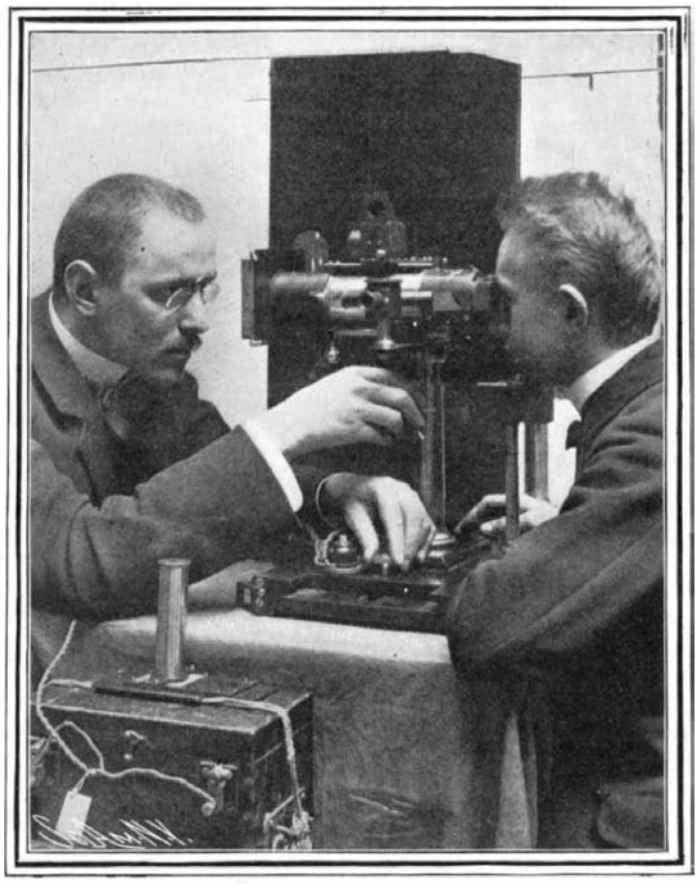
NEW APPARATUS FOR PHOTOGRAPHING THE BACKGROUND OF THE EYE.

Dr. Walther Thorner, of the University Eye Clinic at the Royal Charité in Berlin, has recently succeeded in solving a problem that has long occupied the minds of oculists, many fruitless attempts having been made heretofore to find a solution. His invention is an important one, and is a big step forward in the treatment of eye diseases. Dr. Thorner has devised an apparatus, by means of which it has become possible to photograph the background of the eye and obtain good pictures of the same. His contrivance constitutes a material improvement of the ophthalmoscope invented by Helmholtz in 1850, which latter device only admits of looking at the background of the eye. Owing to the peculiar construction of the eye, it has been impossible heretofore to photograph the interior or back of the eye. It is a matter of great difficulty to illuminate the interior sufficiently to take a serviceable picture, and even if strong sources of light were used, the exposure would last too long, rendering necessary a fixation of the eye, which in turn would entail serious inconvenience to the patient.

By means of his apparatus, Dr. Thorner first succeeded in obtaining photographs of the eyes of animals, particularly cats.

The interior of the human eye being much darker than that of the cat, it required many improvements to take good photographs of the interior of human eyes with the apparatus.

The result was highly successful, the changes proving perfectly satisfactory. We present to our readers a picture of Dr. Thorner's apparatus, constructed by the firm of Schmidt & Haenisch, of Berlin.



APPARATUS FOR PHOTOGRAPHING THE BACKGROUND OF THE EYE.

