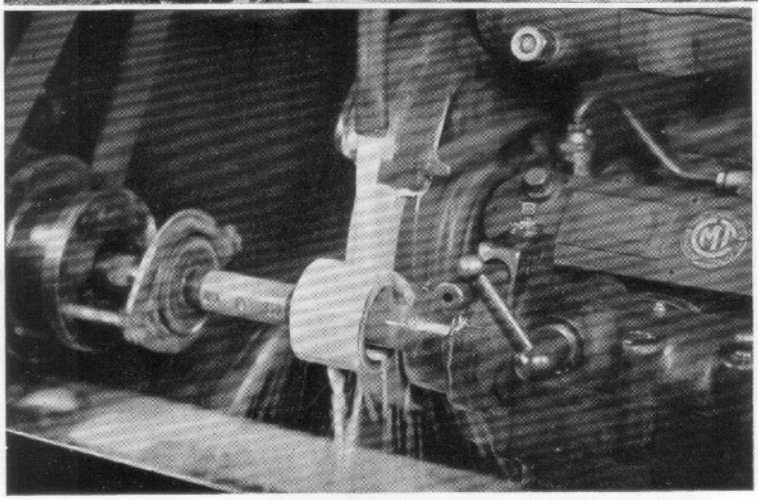


Fig. 79 (centre)—Another view of the toolroom showing a group of machines comprising a Lang 21 in. swing gap lathe, Butler 36 in. stroke Openside Crank Planer, and a Richards No. 1 Horizontal Borer.

Fig. 80 (bottom)—A double-ended plug gauge being finished on a Churchill Universal Plain Grinder; 'go' 2.8748 in., 'not go' 2.8755 in.

The following illustration shows this groove casting being poured with Meehanite metal at approximately 1300 to 1350 deg. C. It will be noted that there is a skimmer and also a pourer, the idea being always to keep the pouring basin full, to avoid down currents of air and slag which would cause trouble in the casting.

Before each pouring of metal, a sample wedge is taken from the ladle and poured into an appropriate core which produces a wedge. This is then chilled in water and broken on a block, and the depth of chill on the point is recorded, which tells the controller or the metallurgist whether the metal is correct for the casting concerned. If this is correct, it is chalked on a board against the name of the casting which is being made, together with various other data. The information is then booked up in a ledger from which records can always be looked up to give a customer the exact analysis and tensile of any given casting.

The wedges taken are a preliminary test to ensure that the metal is at the right temperature for the said casting and approximately what is considered to be the right metal for that particular job. Test bars, however, are cast integral with the job, and tensiles as well as other tests are conducted in the laboratory, such as deflections and analysis of the various elements in the metal according to specifications which are demanded by the engineers.

The bulk of the sands used in the foundry are supplied from local sources, being delivered by rail or barge. There is an elaborate sand plant which takes used sand, conditions it, aerates it, and adds bond, coal dust and other ingredients. For the oil sand, the bond is added in mixers and the facing sand is also prepared in a special mixing plant with the necessary additions.

An outstanding feature of the foundry is the excellent visibility available at all points on the floor due to the lightness of the interior surfaces. The walls are light cream interspersed with eau-de-nil buttresses. All surfaces are vacuum cleaned every six weeks and, in addition, the walls are washed down, screeded and cleaned every three months.

Fig. 76 shows a view of the pattern shop; this is a fine, light shop 45 ft. wide × 150 ft. long, with plenty of top light. The benches are arranged down one side of the shop where a group of about twenty pattern makers work on general jobbing pattern work, alterations, new patterns, and machine patterns. On the far side of the shop, which is not shown, there is the usual machinery found in an up-to-date pattern shop, including lathes, sanders, band saws, small planers, and various electric portable hand tools.

Stores

If the machine shops at times give the appearance of being uncomfortably congested through a super-abundance of small batch work, no suspicion of any deviation from well regulated, unconfused, apple-pie order ever arises in the stores. As our illustrations, Figs. 81 to 84 inclusive, indicate, here are methodical arrangement, systematic classification and sub-division, bold visual identification, convenient accessibility, and adequate records.

