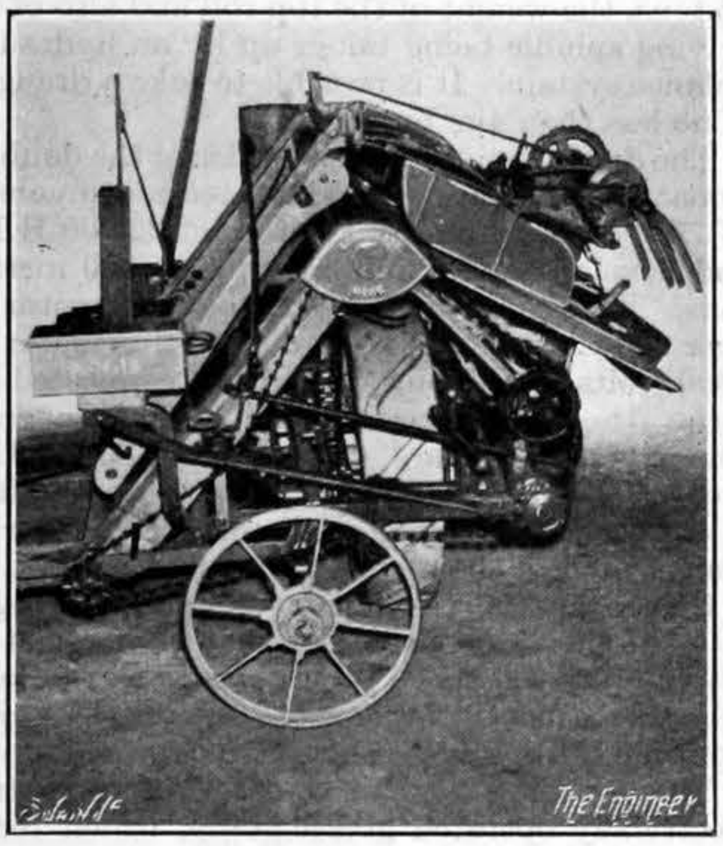
of the machine, and the same was done with the headers. The following were the principal machines we inspected :—

Auto Header.—This machine is a 12ft. self-propelled header harvester, which was originally designed in 1925 and was fully described in THE ENGINEER of September 26th, 1941. A feature of the design which was demonstrated is the all-steel front, which can be automatically raised or lowered to suit the crop height or condition. In Australia one of these Sunshine auto headers created what is still believed to be a world record, when on January 6th, 1938, at Horsham, Victoria, it harvested 78 acres of wheat, yielding 3300 bushels in one day.

Engine-Functioned Header.—This machine, which was demonstrated with corn, in order to show the threshing and cleaning of the grain, is a 6ft. cut unit of very compact design and construction and is worked by a 16 B.H.P. engine.

Binders.—The binders were demonstrated with sheaves so that the elevators and the tying mechanism could be closely inspected. A novel feature on the machine is the automatic trip on the binding attachment, which permits a sheaf to be tied at any time, a feature which is most valuable when opening up a



"SUNSHINE" BINDER

heavy crop. Favourable comment was made on the strong construction of the main wheel, the main frame, and the driving platform. Some of these features have been specially adopted in order to meet British conditions, and we were informed that the additional strengthening has stood these machines in good stead, and that they have shown very good results when operated by comparatively unskilled labour during the last four years of war. The binders can be supplied with either a tractor hitch or a horse-pole. It was announced that a new type of Sunshine power binder, embodying all the principal features of the ground-drive binder, will before long be arriving in this country for distribution.

Drills, Cultivators, and Harrows.—A wide range of Sunshine drills was set out for inspection, and we noted that all these machines have large-capacity grain or grain and fertiliser boxes mounted on them. This is a special feature of the class of drills referred to, and it is greatly appreciated by users, who to-day are asking for increased sowing quantities of grain and fertilisers. With large boxes many refilling stops are saved. The boxes are built as an integral unit and are not of the type with the fertiliser box added as an attachment.

