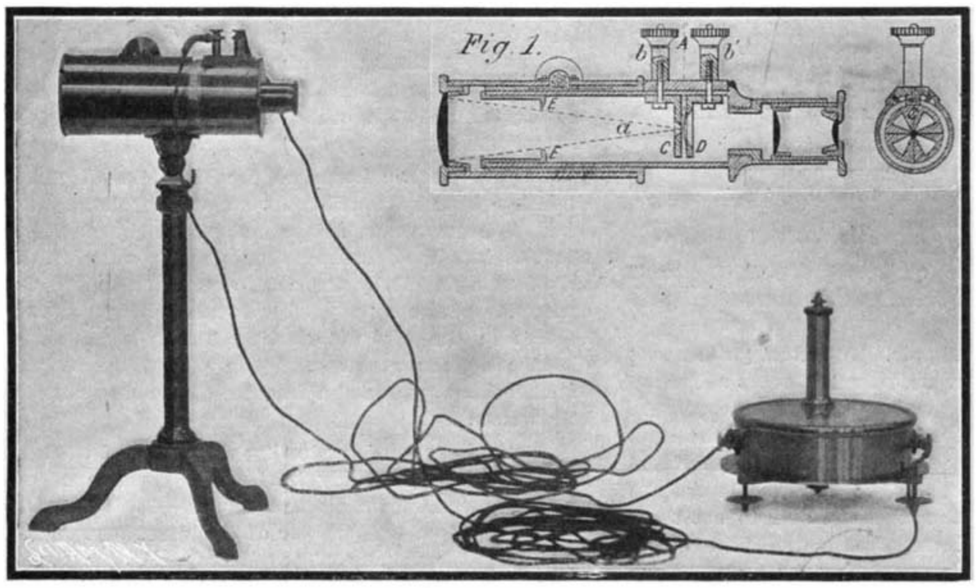
THE FÉRY PYROMETRIC TELESCOPE.

BY DR. ALFRED GRADENWITZ.

A pyrometer tl e range of which is practically unlimited, has recei tly been designed by Prof. Ch. Féry, of the Paris Ecole ue Physique et de Chimie. The under-



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lying principle on which the apparatus is constructed, is the law regarding the relation of the thermic radiation of heated bodies to their proper temperature as enunciated by Stefan as far back as 1880 and confirmed by the researches of Prof. Boltzmann and other physicists. The problem solved by Stefan seemed for a long time a rather complicated one, as the emissive power of solids is itself in most cases an unknown function of the temperature, which further complicates the relations observed. The problem, however, is simplified in a high degree when considering the so-called *black bodies*. The notion of "black bodies," as first introduced into science by Kirchhoff, is relative to a body emitting, when heated, any kind of radiation in normal proportions; carbon and a large number of black metallic oxides will show this behavior. The theoretical notion of the "black body" is however best realized in practice by a large sized furnace, possessing only a very narrow opening through which the radiations are allowed to pass. Any body heated, not in the open air but in a large closed furnace, will accurately show the normal radiation of black bodies quite independently of the nature of the walls of the furnace. Now as a similar heating process is mostly used in industrial practice, an instrument based on the behavior of black bodies would seem to be highly suitable for industrial purposes. This behavior of black bodies is indicated by Stefan's law as follows: The amount of heat radiated from a black body (or from the opening of a furnace) brought to a high temperature, is proportional to the fourth power of the absolute temperature of the black body (or the furnace).

The instrument designed by Féry on this principle is represented diagrammatically in Fig. 1. The cross wires of a telescope, the objective of which is made of fluorine (a substance highly transparent to any radiation and the presence of which does not alter to any appreciable degree the composition of the radiation), are replaced by a system of two narrow and extremely thin plates of iron and constantan* respectively soldered to one another at their points of intersection and fixed by their ends to two brass disks, *C* and *D*, from which the electric current is taken through the binding posts *b* and *b'*. This system obviously embodies a thermo - electric couple. The attachment is readily pointed at the hot body, while being independent of any lateral stray radiations; in fact, on the tube of the telescope being heated, the temperature of all the soldered seams of the thermic battery constituted by the two metallic plates will be increased by equal amounts without any disturbance in the readings being produced. In order to limit the length of the plates submitted to the thermic radiation, a cross - shaped screen has been added, allowing only the soldered seam to be exposed; finally a diaphragm, *E*, placed at a constant distance from the cross-wire plates, makes the readings independent of the distance at which the body is placed. The angle, *a*, of the cone of rays striking the soldered seam will accordingly be independent of the length to which the tube of the telescope has been drawn out.