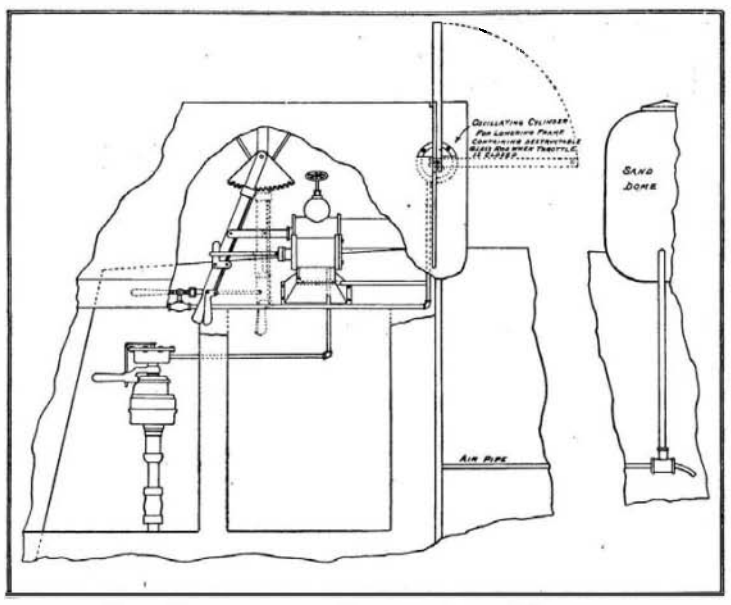
With the mild light of a kerosene lamp, the eye is first so focused that its back yields a clear image on the photographic plate, a telescope-like focusing glass forming part of the apparatus being used for this purpose. The focusing having been accurately done, and the plate put in, the camera itself is opened by pressure on a special lever, and a flash-light composition ignited by means of an electric spark generated in a storage battery. Thereby the background of the eye is lighted up sufficiently for a moment to produce a good image on the plate. Still, the pictures thus obtained are somewhat underexposed, and require special care in developing, to obtain the best results.

A large number of such photographs of diseased and healthy eyes have been reproduced by Dr. Thorner in his recent book, equally interesting to the profession as to laymen, entitled "The Theory of the Ophthalmoscope and the Photography of the Back of the Eye," published by August Hirschwald, Berlin.

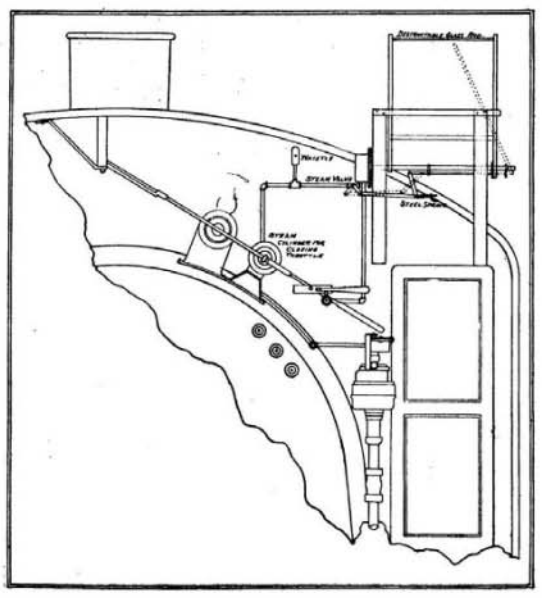
It is possible to distinguish healthy eyes readily from sick ones, the eye of a strongly short-sighted person being, for instance, characterized by a peculiar ring around the sun-like illuminated center. Oculists will now be enabled to watch the progress of eye diseases or disorders step by step. The apparatus also permits of taking a picture of any separate parts of the interior of the eye.

AUTOMATIC CONTROL OF LOCOMOTIVES.

The shocking accidents which have recently occurred in the vicinity of New York city, on railroads fully equipped with block signal systems of the most improved type, and in perfect working order, have shown very forcibly that between these signals and the throttle of the locomotive, which they are supposed to control, is an unreliable human intermediary. The perfect system would, therefore, seem to be one capable of acting directly on the throttle when ignored or wrongly interpreted by the engineer. Many systems have been invented, but as we stated at the time of the Westfield horror, these are all open to the same objection, namely, that they are liable to destroy the watchfulness of the engineer, and then, should the automatic mechanism become disarranged, the chances of accident would be greater than ever. But this objection does not apply to the automatic signal system which we illustrate herewith, for it is so arranged as to increase, rather than diminish, the vigilance of the engineer. Every time a signal is ignored, the locomotive is automatically stopped, but at the same time a record of the fact is automatically made which the engineer must explain at the end of his run.



