height in connection with the falling current of air. A very stupid arrangement is commonly carried out in middle class houses, of the kitchen being built out at the back, and the range being placed at right angles with the back wall, some two or three yards distant. The flues are here gathered over to the back wall, by which they are particularly horizontal at their junction with the main building, up which they are conveyed to a chimney at the eaves, as at Fig. 4. As is well known, such flues rarely work, and are most difficult to clean. A far better plan would be to place the range along the back wall of the main building, giving the full width to the narrow kitchen, and carrying the flue past the line of the eave to a height superior to the ridge, and protecting it with a gable, as at Fig. 7, B. Fig. 8 shows the roof plan of Fig. 7, where A is the ordinary faulty mode of construction, and B the improved mode of gables supporting the taller chimneys.

We have said sufficient to show that the subject of "The relation of domestic chimneys to the construction of roofs" is one worthy of great and careful consideration. That it has not had the attention it deserves is most true, proof of which is furnished every day. We can instance a large builder of fifty years' standing, who resided in a house in which the chimneys were constructed on the principle of Fig. 7, A. He dare not raise the brickwork of the chimney, and trust only to stays from the roof. The only course which appeared open to him was to fix pots and cowls designed for the prevention of smoky chimneys. This he did, indulging in about half a dozen varieties in three years; they all failed, and he had to leave, having built himself a house on adjoining land, on the same roof and chimney model.—*Building News.*

Tests of Stained Glass.

I have discovered a simple mode of testing whether, on the one hand, glass is sufficiently opaque so as not to appear flimsy or watery when put up in a window, unassisted by shading, according to the practice of the flat style of glass painting; on the other, whether it is sufficiently clear to produce as brilliant an effect as the old does. As follows: If the glass, when held at arm's length from the eye, and at the distance of more than a yard from an object, does not permit of that object being distinctly seen through it, the glass will be sufficiently opaque. And if when held at the same distance from the eye, and at the distance of not more than a yard from the object, permits of its being distinctly seen through the glass, it will be sufficiently clear and transparent.

I have found this to be the case with a great many pieces of glass of the twelfth, thirteenth, and fourteenth centuries, which had been rendered clear by polishing the surface, or which were already quite clear; for it is a great mistake to suppose that all old glass has been rendered dull on the surface by exposure to the atmosphere. I have seen a good deal of glass of the twelfth and thirteenth centuries that is as clear now as when it was first made, its surface not having been corroded in the least. But the glass of which these imitative works are made is either smooth on the surface and so pellucid or watery as, when held at arm's length, to permit of any object being perfectly seen through it which is at the distance of 100 or even 1,000 yards, or more; or else is artificially roughened on the surface, a practice which reduces the condition of the glass nearly to that of ground glass, for, when held at arm's length, it will not permit of any object being seen distinctly through it which is distant more than an inch from the glass.

The practice, not unfrequently resorted to by the imitators of old glass, of *antiquating* smooth surfaced glass—that is, dulling it with the enamel color used for painting the outlines—renders it, when held at arm's length, nearly if not quite as opaque as rough surfaced glass; indeed, almost the only perceptible difference in this respect between rough surfaced glass and smooth surfaced glass that has been antiquated is that the former is free from the tint necessarily imparted to the latter by the enamel color with which it is antiquated. Thus we find that imitations of glass of the twelfth, thirteenth, or fourteenth century, if executed in smooth surfaced glass that has not been antiquated, are very poor and watery in comparison with original work of the period; and that, if executed in glass that has been antiquated, or rough surfaced glass, they are much too opaque. In the one case, to speak popularly, the vision passes too uninterruptedly through the glass; in the other it is stopped at the surface of the glass, instead of passing about a yard through it, as in the case of ancient work.—*C. Winston, in The Architect.*

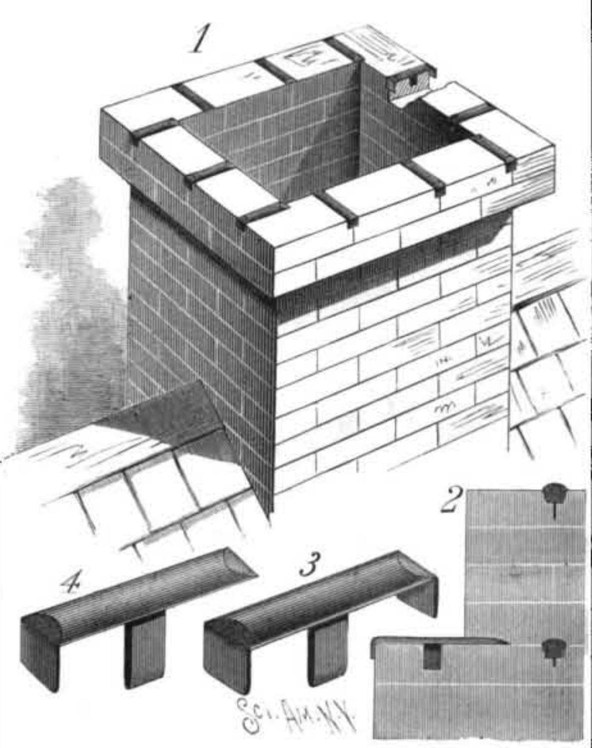
Westward the Squirrel.

