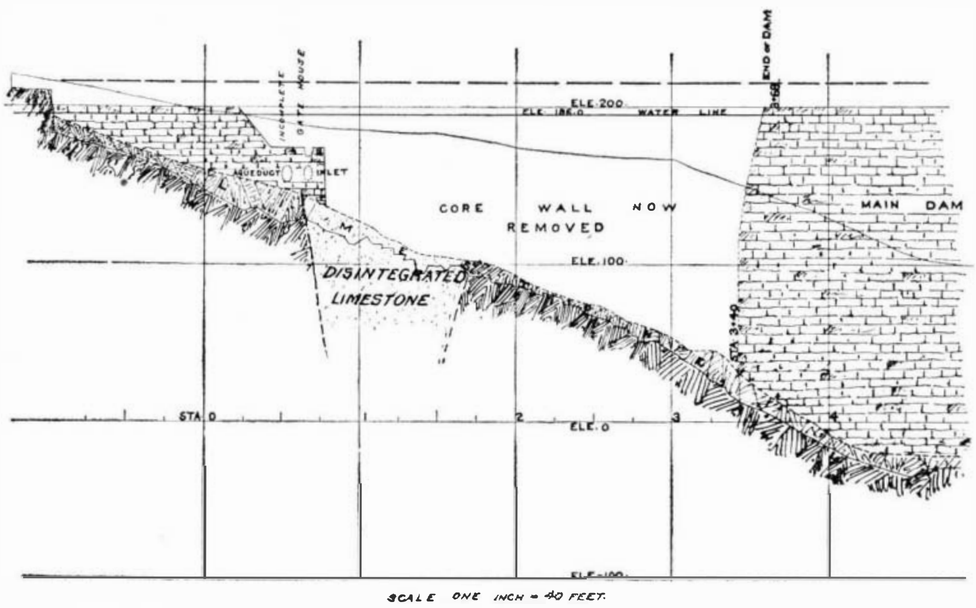
an uneven track, the connecting rods from lever *K* are not rigidly secured to the arms *N*, but slide freely therethrough until the springs on the connections *L* have been sufficiently distended to bring the collars on the rods into engagement with the arms *N*. Obviously the collars can be so placed that the crank arms will not be moved until a considerable weight has been imposed upon the fender. When the fender drops, whether automatically or otherwise, it is locked in this position by means of lock bars, which swing backward from the common pivot and are held by pawls *H* engaging ratchet teeth formed on the bars. The fender can be easily attached to a car, two bolts on each outside sill of the car platform being all that are necessary to hold the fender, hangers, and adjustments. It can be compactly folded, and does not interfere with the headlight or offer any obstruction when coupling. The rods each have a direct pull, so that the fender is not liable to get out of order. The cushion front of the fender is made of rubber tubing with a small steel wire cable passing through it, which, together with the telescopic frame, makes a most flexible fender for contact with an obstacle.

The fender is the invention of Mr. W. T. Watson, of Newark, N. J., who has also invented a wheel guard for use on cars not provided with fenders. In our illustration of the wheel guard, the upper view shows the guard in its normal position with the operating position indicated by dotted lines, while the lower view shows the guard dropped and the normal position indicated by dotted lines. The wheel guard is dropped by means of the trip-bar *A* which is raised on coming in contact with a body larger than would pass under the truck pilot board. Through the intermediary of star wheels *B* the motion of the trip-bar is made to release the catch *C*, permitting the guard *D* to drop to the roadbed. The construction of this guard is very ingenious. It comprises a buffer, from which a number of fingers project, the latter being held outward by light coil springs, as shown. In passing over rough pavements, cross tracks, and the like, the fingers play in and out independently. A finger on striking a stone or similar object will be pressed back into the buffer until the latter, owing to its beveled under surface, slides over the obstruction and permits the finger to spring clear of the same. This construction, it will be observed, prevents injury to the parts and at the same time allows the guard to hug the roadbed in order to prevent it from passing over a body. The guard can be readily attached to any pilot board of standard make. It has no connection with any part of the car body and therefore swings around curves with the truck, being held directly over the rails at all times. This feature is particularly important for double-truck cars. The trip-bar *A*, being well in advance of the wheel-bar, when rising over an obstacle gives ample time for the wheel guard to drop. Snow does not interfere with this type of wheel guard because a lifting motion of the trip-bar is necessary to cause the buffer to drop, and in this construction the bar on coming into contact with a drift is forced directly forward, cutting through the snow instead of passing over it.