Suntyne cultivators were also on view and were shown in twelve, sixteen, and twenty-row sizes. Some of these machines had standard lever controls, with the power lift and screw adjustment operated from the tractor driver's seat. Others were equipped with an interesting one-man control arrangement, which comprises a steering and clutch control, taken back from the tractor to the footboard of the drill, so that the tractor driver is done away with. This same control can be fitted, we learned, to a standard drill. An unusual machine in this class, which we illustrate herewith, is a grain and fertiliser disc drill, which is noteworthy for its simple gearing and the ease with which it can be adjusted. The closely fitting disc bearings have proved very satisfactory under United Kingdom conditions. On the larger sizes of these machines, as will be seen from our engraving, rotary disc scrapers are fitted to the ground wheels. Our illustration also shows a flexible harrow following the drill, the purpose of which is to cover the ground more closely, and which has given excellent results in the field. Other types of drill exhibited included a twelve-row grain drill, which has the largest capacity box of any sold in England, namely, 6½ bushels of wheat. This machine is popular with certain farmers who prefer a drill without a fertiliser box. Each of the drills to which we have referred can be fitted with a new type of grass seeder, which has been designed to handle rye grass, clover, cocksfoot, timothy, &c. The boxes are of the force-feed pattern and are provided with alternative fine and coarse feeds. An ingenious device maintains the feed and keeps the seeds well mixed.

During the afternoon a field demonstration of a twelve-row Suntyne combined drill and cultivator was made on one of the Butterley Company's own farms. The four rows of tines cut out all the weeds, and did an excellent cultivating job. This particular machine is new to Great Britain, in that it cultivates the ground as it sows. It can be employed also as a straight-out cultivator at all times of the year. Reports show that in many parts of the country better results have been obtained than ever before even when just drilling straight over ploughed ground. Some farmers claim to have sown much less grain and to have used much less fertiliser when employing the drill cultivator, and have still maintained good crop yields.

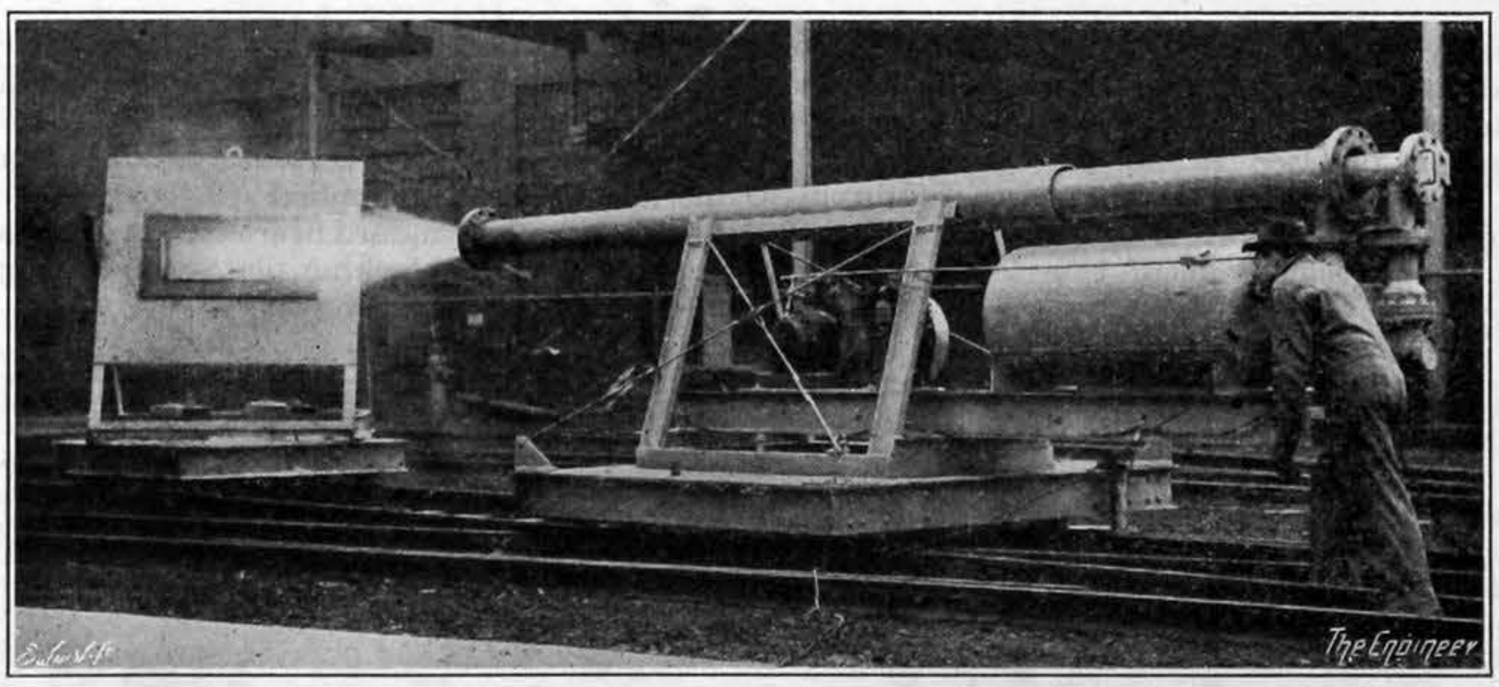
In a speech made after the luncheon, Mr. Fitzherbert Wright, director and general manager of the Butterley Company, Ltd., welcomed the guests, among which were included representatives of the Ministry of Agriculture and Fisheries, the Ministry of Supply, prospective agents, and other interested parties. He spoke of the great engineering experience of his company, which, he recalled, had been established 154 years, and was now employing some 10,000 workers in different works. The company was, he said, a newcomer to the agricultural machinery trade, but the combination of Butterley enthusiasm and resources, which were not inconsiderable together with Sunshine organisation and experience, should make for success. In a comparatively short time much had already been accomplished with regard to the setting up of a twenty-four-hour spare part service and the assembly of machines imported by the Ministry from Australia. He looked forward to the combination of British and Australian interests serving the future agricultural policy of this country, and also to building up manufacture for export. He emphasised the desirability of standardisation in agricultural machinery if prices were to be kept down and export trade fostered. In his reply, Mr. Stuart McKay, speaking on behalf of the Sunshine Harvester Company, Ltd., of Aldwych House, London, W.C.2, pledged his personal assistance and that of the Australian organisation he represented.