On the south side of the works and adjoining the Company's private sidings and wharf, the main building of the general stores occupies an area 66 ft. wide × 460 ft. long. In addition there are stock yards, covering approximately 3,000 sq. ft., for plates, sections, bar and steel castings. Mechanical handling in the stores building is done with a 5-ton overhead travelling crane hav'ng a maximum height under the hook of 20 ft. In the yards there are a Rapier 5 Super mobile crane and a 6,000 lb. fork-lift truck, the latter being used chiefly for stillage work.

Administration and organisation are the responsibility of the stores superintendent who has supervisors covering four subdivisions: general; excavators; mobiles, mixers and pumps; plates and sections. Stocktaking in the stores is a continual process, with the exception of the plates and sections yard. With every incoming consignment the storeman counts the balance in the locker before adding the new material and writes that balance on the back of the route slip before handing it into the office. The clerks in the office then correct their cards when they book in the new consignment. The exception to this is the plates and sections stockyard, where an annual stocktaking must be made during the shut-down period for the works summer holidays.

Stores consist of six classes of materials:

(1) Basic raw materials such as plates and sections, steel castings, pipes and non-ferrous ingots of copper, gun metal, aluminium; incidentally coke and pig-iron also come under this category.

(2) Ironmongery, including bolts, nuts, screws, pipe fittings, etc.

(3) General stores materials, which include waste, rag, soap, oil, grease, electric lamps, paint, etc.

(4) Finished manufactured parts held for the erecting shops, or for spares and servicing in the field.

(5) Factored goods such as engines, electric motors, controllers, ropes, pump hoses, wheels and tyres.

(6) Unclassified goods which are generally special purchases for customers' orders, crane grabs, special electrical goods, crane magnets, etc.

Stores control aims at providing the right quantity of material at the right time with the minimum of investment. As a corollary to the foregoing, building of surplus or obsolete stocks must be avoided. Control functions through:

(a) Determination of material requirements.
(b) Obtaining and storing adequate supplies.
(c) Issuing material as required.
(d) Recording all transactions.
(e) Supplying cost office and accounts

Fig. 81 (top left)—Part of the south side of the general stores showing the gallery and 5-ton overhead travelling crane.

Fig. 82 (top right)—Large bold identification markings facilitate incoming and outgoing movements of materials.

Fig. 83 (bottom left)—A corner of the stores devoted to factored electrical goods.

Fig. 84 (bottom right)—One of the stores offices used for recording all incoming and outgoing transactions by a visible card index system.