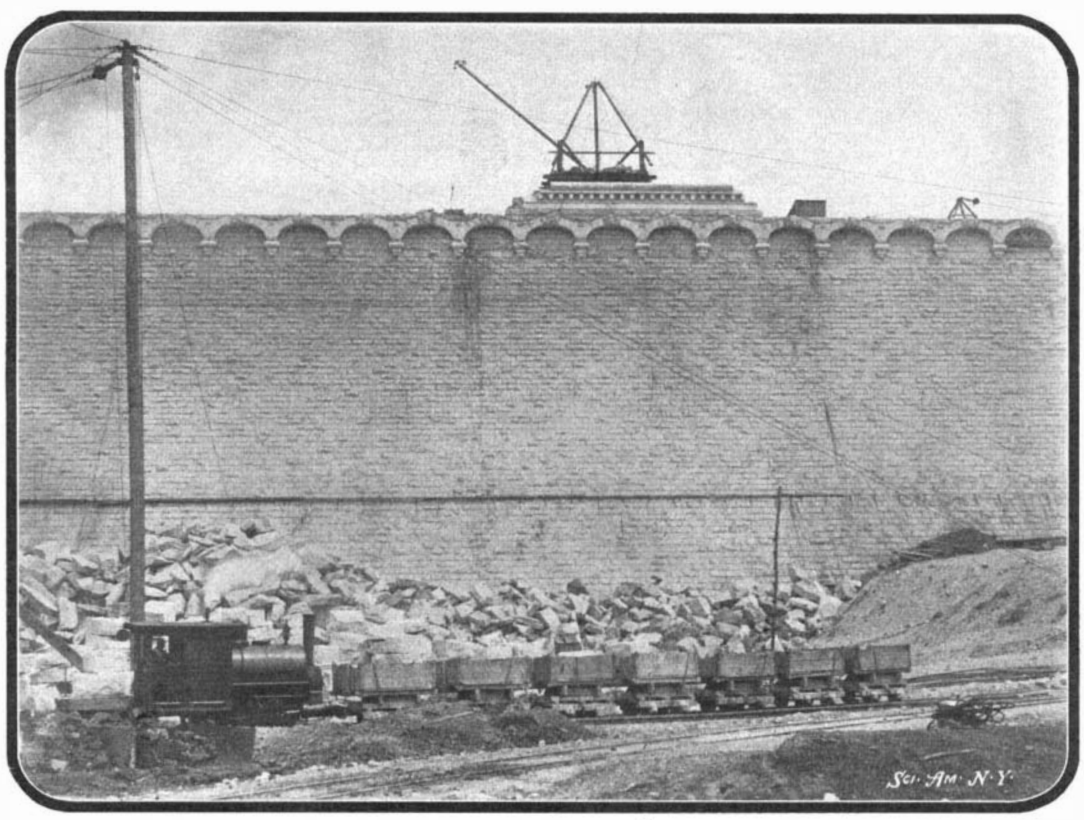



**Longitudinal Section on Axis of Dam, Showing Masonry Dam, Part of Core-Wall, and Defective Limestone Foundation.**

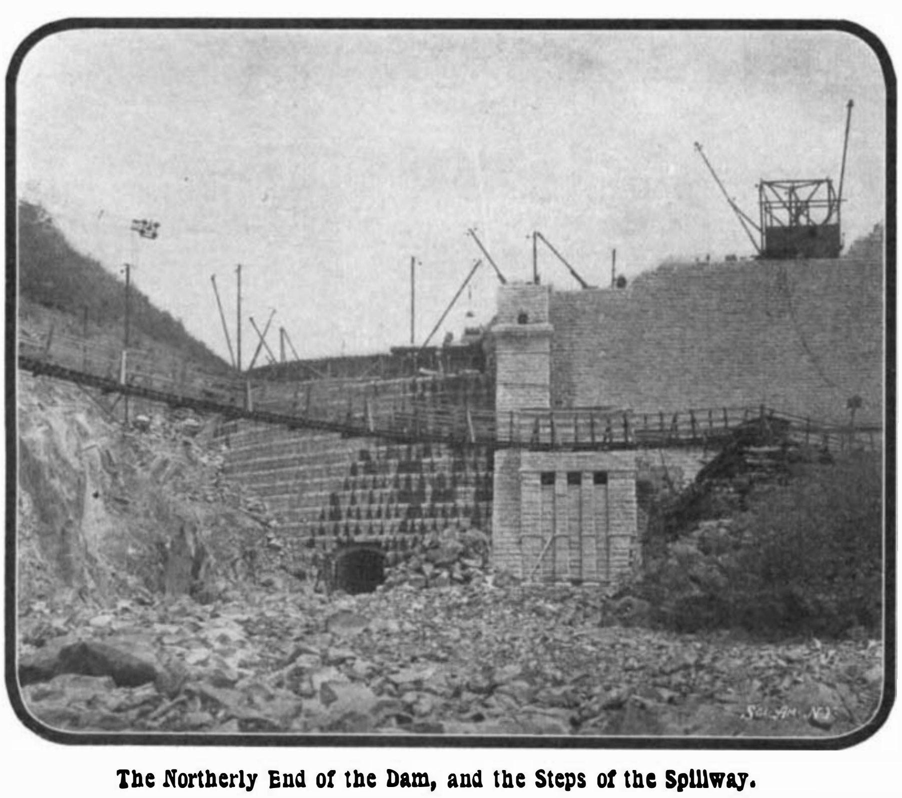
### THE PROBLEM OF THE GREAT CROTON DAM—NEW YORK CITY WATER SUPPLY.