Compressed Air Cannon for Aircraft Windscreen Tests

THERE are many minor problems of flight about which little is heard. One of them is provided by migratory birds which, when struck by a fast-moving aeroplane, may cause serious damage. It has been recorded in America, for instance, that a bird once not only broke through the windscreen of a passenger aeroplane, but punched a hole through the metal bulkhead behind the pilot, travelled the full length of the passenger compartment, burst through the rear wall of that compartment, and finally came to rest—somewhat shattered—amongst the luggage !

WINDSCREEN SHATTERED BY BIRD

Tests have recently been carried out by the Westinghouse Electric and Manufacturing Company of various windscreen materials with the object of devising a screen that will stand up to the impact. With true American realism, a "cannon" was devised, by the use of which test specimens of windscreens were bombarded with such missiles as chickens and turkeys.



COMPRESSED AIR CANNON FOR WINDSCREEN TESTS

The apparatus, which is illustrated herewith, was mounted on an undercarriage carried on rails. It consisted of a motor-driven air compressor supplying a large receiver at pressures up to 200 lb. per square inch. The receiver, through large valves, the design of which was based upon those used for air blast switchgear, supplied air to the barrel of the "cannon" mounted above it. Lengths of ordinary piping were used for the barrel, the diameter and length being chosen to suit the missile and the velocity that it was desired to attain. Windscreen materials were mounted on a sheet steel "easel" firmly anchored to the rails. As will