Millions of squirrels are stated to be emigrating from Mississippi to the more elevated grounds in Arkansas. The plucky little animals swim the Mississippi River, beginning at a point about five miles below Memphis, and continuing from there twenty miles down stream. Thousands of them have been killed by the farmers, who use clubs in place of guns, on account of the immense numbers. A similar emigration occurred in

IMPROVED CHIMNEY CAP.

For durability in exposure to the weather, nothing seems better than the glazed surface of good, well burned brick. But in the upper courses of chimneys the end joints of the brick lack this quality of endurance; the mortar in these joints gives way, the loosening extends, and the whole chimney top falls to pieces. To protect these weak points and still utilize the brick surface in the chimney capping, is the object of the device shown in the accompanying engraving, and for which letters patent have been granted to Mr. J. W. Wetmore, of Erie, Pa.

One of the caps is about 4 inches in length, and crosses a joint from the outside to the inside of the chimney; it is held in place by a thin shank projecting from the under side down into the mortar between the ends of the brick. A flange extends from the outer end, as shown in Fig. 4, and a flange may also be made from the inner end, as represented in Fig. 3, down a short distance along the joint. The cap is convex on the upper and concave on the under side; but Fig. 2 shows a flat cap designed for covering a joint in an offset. In manufacturing chimney caps from stone and cast iron, the sizes must vary in order to adapt them to different chimneys. The advantage of this device is that the cap fits all chimneys built of brick of ordinary size. A builder who



WETMORE'S IMPROVED CHIMNEY CAP.

has used these caps, which are manufactured by the Chimney Cap Company, of Erie, Pa., says: "I examined them in the spring, and found them in good condition. The caps were perfectly firm in their places, the rain and gases and the freezing and thawing not having affected them in the least. There is nothing more to be desired for a complete chimney cap."

The Rotary Iron Jail.

The new jail just completed cost $30,000. Its peculiar feature is that the cells are arranged in the form of a great iron cylinder, which revolves about, so that only one cell is at the opening at any one time. This cylinder is three stories high, there being ten cells on each floor. Its weight is forty-five tons, and this ponderous weight is hung from above instead of turning on a track below. The strangest part of the arrangement is that the great cylinder can be turned by a simple crank with very little force—a man with his left hand moving it readily. When all is complete, it is the intention to have a little water motor in the basement, and then by simply moving a lever the cylinder will be set to rotating.

It is suggested that when there are prisoners who it is feared may be trying to cut out, the cylinder can by a motor be easily kept moving slowly all night, so that the prisoners do not remain long enough in one place to do any mischief, or even to crawl out if they had made a partial break. It seems that prisoners have little chance for escape from this new jail. A cage of iron bars completely surrounds the cylinder in which the cells are. The entrance on each floor is guarded by two doors. The officer standing outside does not have to unlock even the first door, but can swing the cylinder around until the cell appears in which is the desired prisoner, and then by a simple movement the inner door is opened, and the prisoner can step out of his cell. Then the officer can open the other door and let the man out, but the other prisoners are way beyond any possible reach of the officer, and it is impossible for them to make any break on him while he is taking a man out or putting one in. He can handle any number of men in the same way, and they cannot get within reach of him until he chooses to let them.—*Omaha Bee.*

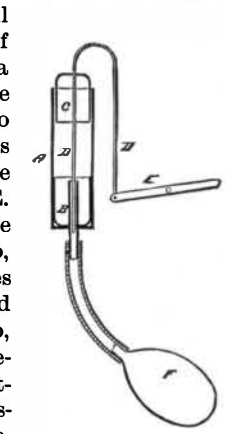
PHOTOGRAPHIC NOTES.

INTENSIFIER FOR NEGATIVES.

It is recommended that a plate whitened with a weak solution of bichloride of mercury be washed, and immersed in a weak solution of pyrogallic acid and water. The density is greatly increased, and from three to four plates may be successively immersed in the single solution, after which a fresh solution of pyro should be made.