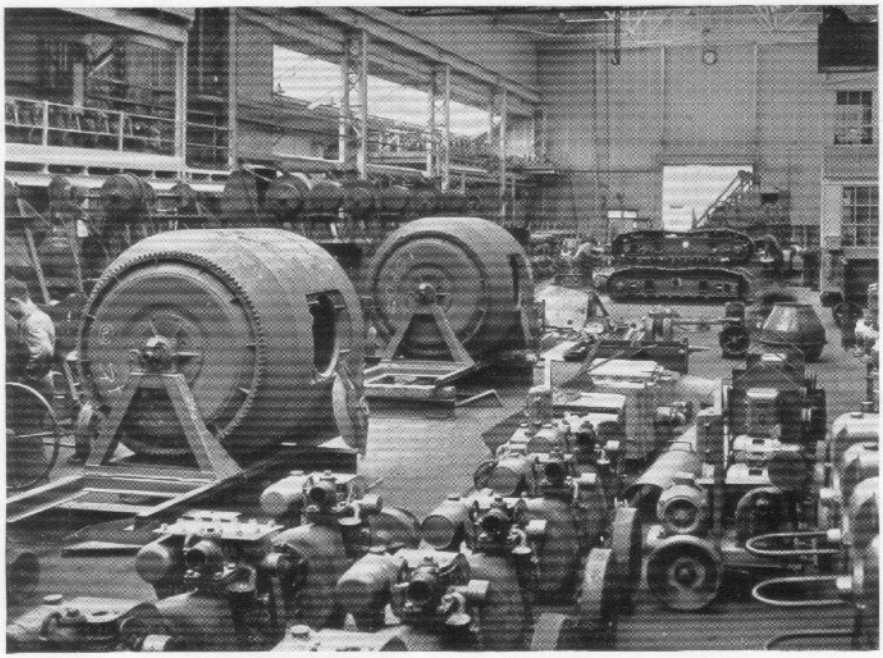


Fig. 85—This erecting bay in the mixer and excavator shop is 57 ft. wide × 220 ft. long.

department with all relative information.

(f) Furnishing information with object of decreasing stock and increasing output.

Taking these categories in order, the determination of requirements for raw materials, ironmongery and factored goods is governed by the works production plan. Quantities are ordered with due regard to completion dates, an allowance being made for contingencies such as spoilage and accidents. General stores are based on maximum and minimum quantities, these being governed by current market delivery times.

Having determined requirements, the buying office is then authorised to order and copies of all orders are sent to the stores. In some cases bulk quantities covering up to twelve months' supplies are ordered to facilitate the suppliers' production programme. Capacity for storing has to be watched, however, and deliveries spread out accordingly.

An incoming consignment is first checked by an outside staff who record the main details which are passed, with advice notes, to the receiving office for comparison with the copy of the order. The goods are then distributed to their appropriate lockers or departments in the works.

In the case of the firm's own finished manufactured parts, these come to the stores from the inspection department of the originating shops, a route slip accompanying each consignment. The route slip bears the order number, quantity and item number. This information is transferred to Kardex records and the parts allocated to their proper lockers. The route slip is then passed to the cost office who use it as a credit or debit to stores.

Withdrawing basic raw materials, plates, sections, castings, etc., from the stores to the works originates with the progress department who send issue forms to the stores several days before the material is due. The forms carry the destination for the material and the date on which it is wanted. Ironmongery and general stores are issued over the counter against signed and countersigned slips issued by shop foremen.

Finished manufactured parts are issued on group lists, each covering a number of items required for an assembly built in the works. The lists come to the stores from the production department who add at the bottom of the lists the dates on which the assemblies are required. The spares department also issue similar instructions to stores for parts needed in servicing machines or for customers' own stores.

For recording all transactions, the fourth function mentioned of stores control, a unit booking system is used, i.e., one form for one item and only one item per form. This minimises movements in the recording section of the stores, because before the forms are booked off, the clerks can arrange them in numerical order and run straight through a series of trays instead of having to move continually from one tray to another. Inwards goods have to be recorded and the inwards goods ledger is used as a medium for passing invoices. The accounts department send all their