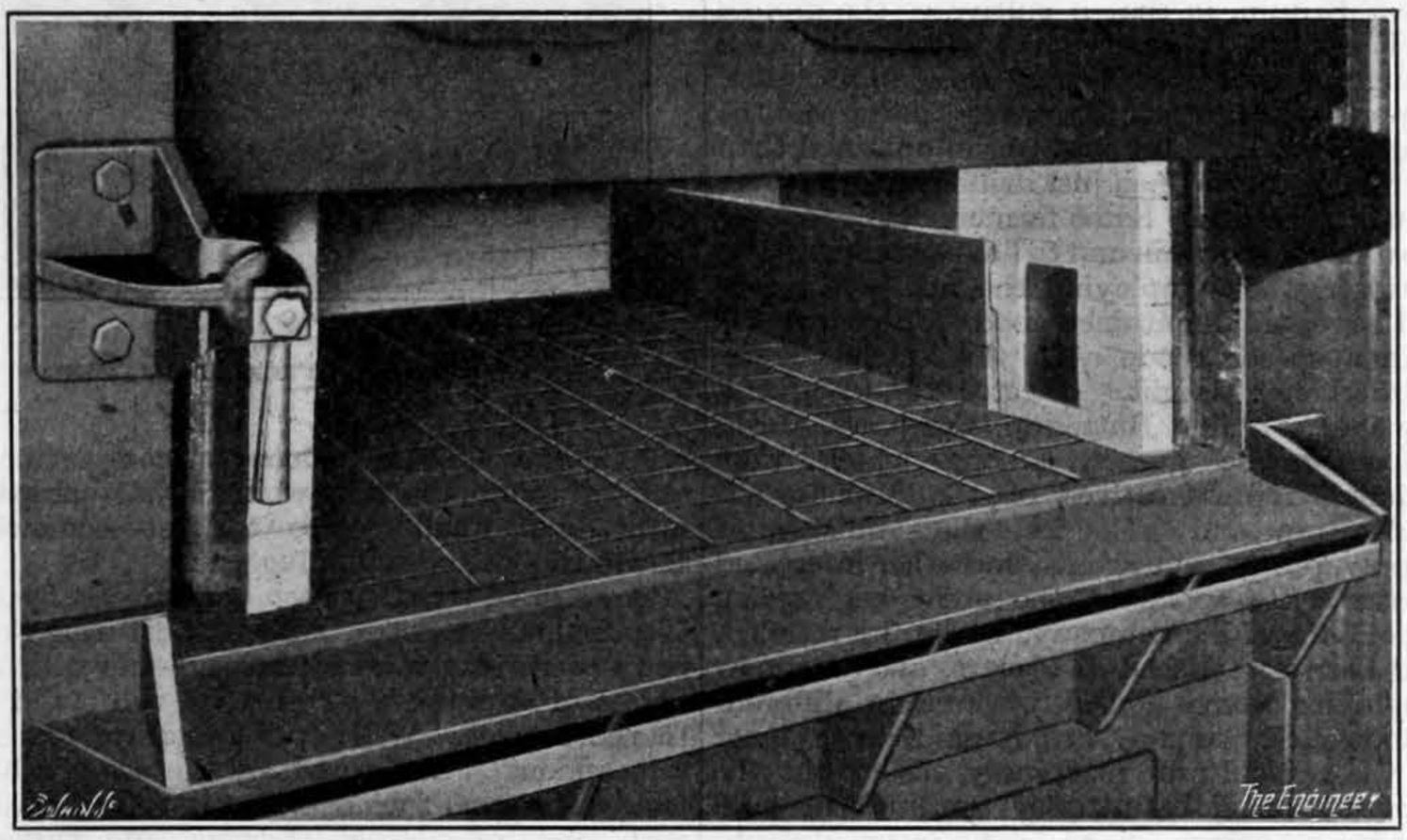
be seen from the engravings, this "easel" was so designed that the "specimen" could be set at any desired angle to the direction of approach of the missile.

As a result of the experiments a type of construction has been developed that will withstand the impact of a 15 lb. bird at speeds up to 200 m.p.h. On the outside there is a layer of full-tempered glass. Next there is an air space, through which air heated by the engine exhaust can circulate for de-icing purposes. Behind, there is a "sandwich" consisting of two sheets of glass separated by a thick filling of plastic. The plastic extends for an inch or so beyond the edge of the glass all round, and the complete panel is held in position in the frame by bolts engaging with the plastic alone, which thus acts as a shock absorber.