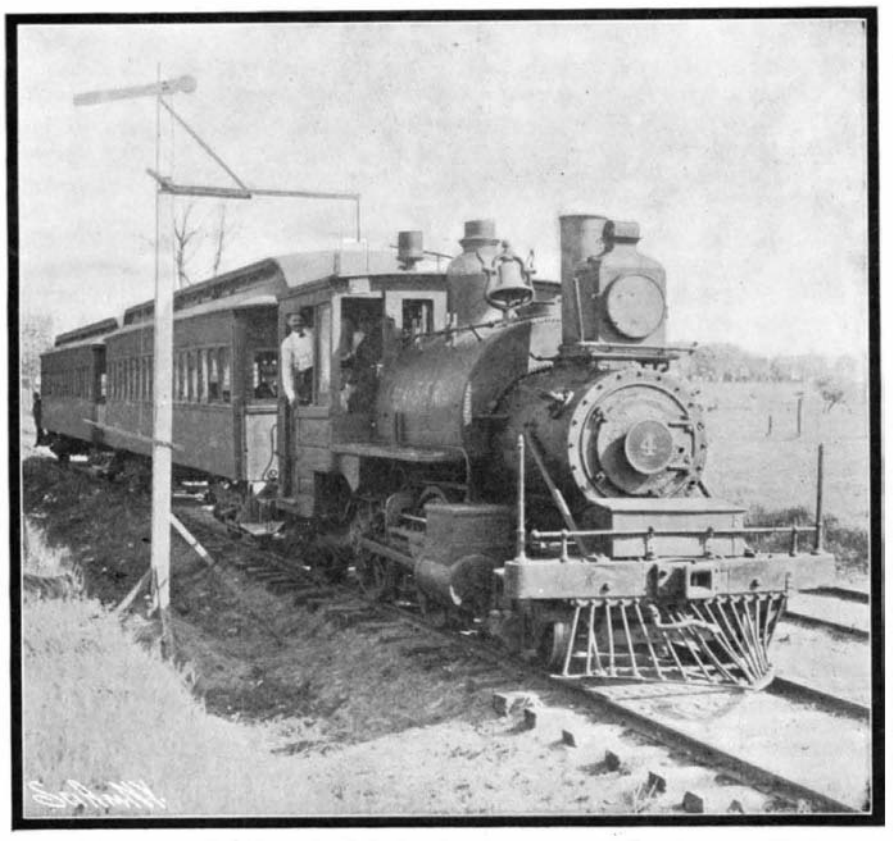
Side View, Showing the Details of the Controlling Apparatus.



Front View of the Controlling Apparatus.

The mechanism employed in this system is very simple, and is clearly indicated in our detail views. Projecting above the cab of the locomotive are two parallel and vertical arms, the outer one of which is pivoted to swing sidewise toward the other arm, but is normally held parallel therewith by a glass rod interposed between the arms at their upper ends. The signal system along the track consists of the usual block signal semaphores, but in addition to these each signal post is equipped with a lever normally in a vertical position, connected to these semaphores. When the danger signal is set, this lever is swung to horizontal position over the track, so as to strike and shatter the glass rod carried by the locomotive. When the glass is broken, the pivoted arm swings to the dotted position shown in our front view of the apparatus. In so doing, by means of the lever connections shown, a steam valve is thrown which admits steam to the throttle-closing cylinder. As shown better in our side view, the piston rod of this cylinder is so connected to the throttle-lever as to first unlock it and then draw it to closed position. At the same time a valve is turned which throws the sand lever. When the throttle is closed, the piston in the throttle-closing cylinder uncovers a port leading to a valve which acts on the engineer's brake lever and sets the emergency brakes. Thus, the train is automatically brought to a standstill without the assistance of the engineer, and cannot be started again until a new glass rod has been placed between the pair of vertical arms. This, however, occurs only in an emergency, as the engineer is provided with a means for swinging the glass rod out of the path of the danger signal, and is held responsible for any failure to do so; but by means of an interlocking system, the throttle must first be closed before this can be done. The two arms which hold the glass rod are mounted in a swinging frame, so that they can be swung forward and downward, thus clearing the danger signal. The swinging frame is operated by an oscillating steam cylinder controlled by a valve lever near the throttle lever, but is locked by a rod extending from this lever. When the throttle is closed, this locking rod is withdrawn from engagement with the valve mechanism, permitting the latter to be turned to admit steam to the oscillating cylinder, which will then swing the frame to the dotted position shown in our side view. Owing to the interlocking connection of the valve with the throttle, the latter cannot be opened until the valve has been closed, shutting off the supply of steam and permitting the frame to swing upward to its normal vertical position. This precautionary device prevents the careless engineer from running his engine with the automatic mechanism in the inoperative position. Owing to the fact that engineers sometimes suddenly die or lose consciousness at their posts, a whistle has been attached to the steam pipe which leads to the throttle-closing cylinder, so that whenever the automatic operations take place, this whistle will sound a call to the fireman, who can come to the engineer's aid in case of necessity.

