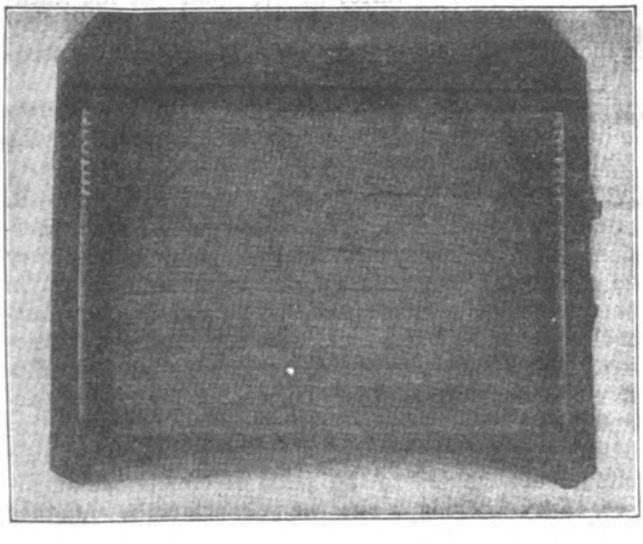
The Power Indicating and Limiting Apparatus for the Chicago, Milwaukee & St. Paul Railway.—B. H. SMITH.—The writer deals with the method of keeping the dispatching office in touch with the power being supplied at the various substations along the Coast and Columbia divisions of the Chicago, Milwaukee & St. Paul Railway. The dispatcher's office is near Tacoma at the western end of the division. At the easternmost substation there is a 1-kw. generator which produces a current with frequency so controlled that it varies with the power as measured by the wattmeter at the substation. The voltage generated is stepped up to 2,000 and transmitted to the next substation about 100 miles (160 km.) to the west. Here the frequency is not increased directly, but another alternating-current generator is introduced and so controlled that its speed and frequency are proportional to the power being measured at both of the substations. This process is repeated until the indication at the load dispatcher's office gives the total of all power received by the electrified section of the road. Since the railroad buys energy on the basis of a maximum five-minute integrated load, it is necessary to keep the peak loads as low as possible. This is accomplished through the agency of a load regulator which, when it reaches a predetermined point, closes its contacts in the lowering direction and sends out to the substations a direct current which acts on the field rheostats of the generators to reduce the normal 3,000 volts at the trolley at times of heavy overload.—*Electric Journal,* February 1920.

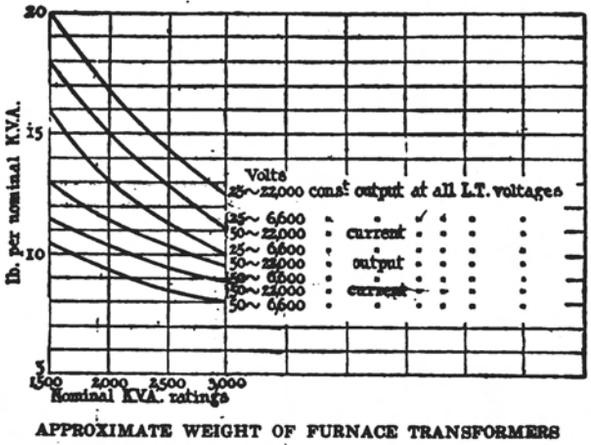
Present-Day Radiography.—G. W. C. KAYS.—The writer calls attention to the great stimulus given to the use of X-rays for surgery during the war. A new branch of radiography has been developed within the last year or two in the application of X-rays to the



RADIOGRAPH OF ELECTRICALLY HEATED EARTHENWARE COFFEE POT

study of materials and structures. For this purpose it is said that the Coolidge tube is by far the biggest step in the progress in X-ray work. A number of examples are given of the use of X-rays in examining the internal structure of engineering materials.—London *Electrician,* Feb. 6, 1920.

Transformers for Electric Furnaces.—J. L. THOMPSON.—This is a comprehensive discussion of the present and future status of transformers for electric furnace work. The author states that at the present time electric steel furnaces have been designed for capacities of 15 tons and that the future will demand larger sizes up to 30 or 40 tons. Assuming that 200 kva. is required per ton, transformer groups of 6,000 kva. to 8,000 kva. will be required. While transformers of larger capacities have been designed, this particular problem is complicated by the low voltage and heavy currents required. The writer then deals with the design of the furnace with special regard to the heavy magnetic fields involved, the mechanical stresses and



APPROXIMATE WEIGHT OF FURNACE TRANSFORMERS

furnace layout. He states that in order to reduce the possibility of a heavy choking effect and unbalanced voltages, the following suggestions may be useful: (1) Transformers should be placed as near to the furnace as possible, so that heavy low-voltage leads may be of minimum length. (2) Low-voltage leads of the various phases should be symmetrically placed with respect to transformers and furnace. (3) The area between positive and negative low-voltage leads should be as small as possible and also that between phases so that inductance may be a minimum. (4) Low-voltage leads for heavy currents (above 5,000 amp.) should be in multiple and interleaved from the transformer to a point as near the furnace as possible. This will keep the inductance low and make that of each lead approximately the same, thus insuring that each parallel lead takes its proper share of the load. (5) Heavy current leads should not be run near any heavy magnetic structure such as girders or supporting columns unless both the positive and the negative leads are run together and interleaved. (6) No magnetic material should form a closed circuit around any positive or negative conductor, or heavy currents will be induced in that circuit. The positive and negative conductors interleaved may be run through a magnetic circuit. Clamps for heavy-current leads should be of non-magnetic material.—London *Electrician,* Jan. 30 and Feb. 6, 1920.

Electric Mine Hoists.—G. HACAULT.—In the last installment of this extensive series of articles, the earlier parts of which we have already referred to in these columns, the author takes up for discussion the various systems of direct application of alternating-current motors for driving the hoist drums. In Europe the induction motor is only seldom used for high-power hoists, owing to the difficulties of adapting it for reliable regenerative braking. During later years, however, the alternating-current commutator motor has come into extensive use in this field, in units up to many hundred horsepowers. A popular type is the Deri