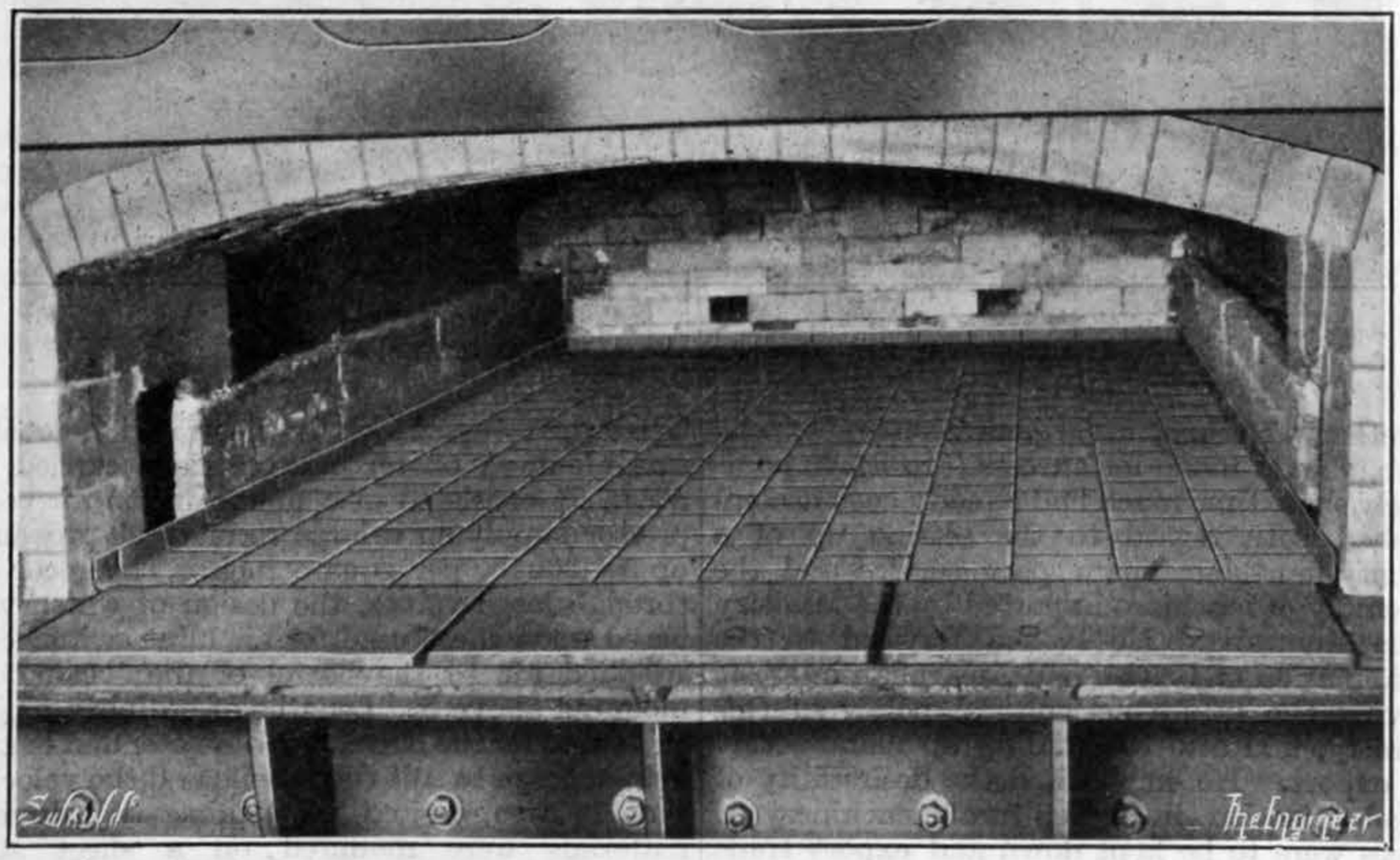
Distortion-Free Metallic Hearths

FOR many years furnace engineers have sought to evolve a metallic hearth for heat treatment, carburising, and annealing furnaces. A metallic surface facilitates charging and discharging operations, hearth temperature is quickly recovered after the charging of a cold load, and there is greater resistance to abrasion than with a brickwork hearth. It has been common practice to fit heat-resisting plates on an ordinary brickwork hearth in furnaces subject to unusually rough and heavy usage, but the development of this form of hearth protection has been hindered by the distortion of such plates when continually subjected to to the loading of cold components. Such distortion not only makes it difficult to charge and discharge the furnaces, but the life of the plates is considerably reduced because the protective scale, normally formed on the surface of a heat-resisting metal, is cracked off when the plate distorts, with the result that oxidation in depth quickly develops.