Simple Pneumatic Release for Shutters.—At a recent meeting of the Society of Amateur Photographers in this city, Mr. Grisdale presented a simple form of pneumatic release, constructed from a common combined patented metal pen and pencil holder. The handle or cylinder of the pen had a punched up coarse thread at each end, into which the shorter tubes holding the pen and pencil screwed, their threads being half an inch from their extreme rear ends. The handle was shortened and the screw thread was cut off, both on it and the pen tube holder; the latter was then inverted and fitted like a cap piston loosely into the handle. The accompanying illustration explains the construction more fully.

A is the handle with both screw threads cut off. B is the lead pencil cap inverted and soldered to tube, A. Through its center is seen a small metal guide tube, over the end of which is a rubber tube leading to a rubber bulb, F. C represents the penholder cap inverted, soldered to the guide wire, D, which passes through its center and also outside downward to the release trigger, E. The wire, D, also fits loosely in the lower guide tube. When the bulb, F, is compressed, the air passes through the guide tube around wire, D, and raises the piston cap, C, thereby elevating the wire, operating the release lever, E, and letting off the shutter. When pressure on the bulb is released, the cap, C, drops back. The cylinder, A, and cap, C, are nickel plated, making scarcely any friction to the movement of the cap.



The object of the lower guide tube is to prevent the cap, C, from binding against the sides of the cylinder. The release worked as perfectly as if it had been expensively made.

Orthochromatic Photographs.—No better proof of the failure of ordinary gelatine dry plates to accurately register the varying intensity of different colors is found than when one attempts to copy a brilliant oil painting or a chromo. Improvements in this direction are always interesting, and to Mr. Fred'k E. Ives, of Philadelphia, inventor of the Ives phototype process, belongs the credit of the development of chlorophyl as a sensitizing medium.

We were recently shown a few comparative specimens made by this process, which were remarkable for their softness and the brilliancy with which ordinary non-actinic colors, such as red and yellow, were brought out. Under each orthochromatic photograph was mounted an ordinary one. One of the drawbacks of the process is that the solution has to be freshly prepared shortly before use, and the exposure necessary is unusually long.

In explanation of the specimens shown us, Mr. Ives states that a wide angle rectilinear lens with the largest stop was used. The exposure was *five* minutes in direct sunlight. When the picture is particularly bright colored, only one or two minutes are necessary; but if, instead of a wide angle lens, a rapid rectilinear lens is used, it is possible, with a brilliant light, to reduce the exposure to less than a minute.

A curious fact observed was that the plates were relatively much less sensitive in a weak light than with bright sunlight, so much so as to require at least *twenty* times more exposure, while the proportion in an ordinary rapid gelatine plate would not be more than four or five times.

Speaking of the emulsion, he says: "The most sensitive plates are prepared with a fresh chlorophyl solution, which has been made up with alcohol tinted with eosine. But no eosine should be used in making up chlorophyl solutions which are to be kept more than a week, because an *old* chlorophyl solution gives more accurate photographs when it contains no eosine."

Regarding some of his recent experiments, he continues: "Lately I have had some emulsion which would not work clear except when the tea organifier was used with it. I would therefore advise any who experiments with the process to use the tea organifier, not only because it increases the sensitiveness to light, but because it may insure better results."

It is probable the line of experiments commenced by Mr. Ives may be followed up by some other interested experimentalist, who may discover a way of making color sensitive plates which will retain their sensitiveness, similar to the ordinary gelatine plate, for any length of time.

There is an ample field for improvement in this direction, and the subject is worthy the attention of all photographers and amateurs.

THE NEW CROTON AQUEDUCT.