As a check upon the engineer for failure to close the throttle at each danger signal a time-recorder is placed in the cab, and this records each automatic closing of the throttle. Furthermore, each engineer is provided with a limited number of glass rods and must account for them all at the end of his run, giving satisfactory explanation for



BLOCK SIGNAL DIRECTLY CONTROLLING THE THROTTLE OF A LOCOMOTIVE.

any missing ones. We recently witnessed a very interesting test of this system on a branch line of the Long Island Railway, which proved the efficiency of the apparatus beyond a doubt. The accompanying photograph shows the locomotive used in this test approaching one of the danger signals along the line.

Santos Dumont's New Airship.

Santos Dumont's airship No. 7, which is to be used at St. Louis, has been overhauled and considerably modified in the details of the *nacelle*. A visit to the balloon shed near Paris showed that the No. 7 was already inflated with gas, and is only awaiting a favorable moment for making a sail. The aeronaut states that the trials which he has made of the motor and the mechanical parts have been very satisfactory, and he is confident of the success of the new airship. He expects to make a very thorough series of trials in the air in order to become perfectly familiar with the maneuvers, and will not leave for St. Louis before this is carried out. Beside the No. 7 is a new airship of somewhat similar form, but of smaller size, to the No. 11, which has been sold to an American. It has a long *nacelle* and the basket will contain four persons. The motor is of the Clement-Bayard type with a special carbureter, and is rated at 16 horse-power. The balloon has been constructed at the Lachambre establishment. It is already filled out, and will, no doubt, make a trial trip shortly. The No. 9, the smallest airship yet constructed, with which Santos Dumont made a number of interesting performances last year, has been purchased by another American, Mr. Boyce, who expects to try it soon at New York. Mr. Boyce had previously purchased the No. 8, but had an accident with it during his first ascensions.

The Burning of Troy Polytechnic Institute.

The main building of Rensselaer Polytechnic Institute, one of the oldest and most widely known schools of civil engineering in the country, was destroyed by fire on June 9. This is the fourth fire to visit the institution in a year and a half. Two were in the chemical and one in the electrical laboratory.

The Rensselaer Polytechnic Institute was founded by Stephen Van Rensselaer, of Albany, the last, save one, of the Patroons, on November 5, 1824. Until 1850 it was known as the Rensselaer School, and was devoted to theoretical and practical science. It was reorganized in that year as a general polytechnic institute, and assumed its present name. The purpose of the Institute, as declared in its charter, is to maintain a school for instruction in mathematics, civil engineering, chemistry, mineralogy, geology, botany, literature, and, in their application to the arts, agriculture, domestic economy and manufacturing. In carrying out its purposes it was extensively equipped with apparatus and collections, but the work especially carried on is the instruction of engineers.

The Current Supplement.

The current SUPPLEMENT, No. 1485, opens with a splendidly illustrated account of Creusot ordnance. F. J. Rowan recently read before the Institution of Engineers and Shipbuilders a most exhaustive paper on superheated steam. His treatment of the subject is so valuable that the Editor publishes his paper in full. A novel balanced rotary valve for gas-engines, which controls both functions of induction and exhaust of the gas to and from the motor, and which can be used for two or three cylinders, thus dispensing with two or three sets of valves and gearing, is made the subject of an article that is very elaborately illustrated with diagrams. Charles Fremont's method of testing steel rails is described. Dr. C. A. Herter writes in an appreciative vein on the influence of Pasteur on medical science. Some novel studies of radium will be found among the minor articles.

The Invention of Babbitt Metal.