The public alarm over the reported defects of the great Cornell Dam, which, when it is completed, will impound an additional 32,000,000,000 gallons of water for the supply of New York city, is perfectly natural and to a certain extent justified. It is natural, for the reason that if the structure after its completion should give way, not only would the additional supply of water be lost, but probably the present Croton Dam behind it, further up the valley, would be swept away in a terrific downward rush of the water, and New York city would be immediately brought face to face with a water famine that would be tragic in its results. Public concern about the dam is justified, moreover, to the extent that the natural foundations below the existing core-wall-and-earth dam have been proved to be exceedingly treacherous, and unless they are improved by carrying down the excavations until they reach a solid, impervious rock, they will constitute a serious menace to the future safety of the whole structure.

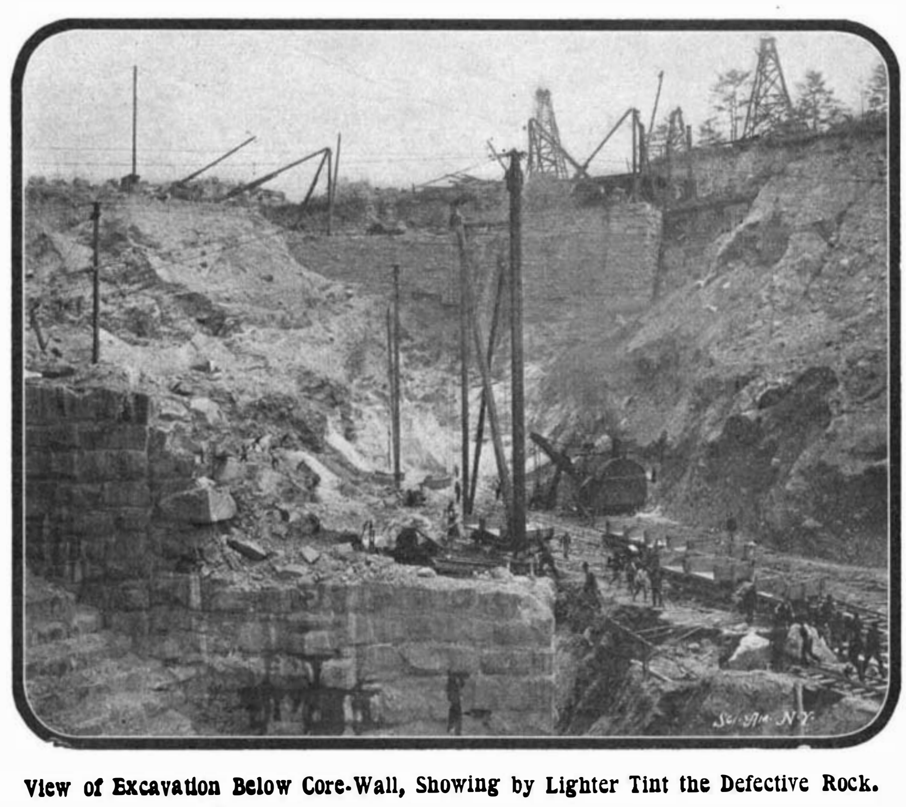
The dam as originally laid out, and now nearly four-fifths completed, consisted of 1,000 feet of masonry spillway, 1,000 feet of masonry dam, and about 600 feet of dam at the southern end of the structure, built on the core-wall-and-earth system. The masonry dam proper consists of an enormous mass of rubble work laid in cement, which is over 200 feet in width at its base and extends for about 300 feet in height from base to crest. In building this portion of the dam a huge trench, extending 160 feet below the bed of the Croton River, was excavated, all the loose, disintegrated rock that was at all pervious



