MODERN THERMOMETRIC APPARATUS FOR HIGH TEMPERATURES.

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Within comparatively recent years, the demand for apparatus for pyrometric measurement has increased rapidly. Wherever high temperatures are used in the production or treatment of manufactured products it is now more or less necessary to have complete knowledge of temperature conditions. Not only is this the case purely in the interest of theoretical science—in practice time is usually not available for this purpose—but it is true from an entirely practical standpoint. Often it is absolutely essential to know if the firing is being done economically, if the same effect can be produced with a lower temperature and a consequent saving of coal. Another consideration, particularly in iron and steel works, has led to the introduction of the recording pyrometer. For the proper control of a blast furnace it is of the utmost importance that the temperature of the hot blast, heated by a Cowper apparatus and forced into the furnace, shall not fall below a certain point. As a blast furnace is in operation continuously, day and night, it is of course impossible constantly to examine it. Consequently the continuous registration of the thermometric conditions places in the hands of the superintendent an invaluable means for correcting irregularities of more than momentary duration. For this particular purpose the pyrometer has come so generally into use that it is practically an absolute necessity, and there is probably no iron works of any size in which it is not used. The following is an account of a type of apparatus recently introduced by the Siemens & Halske Company, of Berlin. It may be said here, that the illustrations show the instruments exactly as they are in operation and in the condition in which they have repeatedly proven their usefulness.

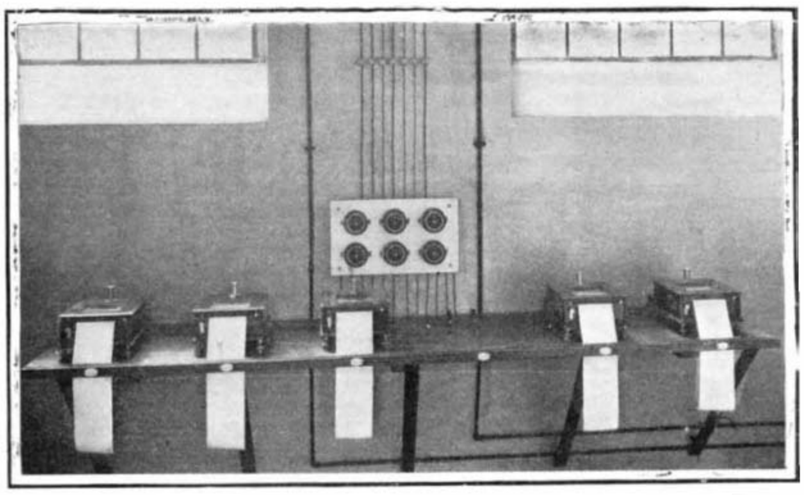

Fig. 4.—APPARATUS FOR RECORDING THE TEMPERATURE OF THE PRODUCTS OF COMBUSTION OF FIVE BLAST FURNACES.

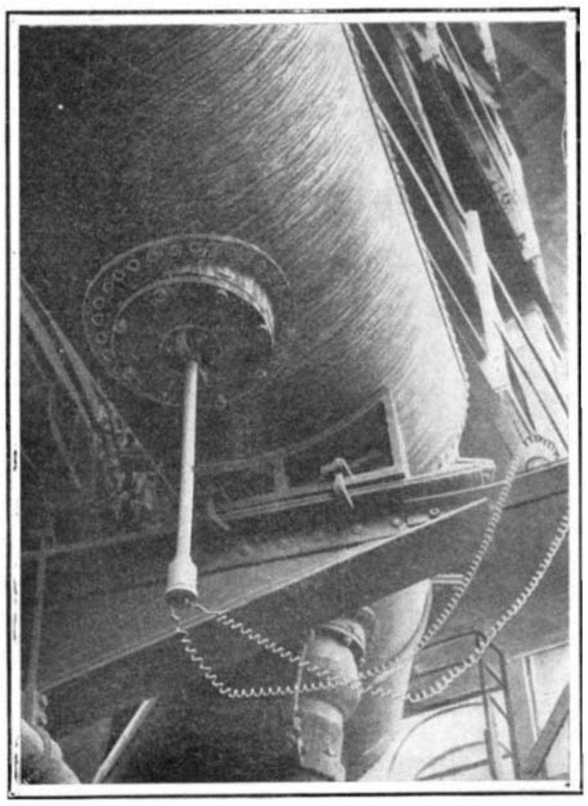

Fig. 3.—HOT-AIR CONDUIT OF A BLAST FURNACE WITH THERMO-ELEMENT.