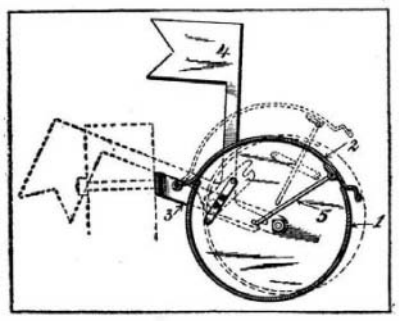
Although Babbitt metal is one of the most common anti-friction metals in use at the present time, but few users of this metal are aware that Isaac Babbitt, whose name it bears, was the inventor and patentee of the method of lining boxes with soft metal rather than of any particular alloy of the metal itself. The Metal Industry recently published a copy of the original patent, No. 1,252, which was granted to Isaac Babbitt, of Boston, Mass., July 17, 1839. In this he claims to have invented a new and improved mode of making boxes in which gudgeons or journals are to run. To quote from that part of his patent relating to the metal used, he says: "I prepare boxes which are to be received into housings or plummer blocks in the ordinary way of forming such boxes; making them of any kind of metal or metallic compound which has sufficient strength and which is capable of being lined. The inner parts of these boxes are to be lined with any of the harder kinds of composition known under the names of britannia metal or pewter, of which block tin is the basis. An excellent compound for this I have prepared by taking 50 parts of tin, 5 of antimony, and 1 of copper. But I do not intend to confine myself to this particular composition."

No claim whatever is made for the composition and, in fact, that specified is somewhat softer than what is now known as "genuine babbitt," which is commonly composed of 96 parts of tin, 8 parts antimony, and 4 parts copper.

Although Babbitt's name is somewhat erroneously applied to the metal, yet, as he was the first to exploit the use of soft metals in the manner in which they are now so commonly employed, it seems but just that his memory should be perpetuated in this way.

MAIL BOX FOR RURAL DELIVERY SERVICE.

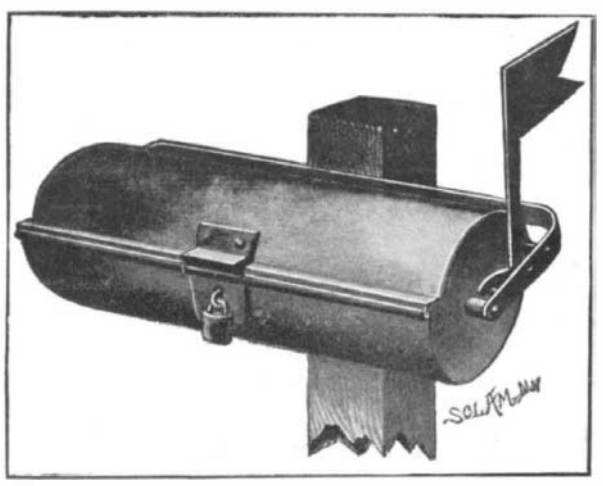
The rural free-delivery system recently introduced by the Post Office has created a demand for a new type of mail box, one which will indicate by a signal whether or not it contains any mail matter. The rural mail box must be situated along the main road, often a considerable distance away from the house it



CROSS SECTION THROUGH THE MAIL BOX.

serves; and it is evident that a signal which would automatically indicate that mail has been deposited in the box, would save the owner many useless trips thereto.

We illustrate herewith a mail box of this type, which was recently invented by Mr. A. M. Hoes, of Palmer, Neb. This box, it will be observed, is of cylindrical shape, the lower half and ends, 1, constituting the main body, and the upper half, 2, constituting the lid. The box is eccentrically mounted in bearings in a yoke piece, 3, which may be secured to a post or other support. The lid is also hinged to this yoke piece at the rear. A bell crank is pivoted to one arm of the yoke, and carries a flag or other signal, 4, at its upper end, while its lower end is slotted to engage the end of a rod, 5, which projects through the end wall of the mail box. This signal serves to notify the owner that mail matter has been deposited in the box; normally, however, the flag is not held upright, but rests against the cross arm of the yoke piece. The rod is secured at its upper end to the lid, as shown in our section view. When the lid is raised, this rod, together with another rod similarly connected at the opposite end of the mail box, serves to swing the body portion, 1, on its eccentric pivots to the position shown in



MAIL BOX FOR RURAL SERVICE.

dotted lines. The projecting end of rod, 5, will, at the same time, tilt back the signal bell crank until the flag falls to normal position. To set the signal, the postman while closing the box, after having deposited mail therein, holds the signal bell crank in such a position that its slotted end will be engaged by the projecting rod, and thereby raised to a vertical position. Owing to the cylindrical form of the box, and to the fact that the lower part rotates eccentrically on opening, the mail matter will slide forward, coming within easy reach, and the entire contents of the box will be brought into view as soon as it is one-third open.