**A Portion of the Dam Completed to Its Full Height.**



**The Northerly End of the Dam, and the Steps of the Spillway.**



**View of Excavation Below Core-Wall, Showing by Lighter Tint the Defective Rock.**

**THE GREAT CORNELL DAM.**

to water was carefully removed, the solid bedrock as thus exposed being thoroughly cleaned and washed with pure cement, and the great rubble wall was then built up with extreme care upon the foundation as thus prepared, the blocks of stone of which it is built averaging three feet or more in thickness and weighing several tons apiece. The masonry portion of the dam as thus built up, now practically completed, is a magnificent piece of work, and among the greatest of its kind ever constructed. From motives of economy, the southerly 600 feet of the dam was originally designed to be built with a central core wall founded like the main dam upon rock, and extending to the full height of the dam, with a mass of earth banked up against it on both the up and downstream sides, the earth and embankments being built up in six-inch layers, watered and rolled as they were put down. In this type of dam the central core wall, which in the present case was 18 feet wide at the base and tapered to a width of 6 feet at the top, is supposed to present an absolutely impervious diaphragm to the passage of water, while the mass of earth on both sides of the wall is supposed to give the necessary inertia to resist displacement by the pressure of the impounded water. Smaller dams of this type have been built and have stood successfully for many years; but there is no record of any being built of the great height and importance of the Croton Dam. For this reason, and also because it was considered that the sudden transition from the massive and unyielding masonry dam to the relatively light and thin masonry core wall presented a feature that was constructively undesirable, and for the further reason that serious cracks had already developed in the core wall before there was any water pressure upon it, the present chief engineer of the work rcommended that the core wall be removed, and that the southerly 600 feet of the dam be built of masonry to correspond with the existing masonry portion of the structure as above described. An expert commission was appointed to examine and report upon the suggestion, and they unanimously recommended that the change recommended by the commissioners' engineer be carried through. The blasting away of the core wall and the carrying down of the foundations to secure a solid rock bottom has been going on for several months. On laying bare the foundations, it was discovered that for a distance of some 60 or 70 feet the core wall had been built upon a stratum of disintegrated limestone, which was so soft that upon being struck with a pick it crumbled into dust, and under the action of water would run like so much quicksand.

It was the discovery of this stratum which gave rise to the alarmist rumors concerning the insecurity of the whole dam as constructed. As a matter of fact, it was only a portion of the extreme southerly end of the dam, where it is comparatively shallow, that is affected, and it now becomes merely a question of quarrying down and taking out this decomposed limestone until a perfectly solid rock bottom has been reached. Unfortunately, the limestone stratum is approximately vertical, and runs at right angles to the axis of the dam, and hence it may be necessary to go down to an unprecedented depth before the pocket has been cleaned out and it becomes possible to perfectly seal up the foundations at this point. Borings have been carried down some 40 or 50 feet below the present excavation without revealing any improvement in the material. The disintegrated limestone is creamy white in color, and it can be clearly identified by its lighter tint in one of the accompanying illustrations showing the work of excavating as now being carried on at this point. The wall of masonry shown at the further end of this excavation is the gate house known as No. 1. It was built to control the supply of water from the new dam to the old aqueduct, which intersects the dam at this point. This gate house, together with the location of the limestone stratum, the core wall which is now being removed, and the existing masonry dam, are all shown in the accompanying drawing representing a section along the axis of the dam. Last year, at the request of the chief engineer, the Aqueduct Commission invited Prof. Kemp, of Columbia University, and Prof. Stevenson, of New York University, both geologists, to investigate the matter of the foundations, and their findings spoke of the condition of the foundations of gate house No. 1 and of the adjoining portions of the old aqueduct as "deserving very serious consideration." It is more than likely that the gate house and a small portion of the old aqueduct will have to be taken down and reconstructed during the extension of the masonry dam.