PYROMETER FOR TEMPERING FURNACES.—Figs. 1 and 2 show the arrangement of a tempering furnace whose degree of heat is registered by means of two thermopiles or elements, and a galvanometer. The thermopiles are inclosed in the protective tube which projects from the top of the furnace (Fig. 1). They consist of two wires of platinum, or to be exact, of an alloy, 90 per cent platinum and 10 per cent rhodium, 0.5 millimeter in thickness. The connecting wires from the two elements run to a two-pole switch, by means of which either one or the other of the thermopiles can be thrown into circuit with the measuring and registering instrument. This is placed upon a small but solid bracket shelf on a nearby wall, as well protected as possible from vibrations and shocks. For purposes such as the above, pyrometers are of incalculable value. So high is the grade nowadays required in tool steel, that it is absolutely necessary that in this very process of tempering, the different kinds of steel receive, so to speak, individual treatment. It has been proven that the estimation of hardening temperatures by eye is too uncertain to allow of a uniform product. The readings of a pyrometer enable us to keep the temperature of a modern gas furnace constant to a degree, and by this means a uniformity in the quality of the different kinds of steel is attained which is of the greatest value in the manufacture of tools and which has hitherto been impossible.

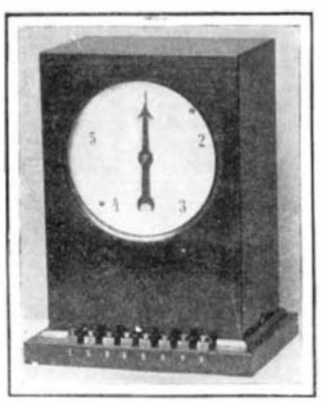

Fig. 5.—AUTOMATIC INDICATING SWITCH.

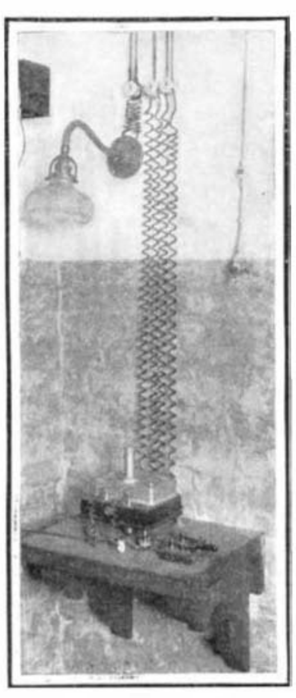

Fig. 2.—INDICATING GALVANOMETER.

PYROMETER FOR IRON WORKS.—Figs. 3 and 4 show the arrangement for temperature measurements in the hot blast conduit of a blast furnace. The purpose for which these instruments are installed is as follows: Every blast furnace includes two so-called Cowper apparatus which are in reverse operation at the same time. The hot waste gases from the furnace pass through the one, heating the brickwork passages, while a current of cold air is drawn into and forced through the other apparatus, which has been previously heated, by means of blowers. This current of cold air is thereby raised some 700 deg. to 900 deg. C. in temperature. When the temperature of the latter apparatus and of the blast passing through it has fallen a certain amount the process is reversed. That is, the cold air is drawn into the heated apparatus while the other is again reheated. In order to permit these proceedings to be closely watched a thermopile in a protective tube is inserted in the hot blast conduit which encircles each furnace. The conductors, carried on insulators, lead from the free ends of the thermopiles to the common location of all the registering mechanisms. Lightning arresters are included in the circuit to protect the instruments against atmospheric discharges or high tension external circuits.

It is very easy to keep a close watch on this arrangement and by means of it the running of each individual furnace can be followed from the above said central location. Every variation in temperature is at once recorded in the diagram, so that the superintending official is at once in a position to correct possible irregularities, which in an industry of this kind are otherwise very difficult to locate and to trace.

PROTECTIVE CASING.—At such places where an open installation of the instruments, which are, on the whole, rather delicate, is not advisable because of dust or injurious vapors in the air, it is best to inclose them in tight protective casings. Each of these casings contains besides the instrument itself, a roll for the recording paper which can be adjusted from the outside. Besides the slit for the paper strip, there is an opening closed by a lid, for winding or regulating the clockwork. Consequently it is necessary to open the case only when the roll of paper is to be renewed, that is, four times a year. Glass-covered openings in the top of the case afford means for taking readings.

The above sketched examples are but a few of the many ways in which these instruments may be utilized. Particular constructions make these methods of measurement applicable for many different purposes. For instance, their use enables us easily to regulate the steam temperature in superheating steam engines; or in other cases to ascertain the temperature of chimney or flue gases. Particularly useful are they in the latter instance in the investigations or tests of boilers.

