ELECTRIC WELDING.

[*Abstract of remarks made by Prof. Elihu Thomson, on showing his electric welding apparatus in operation, at the stated meeting of the FRANKLIN INSTITUTE, held September 19, 1888.*]

JOS. M. WILSON, President, in the Chair.

Prof. THOMSON spoke substantially as follows :

About a year and a half ago I gave a description of the newly-developed art of electric welding, calling attention to the principles underlying its practice and the results accomplished in the welding of various metals and alloys.

On the present occasion, the purpose is to show the apparatus, or at least a few forms of it, in operation, and to describe the working and construction.

Quite a number of types of apparatus have been developed, some of which are before us, and others we have at our factory at Lynn, Mass.

What we call the indirect, or induction, type takes current of comparatively high potential from a dynamo giving alternating currents, or from any other suitable source, such as a lighting supply line, and converts, or induces, from it a current of very low potential and great volume for electric welding, soldering, brazing and forming of metals. One form of apparatus, which will be used for welding iron and copper wires, is here before you (*Fig. 1*).

The "direct" type generates the currents needed directly from belt power or mechanical energy, and consists of a specially organized dynamo provided with a set of welding clamps. In fact, the needs of electric welding have given rise to a number of special and somewhat curious types of dynamos, which might not otherwise ever have been invented or constructed. But one of these forms is here shown, a number of others having been designed and constructed, and others again are undergoing construction. *Fig. 2* is an example of a type of direct-welding dynamo,

similar to the one on the platform, belted to the INSTITUTE engine.

The storage battery, properly arranged, constitutes another type. It is charged from a line, or by a small dynamo kept running constantly by power. Since the welding or heavy-discharge currents are only needed at intervals, a comparatively small dynamo will usually suffice for the charging. We have used a suitable cell of storage battery quite successfully in electric welding. Even primary batteries may, if of sufficiently low internal resistance, be used for the work, but are comparatively expensive to run.

FIG. 1.

Variations in the proportion and details, especially of the clamping devices, are made to suit the nature and size of the work to be done, and the shape of the pieces to be handled.

It may be mentioned that for some purposes a combined engine and dynamo for welding may come into use, especially where the work is intermittent. Thus an apparatus in all respects like a steam fire engine, but with a dynamo generating the requisite currents and substituted for the pumps, would be useful where portability is requisite and comparatively heavy work is to be done in isolated localities. The fact that the work is intermittent permits the use of less

boiler capacity than would be the case were the plant to be under full load continuously.

(At this point a number of lantern slides were shown on the screen. They represented some of the various forms of apparatus which have been constructed, and their differences were pointed out.)

FIG. 2.

Prof. THOMSON continued :

I call attention to the numerous examples of work done as exhibited by the specimens which are found on the two sample boards before you, and upon the table. Here is a unique specimen, a shaft with two collars, formed without any welding at all, by simply pressing it endwise, by the clamps with the current put on.

Here, again, is a very curious piece, which I am sure could not be produced at all without such apparatus as is

shown here. It demonstrates the rapidity with which work can be done, and the localization of the heating effects.

The specimen referred to is one in which a bar has been put through a hole in a flat piece of wood, and burrs raised on the bar at both sides of the wood, so that the wood is held between the two expansions in the bar, and almost pinched between them. The operation was so quickly done that the heat had not time to char the wood and enlarge the hole; or, if I may be permitted to say it, the wood had not time to find out that it should burn.

Among the specimens here shown are rings, cast-iron pieces, various tools constructed by use of electric welding, chains and links, etc. The various metallic alloys, as brass, German-silver, are seen, in addition to heterogeneous welds or welds of different metals one to the other.

Many persons are puzzled to know how a ring can be welded at all by the current, especially such small and thick rings as are here shown, but there is no mystery about it. The current goes by the short path in greatest amount, and so welds the ring. This is particularly true of alternating currents of rather rapid rate, and, in fact, we have organized devices which absolutely prevent more than a small fraction of the current going around the ring. To do this we have only to establish conditions such that a current going around the ring has to produce magnetism in a closed iron core, while that which does the welding is comparatively free from such necessity. In such case, self-induction, and resistance are both acting together to prevent flow around the ring, instead of across the joint to be made.

Tests of tensile strength of electric welds are eminently satisfactory, and the occasion may sometime come when I can present the results, or consider for you electric welding from the standpoint of its perfection as a welding process. Its utility is, however, already established. It does very many things which no other process can do or has done.

Here is a sample of lead pipe welded without obstruction of its interior, and even without expansion outside. At a short distance away, the pipe cannot be distinguished from a plain piece, and its exterior has been left just as it came out of the welding clamps.

Here again, is a finished axe, with the steel cutting edge welded to the body by electrical means, the welding being the last operation done before final grinding for finish.

Here is a steel rake made by electricity, and several specimens illustrating the making of carpenter's squares by electric welding.

(Prof. THOMSON then explained the apparatus, which had been brought for inspection of the INSTITUTE, and showed practically the operation of electric welding.

He used both the induction coil type (*Fig. 1*), and the direct types (*Fig. 2*). Some of the apparatus was remarkable for its small size in relation to the size of the pieces upon which it would successfully operate. The devices for holding the pieces in place, putting on the current and giving the pressure to the pieces were shown to be very simple and easily operated.

He also exhibited some automatic apparatus, in which the pressure given is automatic, and the current stops when the weld is completed, thus enabling the operation to be indefinitely repeated in the same way without involving skill on the part of the operator.

At the close of Prof. THOMSON's remarks, a vote of thanks was tendered to the speaker for his extremely interesting presentation of the subject.)