These considerations of the faulty character of the rock below the southerly portion of the dam do not imply that there is anything wrong with the foundations below the main dam. But in order to set at rest any doubts on the subject, a series of deep borings is to be made across the valley at the base of the dam, to ascertain, beyond all question, if there are any pockets of permeable material that need to be dealt with. The Aqueduct Commissioners have appointed Prof. Burr, of Columbia University, to advise the Commissioners and consult with their Chief Engineer on the whole subject of the dam foundations; and while it is, of course, deplorable that this much-delayed and urgently-needed public work should be subjected to still further delay, there is at least the satisfaction of knowing that the work as now being carried through will be beyond any suspicion of weakness and will last as long as the hills themselves.

Our various photographs show clearly the present condition of the work, which is so far advanced that it is proposed to commence filling the dam late in the present year. Including the southerly 600 feet, the total amount of masonry in the whole structure will amount to 820,710 cubic yards. Of this total, 687,180 cubic yards have been built in place, leaving 134,530 cubic yards, or less than one-fifth of the work, to be laid before the structure is completed.

### Results of the Commercial Vehicle Test.

In the test of commercial self-propelled vehicles, held by the Automobile Club of America on May 20 and 21, eleven delivery wagons and trucks started, and seven succeeded in surviving the two days' test. A 40-mile course was traversed each day, in three stages—one of 20 miles north from the club house in 58th Street to 230th Street and back, and the second and third down Broadway to Canal Street, thence west to West Street, to the Battery, and back Broadway and Fifth Avenue to 58th Street. The 40 miles were covered the first day as far as possible without stops; but the second day, each vehicle was obliged to make from ten to one hundred stops, according to whether it was a heavy or light machine. The lighter cars made the best runs and had the least trouble. Among these were two Knox delivery wagons propelled by the Knox air-cooled gasoline motor. One of these cars had a double-cylinder 16 horse power motor. Its weight was 2,300 pounds, and it carried a load of 1,250 pounds. It was the first to finish on both days, its time for the 40 miles being 3 hours, 35 minutes, and 3 hours, 41 minutes, the second inclusive of one hundred stops. The other Knox car, propelled by an 8 horse power motor and weighing 2,070 pounds, carried a load of 3,315 pounds, and finished third (time 4 hours, 37 minutes) the first day and second the second day in 4 hours, 55 minutes. A Mobile 4½ horse power steam delivery wagon, weighing 1,500 pounds and carrying a load of 775 pounds, finished second in 4 hours, 23 minutes the first day, and third in 5 hours, 10 minutes the second day.

The only vehicle in the electric class was a 6 horse power Waverley delivery wagon. This car weighed 2,420 pounds, and carried a load of 1,210 pounds. It covered the course in 6¼ hours elapsed time the first day, and 5 hours, 18 minutes, inclusive of 100 stops, the second. The first day it was halted and charged 20 minutes, and the second, 40 minutes, during the run.

Among the heavier vehicles propelled by a gasoline motor, were two entered by the Union Motor Truck Company, of Philadelphia. One of these was an express wagon like that illustrated in our recent Automobile number. Its weight was 4,525 pounds, and its load 2,710 pounds additional. Its time the first day was 10 hours, 34 minutes. After covering 20 miles the second day, one of the solid rubber tires came off, causing the wagon to skid suddenly into a sandy spot in the road and throw off the operator and observer, the latter of whom sprained his ankle. The 5,810-pound truck entered by the same company, was, like the express wagon, also propelled by a four-cylinder, 20 horse power gasoline motor. It carried its load of 3,240 pounds the required distance of 30 miles in 7 hours, 51 minutes the first day; but it, too, came to grief on the second day after going 22 miles and making 22 of the 50 scheduled stops. The driver, when trying to ascend the 230th Street hill, ran the truck into a bad hole, and, when backing out and down the hill, saw a train at the bottom and reversed, fearing a collision. By so doing, he bent the crank shaft of the engine, which was not strong enough to stand the tremendous strain.