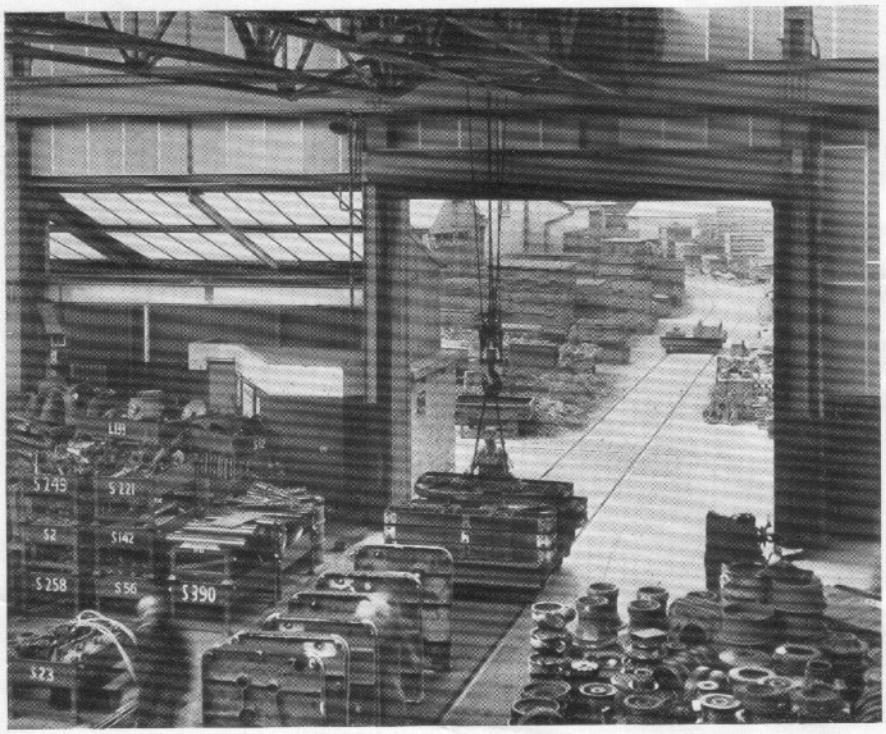
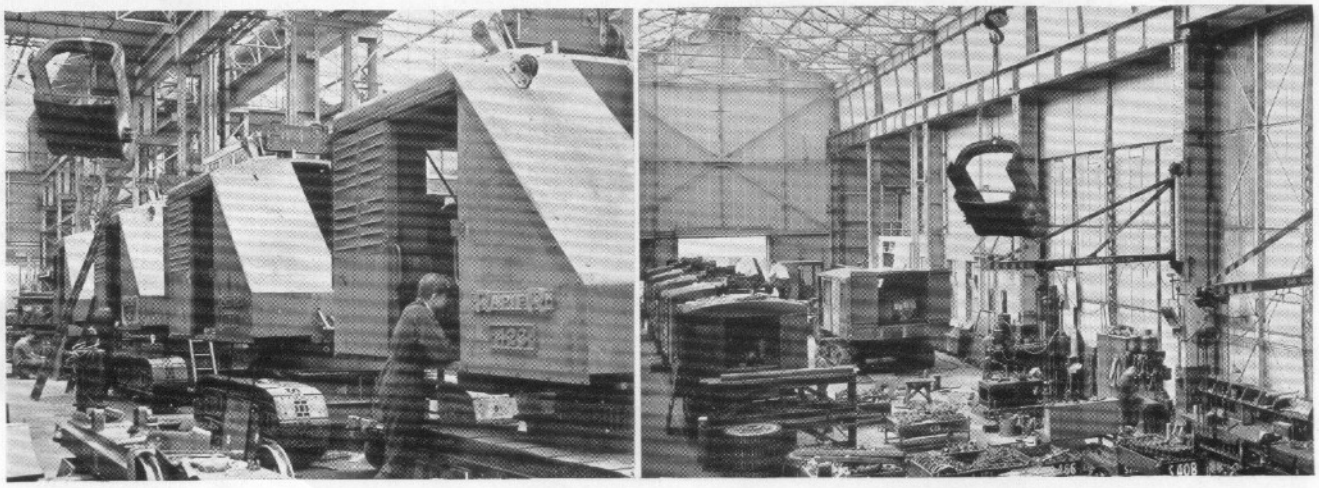


Fig. 86—One end of the erecting and fitting shop, which is 71½ ft. wide × 54 ft. high × 350 ft. long.



Figs. 87 & 88—Assembling a batch of Rapier 423 excavators. This bay is 42 ft. high to the eaves and is serviced by 25-ton and 15-ton overhead travelling cranes.

invoices down to the stores who sign them to the effect that the goods invoiced were received by them on such and such a day. That has to be done before any payment is made. All issues are recorded on the Kardex system which keeps a continuous running balance.