According to the Iron Age two of the largest spiral springs ever made in the United States were shipped recently from Pittsburg. The springs are 27½ inches diameter, and have a height of 34 inches. When closed solid they are 19 inches high. They are made of 1½-inch steel, and the bars were 533 inches in length. The springs are so elastic that they can be moved with the finger, while it requires a pressure of 3,000 pounds to close them down. The rule among spring makers has heretofore been that the inside diameter of a spring must not be over 10 times the thickness of the bars without special appliances to keep the coils in position. These springs, however, are seventeen times the diameter of the bar.

THE BERTHIER ACTINO-ELECTRIC TRANSFORMER.

(*Continued from page* 476.)

induced circuit, since the electro-motive force of the circuit of the selenium battery is constant. When the manipulating disk is revolved, the following phenomena occur: At the moment at which the first pencil of light reaches the selenium, the latter becomes converted into a battery. The current of this latter traverses the primary of the transforming coil, and produces variations in the flux of the magnet and of the electro-magnet. Such variations are made manifest by a current in the induced circuit, that is to say, in the secondary of the transformer or simply of the induction coil. The greater the flux of the magnet is, the greater will be the variations produced therein, and the more intense also will be the induced current—a phenomenon that will be shown by a sound in the telephone. Another induced current is produced at the moment at which the selenium is no longer influenced by the light. We have therefore closings and openings of the circuit, and consequently an alternating current in the secondary circuit of the transformer. The frequency of this current is determined by the rotary velocity of the shutter disk.

The magnet, as I have above stated, may be replaced by an electro-magnet excited by a battery of accumulators, which, according to M. Berthier, may be recharged by the induced circuit if care be taken to put in series with the arrangement, a Nodon electrolytic valve formed of a plate of aluminium and one of lead immersed in a saline solution of phosphate of soda.

Although, up to the present, M. Berthier has desired to produce merely a demonstration apparatus and not an industrial one, his arrangement nevertheless presents a great interest from the viewpoint of the conservation of energy. It would evidently be very interesting to know the exact theory and the efficiency of it.

The second form, which is shown in Fig. 2, is designed for the production of a continuous current. The apparatus resembles the Foucault or the Faraday disk. Nevertheless, while in the Foucault experiment, the disk placed between the branches of an iron horseshoe magnet is movable, it is here stationary. What, on the contrary, is movable is the light-obscuring shutter. The arrangement is plainly shown in Fig. 2. The actinometric disk is this time formed of a sheet of mica covered with sensitive selenium. A disk of porcelain has likewise been tried. The disk is heated to the desired temperature and is then coated with selenium by moving a stick of this material over the surface of the mica, which is afterward kept at a temperature of 210 deg. C. Experiments have been made also with disks of aluminium, copper, etc. It is interesting to observe the current that thus passes over the edges of a stationary disk as the shutter is revolved before it. The edge of the disk is naturally provided with a rim formed of a strip of thin metal. A metallic plate likewise is placed in the center for collecting the current. The current produced should be perfectly continuous. Instead of magnets, it might be possible to employ electro-magnets supplied with current from the battery that runs the motor, although in such a case it is to be apprehended that effects of induction might be produced. M. Berthier purposes to make a series of experiments with slightly different arrangements, especially when employing a liquid conductor. It would be a question then of preventing electrolysis.

The form of shutter need not be exactly that shown in the picture. The apertures, for example, may have the shape of half-crescents. It is possible also to construct the shutter of a disk of mica or glass to which is glued a sector of black paper. The apparatus is inclosed in a tight box having a single window with the shutter in front. Some experiments have been made also with wires of pure nickel coated with selenium and wound into a flat ring and then submitted to luminous variations. The apparatus thus constructed presents, according to M. Berthier, some analogies with the Gramme dynamo with the armature fixed between foliated inductors.

The state of M. Berthier's health has, up to the present, prevented him from pursuing his researches actively. But he has recently secured the assistance of M. Albert Nodon, the well-known inventor of the electrolytic valve that bears his name, and it is probable that under such circumstances the experiments will be actively prosecuted, and that at a period less remote than might be expected, we shall have a definite solution of the very interesting and very important problem of which I have sketched the main features in the above notes.