The Incandescent Heat Company, Ltd., of Birmingham, has now produced for use in furnaces operating at temperatures up to 1000 deg. Cent. the "Nicrotectile" hearth, illustrated herewith. The complete hearth area is covered by a series of small heat-resisting tiles interlocked in all planes in such a manner that the tiles cannot be displaced even when subjected to rough handling. The design of the small tiles, it is claimed, is such that distortion is wholly avoided, and a complete hearth can be built up or dismantled in a few minutes. If after long service a tile should fail, it can be replaced at little cost, whereas the failure of any portion of the surface of an ordinary plate hearth means the replacement of the complete large plate. Apart from protecting the hearth itself, the tiles also protect the furnace guard tiles on either side of the hearth. In most instances the small turn-up along the side and back of the hearth provides ample guard tile protection, but when required this height can be increased to 12in. or more by the use of special interlocking vertical side elements. Special sizes are supplied to complete the dimensions of a standard hearth when necessary. and suitable front locking plates for bolting to the existing furnace cill plates are also provided.



FURNACE FITTED WITH VERTICAL SIDE ELEMENTS



HEAT TREATMENT FURNACE WITH METALLIC HEARTH

Although originally designed for hearth protection, the tiles can be used for many other purposes, being particularly suitable for the construction of waste gas dampers operating at temperatures up to 1100 deg. Cent., their use eliminating in many cases the necessity for water cooling with all its complications.

Iscor's New Blooming Mill

AT 3 p.m. on November 19th, 1943, the chairman of the South African Iron and Steel Industrial Corporation cut a bloom in the Corporation's new blooming mill in the Iscor Steel Works at Pretoria. The erection of the mill started in December, 1942. The mill is designed to roll ingots up to a weight of 20,000 lb. These ingots will be rolled down to slabs 40in. wide and up to 10in. thick, to be sheared and sent to the Vanderbijl works for further rolling into plates and also into smaller sizes down to 5in. by 5in. to feed the existing heavy mill and the new medium mill on which erection is already well under way. The rolls each weigh 25 tons, the weight of the top roll and also of its driving spindle being taken up by an hydraulic balance system. It is possible to take a draught of no less than 4in. on the mill.

The driving motor for the mill is of the double-armature construction, and is rated continuously at 7300 H.P. with a peak rating of 22,000 H.P., and develops a maximum torque of 300 metre-tons. The completed weight of this motor is over 250 tons. D.C. is supplied to this motor at 1600 volts from four generators connected in series, the peak current being 11,300 amperes. These generators are driven by a 5000 H.P. motor fed at 3300 volts, and on the same shaft is a 53-ton fabricated steel fly-wheel. A series transformer in the motor circuit is connected to a torque motor, which controls the slip regulator in the rotor circuit of the driving motor. This lowers the speed of the motor as the load increases, thereby forcing the fly-wheel to give up some of its kinetic energy to the generators.

The greasing system consists of a central electrically operated grease pump, which feeds metering valves at different points on the mill through twin feed lines, the feed being switched from one line to the other by a device operated by the pressure developed. Electrical timers operate red lamps and warning hooters if the pressure fails to build up within a certain time, thus indicating a leak or a grease failure. The various pressure fed oil systems are interlocked electrically with the controls and also operate a red warning light and a hooter.

Owing to the fact that as many as four different sections and consequently four different types of steel may be rolled in sequence in the mill, a complicated and comprehensive communication system is being installed to cover the blooming mill, the old heavy mill, and the new medium mill. To begin with there will be loudspeakers at five different points for verbal instructions, and telautographic transceivers and receivers at nine different points. These instruments operate roughly as follows:—Imagine that the operator at the main shear control point has been told that the slab yard crane is out of order. He immediately writes with a stylus on a metal platen a message to the soaking pit operator, telling him to stop drawing slab ingots. An electrically operated pen controlled from the stylus writes the message in his own handwriting on a roll of paper at the soaking pits control point, and at the same time another pen duplicates the message at the shear control point for record purposes. These instruments incorporate call buzzers.

The mill motor, Ilgner set (English Electric), with its fly-wheel and exciter set, two 5000 kVA and one 2000 kVA transformers and the 11,500-volt and 3300-volt and 380-volt A.C. and 440-volt D.C. switchboards were built in England, while all auxiliary electrical gear, such as electric motors from ¼ H.P. to 350 H.P., with control panels and a 1250 H.P. Ward-Leonard set, were made in America.