In connection with Fig. 4 we may mention an apparatus whereby we are enabled to ascertain the temperature of several points with the use of only one registering instrument. In order to do this an automatic switch or cut-out (Fig. 5) is used by which a number of thermo-elements may alternately be placed in circuit with the registering instrument. This switch at the same time indicates which element and consequently which furnace is connected with the galvanometer.

Navigation on Lake Titicaca.

A second steamship is to be placed in service upon Lake Titicaca in Peru, the highest lake in the world, being some 15,000 feet above sea level. There is already one vessel engaged in traffic upon this sheet of water, the "Coya," the construction of which was described in the SCIENTIFIC AMERICAN some months ago. This latest vessel is named the "Inca," and will carry about 550 tons dead weight. It has ample arrangements and facilities for working cargo, and is provided with accommodation for 24 passengers. The dimensions are 220 feet in length, by 30 feet beam, and 14 feet depth. It is to be propelled by twin-screw engines developing 1,000 horse-power, and will have a speed of 12 knots. The vessel has been designed in England, and erected in the yard of Earle's Shipbuilding and Engineering Company, of Hull. The parts were carefully numbered during construction, then disassembled and dispatched to Mollendo, South America, the Pacific end of the railroad to Lake Titicaca, for disembarkation. The sections will then be transported to the shores of the lake, where the vessel will be re-erected and launched.

Electric fuses are of two distinct kinds, viz., high tension and low tension. In the low-tension system, which is gradually superseding the high, the fuse head consists of two insulated copper wires, joined by means of a thin platinum bridge, which, owing to its higher resistance to the electric current, becomes incandescent when the current passes. This bridge is inserted in a capsule containing an explosive mixture, and the whole is hermetically sealed inside a detonator before being issued from the works. The fuse is fired in the ordinary way by a magneto exploder.

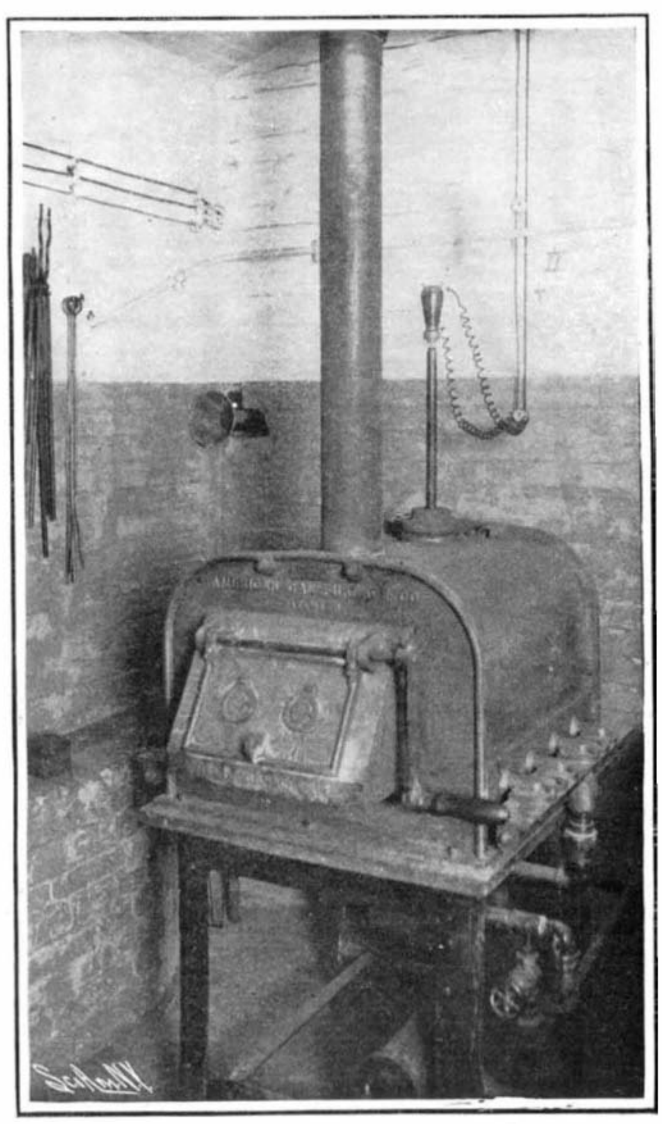

Fig. 1.—MUFFLE THERMO-ELEMENT.