The telescope is, by means of a flexible wire of a known resistance, connected to a special galvanometer by the deflection of which the energy of the radiation is indicated. Experiment goes to show that the relative absorption of fluorine becomes constant from the temperature of 900 deg. C.; that is, the amount of heat absorbed then bears a constant ratio to the amount of heat transmitted. A telescope standardized at a temperature upward of 900 deg. C. will therefore allow of ascertaining immediately the unknown temperature corresponding to an observed radiation.

If, for instance, the deflection obtained on the transparent scale of the galvanometer be 75 mm. in case the furnace the telescope is pointed at is at a temperature of 1,000 deg., and 300 mm. be the deflection due to a body brought to a temperature *x*, then Stefan's law will give immediately

$$\frac{x^4}{(1000 + 273)^4} = \frac{300}{75};$$

whence $x = 2,547$ deg. absolute, or 2,274 deg. C.

As the temperature is proportional to the fourth root of the galvanometric deflection, even a rather large error as to the radiation will result in a much smaller relative error with respect to the temperature. In order to avoid any calculation, the temperature corresponding to the observed deflection may be derived from a curve. There are several diaphragms intended for different ranges of temperature, allowing temperatures included between 800 and 4,000 deg. C. to be readily determined, though the deflection corresponding to the latter temperature be 250 times greater than that observed at 800 deg.

For industrial purposes, the inventor has slightly modified his apparatus, using instead of fluorine lenses, a lens made of a special glass, the opening of which is large enough to insure easy readings on industrial galvanometers. Such pyrometers are standardized by comparison with a fluorine objective pyrometer.

* Constantan is a German alloy of copper and nickel containing 50 per cent of each.

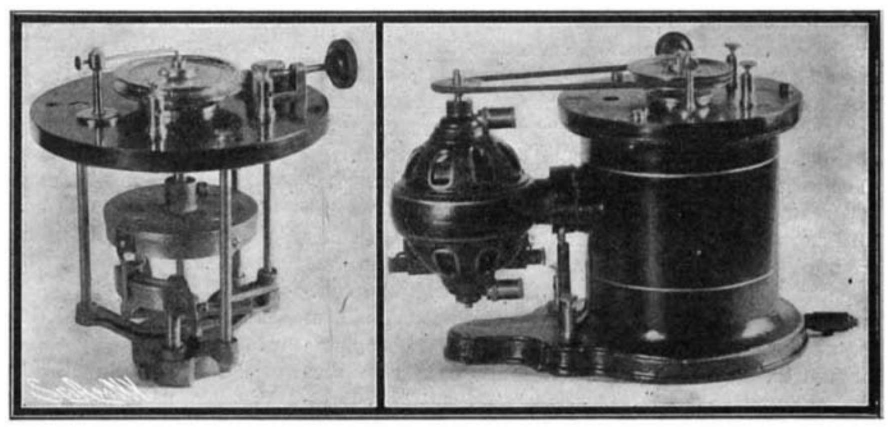
A NOVEL INTERRUPTER FOR INDUCTION COILS.

BY OUR BERLIN CORRESPONDENT.

Ever since induction coils have obtained their present importance in connection with Röntgen rays and wireless telegraphy, there has been a demand for a reliable interrupting device, which can be regulated to give any desired frequency and any desired duration of the current impulses.

This demand is greater in connection with Röntgen apparatus, as Röntgen bulbs have to be regulated during operation, to give most favorable results. On the other hand, such interrupters have to work with a low consumption of energy and the bulbs must be put to as low strains as possible.

The Wodal mercury jet interrupter, which we illustrate herewith, fulfills these requirements in a very satisfactory way. The main casing carries at one side a small electric motor, which drives a shaft located centrally in the interrupter proper. This shaft comprises two sections coupled together but electrically insulated from each other by a disk of hard rubber. The upper member of the coupling consists of a circular metallic plate formed at its periphery with a flange which fits over the insulating disk. A number of contact fingers depend from this flange. Attached to the



The Interrupter with Casing Removed. The Interrupter Complete.

A NOVEL INTERRUPTER FOR INDUCTION COILS.

lower end of the shaft is a centrifugal device which operates in a quantity of mercury which fills the lower portion of the main casing. The mercury is thereby constrained to rise through a pipe to a perforated, curved casing whence it flows out in a broad jet in the path of the revolving contact fingers. Every time a finger encounters this jet, the electric circuit is completed to the induction coil. A shield which fits over the perforated face of the curved casing may be operated by means of a thumbscrew at the top of the interrupter to close any desired number of the perforations, thus permitting the width of the mercury to be adjusted. When the holes are all open, the contact fingers will encounter a broad ribbon jet, and a maximum duration of current impulses will be obtained; on the other hand, in the case of a single hole being opened, the impulses will be of short duration, and the current may

Fig. 1.—Street Post.

Fig. 2.—Fire Alarm Switchboard.

A NEW ENGLISH TELEPHONIC FIRE ALARM.—[See next page.]