In the Kardex system there is also embodied a reservation system which is worked on a running total. All material is reserved as a booking in, and when the material is issued, it is booked out from the reservations as well as from the stock records. All issues are booked to a job number and that job number is carried right through, enabling the costing department to get the final cost of the job concerned. In the use of the Kardex system, the clerks balance their receipts against issues when they come to the end of each column. Recordings cover up to 50,000 stock items and about half that quantity of non-stock parts.

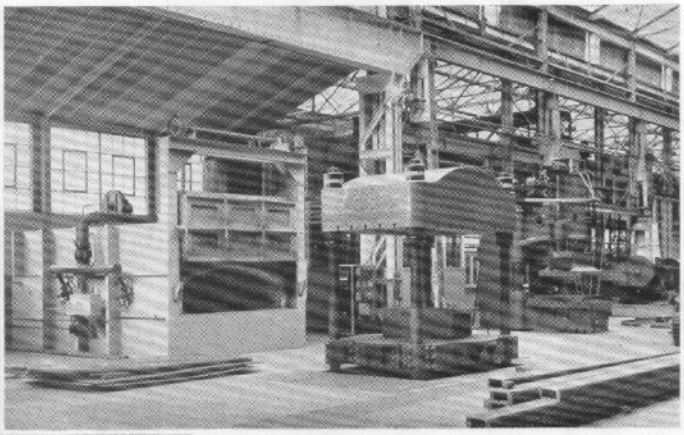


Fig. 89 (above)—Heat-treatment furnace and hydraulic presses in the press and saw shop.

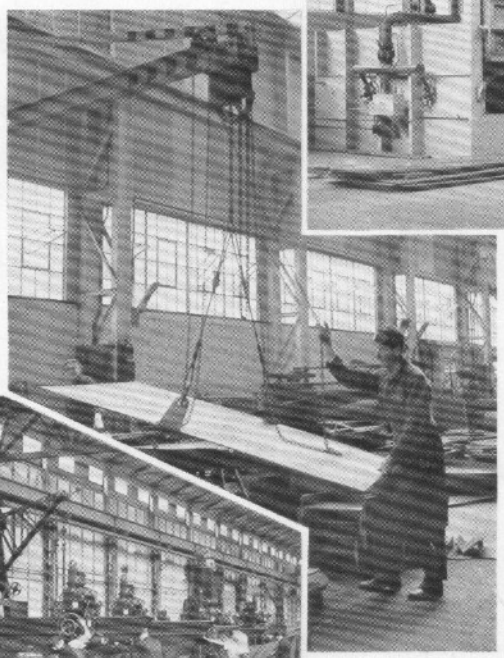


Fig. 90 (centre)—Handling steel sheet in the press and saw shop. Striped marking on end of jib cranes is readily noticeable by personnel operating overhead travelling cranes.

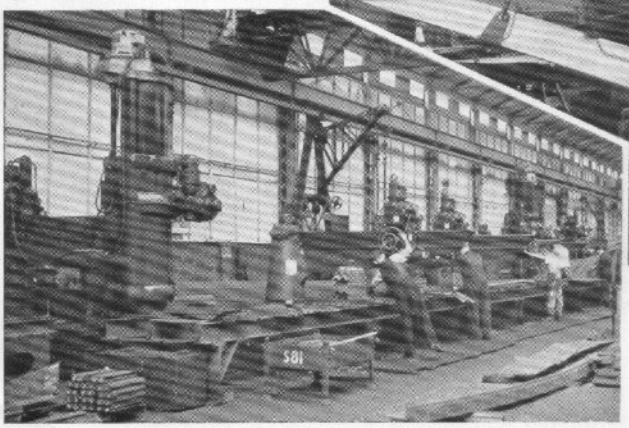


Fig. 91 (below)—Line of Asquith 6 ft. radial drills in girder shop.

Information needed by the cost office and accounts department is gathered from the forms sent to them after material has been booked in. Invoices, also, are checked and signed in the stores before payments are made.

Colour codes are used extensively for the rapid identification of materials and of the different forms. The Kardex system also has colour signals in the form of sliders to give warning of low stocks.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