As the test was the first in which heavy steam trucks have figured in this country, the performance of these machines was watched with great interest. The starters in this class were a 14,225-pound 30 horse power truck, carrying a load of 5 tons, and entered by T. Coulthard & Co., of London; an 11,160-pound, 20 horse power truck, carrying a 5,740-pound load, entered by the Morgan Motor Company, of Worcester, Mass.; two Hershmann trucks of 15 and 25 horse power, weighing 10,225 and 14,500 pounds respectively, and carrying loads of 3,805 and 10,000 pounds. A 10 horse power delivery wagon weighing 3,530 pounds and carrying 1,720 pounds load, entered by Blaisdell & Co., of Brooklyn, completed the list of steam machines. This machine only got to 161st Street before it was forced to retire owing to pump troubles. It also caught fire from leaking gasoline. The heavier Hershmann truck also quit at the same place, owing to leaky boiler tubes. The other trucks finished the first day's run of 30 miles in the following times: Coulthard, 4 hours, 53 minutes; Hershmann, 6 hours, 31 minutes; and Morgan, 9 hours, 21 minutes. The second day all three trucks again succeeded in covering the 30-mile course, the Hershmann and Morgan inclusive of 25 stops, and the Coulthard of 10, in the folowing times: Hershmann, 4 hours, 57 minutes; Courthard, 10 hours, 28 minutes; and Morgan, 12 hours, 52 minutes.

Thus it will be seen that the two leading makes of American steam trucks compared favorably with the English one; although the American builders are as yet in the experimental stage. The detailed results of the test, such as fuel and water consumption, we hope to give in a later issue.

### Electrical Notes.

The John Scott legacy medal and premium was recently awarded by the Franklin Institute to William J. Hammer of New York, for a remarkable experiment in the phonographic and telephonic transmission of sounds between New York and Philadelphia. Two Edison phonographs, two Edison carbon transmitting telephones, two Edison motograph receivers or loud-speaking telephones, two sets of induction coils and batteries and 104 miles of long-distance telephone circuit, 6 miles of which was underground and submarine cable, and 98 miles of which were strung on poles, were employed. The sounds, consisting of talking, singing, and cornet playing, were transmitted through the air five times, and were transmitted through no less than fifteen distinct media from the speaker and musician in New York to the audience in the Franklin Institute, Philadelphia. These media included vocal chords, cornet, air, glass, iron, and mica diaphragms, carbon buttons, styli of steel, palladium, fixed pins or springs, hydrogen gas, distilled water, wax and chalk cylinders, copper wire and the mechanism of the ear. The physical characteristics of the sound waves were changed during transmission no less than forty-eight times. It is interesting to note that the same lecturer, by means of transmitters placed upon the stage, was listened to by audiences in fourteen different cities. Music and talking were transmitted by the phonograph and telephone from the stage of the Franklin Institute to Buffalo, Rochester, Boston, Syracuse, New York, Newark, Orange, and elsewhere.

Treatment of diseases of the eye by electricity has been tried as long as electricity was first scientifically employed in therapeutics. Nevertheless, the advantages of this treatment are very little known. Dr. von Reuss deserves credit for referring to Prof. Mendelsohn's monthly Die Krankenpflege, in a detailed article on partly successful experience in electrical treatment of diseases of the eye, made by himself, which he strongly recommends to his colleagues. Without entering into special information chiefly intended for physicians, one point from the experience of the author has to be set forth. According to his statement, there is no doubt as to the sedative effects of electricity upon a diseased eye, particularly in cases of inflammation. At first electricity was used in diseases of the ophthalmic nerves and muscles of the eye, but in these cases Dr. von Reuss could not secure positive results. Most remarkable, however, are the improvements observed in treatment of inflammatory diseases of the eye by electricity. A great advantage is offered by the treatment being simple and not at all disagreeable. As almost every physician with a large practice owns an induction-coil, he need purchase no new instruments. In order not to make the patient afraid of the action of the electrical current, the physician uses the faradaic hand (named after Michael Faraday). For this purpose the physician touches with one of his hands the diseased eye, while the other hand holds one electrode and the patient the other one of the apparatus. Except a prickling feeling in the hand which clasps the electrode, the patient does not feel anything; nevertheless, the action of the electrical current is so annoying for the physician, that he can not continue one sitting for a longer period than three to five minutes. The electrical current can in case of necessity be brought in direct contact with the eye by a compress tied upon the same. The patient can also in this way regulate the current according to his liking to prevent its becoming disagreeable. The whole affair, including the fixing of the electrode (compress) upon the eye, offers no difficulty, so that the patient may treat his eyes at home without the presence of the physician, which is of greatest value in cases of inflammation of the eyes where violent pains set in during the night. In nearly all cases pain disappears almost instantaneously and ceases for a long while. Dr. von Reuss recommends electrical treatment first of all in cases of iritis, corneitis, and choroiditis. The influence of electricity in removal of photophobia, which is due to a certain kind of conjunctivitis, by which the eyes cannot be opened, has been astonishing. Even upon blind eyeballs, which remain sometimes very painful, the electrical current exercises an extremely beneficent effect.