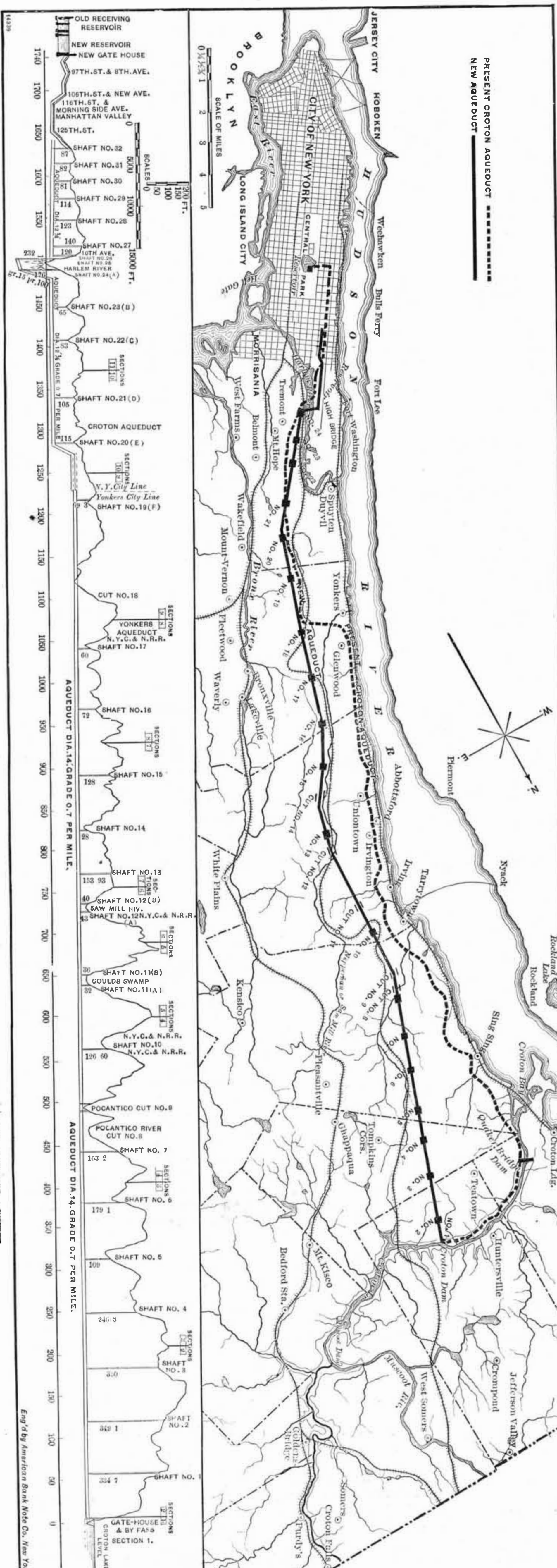
For many years the present Croton Aqueduct—the line of which from Croton Dam to the Central Park reservoir is indicated by the heavy dotted line in the accompanying map—has been forced to carry a quantity of water much greater than its builders designed it for, and as a natural consequence it has been so weakened that nothing but the skill and incessant watchfulness exercised by those in charge have prevented it from long ago yielding to the burden thrust upon it. The necessity for quickly providing greater carrying capacity is, therefore, apparent.

It is estimated that, even in years of the greatest drought, the Croton watershed, from whence almost all of the present supply is obtained, can be relied upon to furnish 250,000,000 gallons daily, or 100 gallons per head per day for 2,500,000 people. The building of Quaker Bridge Dam* would increase the available area of watershed to 361·82 square miles, and the reservoir thus formed would have a capacity of 32,200,000,000 gallons—water sufficient to cover 9,400 acres, 10 feet deep. The dam will be built of solid masonry, will be 178 feet high above the bed of the river, and since the foundation will have to extend to bed rock—100 feet—the total height for a distance of about 400 feet in the lowest part of the valley will be about 300 feet; the width of the dam at the base will be about 200 feet, and the extreme length 1,300 feet.

The aqueduct now being built has a maximum flowing capacity of 320,000,000 gallons per day from Croton Dam to a point near the New York city boundary line, where it is designed to construct a large distributing reservoir to supply the annexed district; a part of the supply being there diverted, the remaining portion of the aqueduct has a flowing capacity of 250,000,000 gallons per day. The northern portion, shown in section in Fig. 4, is 13·6 feet high and 13·6 feet wide; the semicircular arch has a radius of 6·8 feet, the concave sides are on a radius of 20·92 feet, and the invert has a radius of 18·5 feet. Where necessary, the rock walls are evened with concrete, and a masonry lining built 12 inches thick at the sides and arch and 6 inches thick at the invert; but where the character of the rock justifies it, no masonry is needed. The other part of the aqueduct, about 6½ miles in length, will be circular in section, as shown in Fig. 3, 12 feet in diameter, and lined with masonry 12 inches thick. Owing to the insufficient elevation of the land, this section will be depressed about 100 feet below the other, as indicated on the profile. The Harlem River is to be crossed by an inverted siphon, the depth below the river being about 200 feet. All the masonry will be of hand made, hard burned brick, laid in cement mortar, one part cement to two parts clean sharp sand.

From Croton Dam to Harlem River the aqueduct is 28¼ miles long, and to Central Park reservoir 33¼ miles; the total length of open cuts—varying from 0 to 40 or 50 feet between the arch and ground surface—north of the Harlem is but about 3,000 feet; all the rest of the line is through solid rock. The method of building the aqueduct is by sinking shafts about one mile and a quarter apart, and working both ways from each. There are 24 shafts north of the Harlem and 8 south of it, varying in depth from 28 to 350 feet.

* The proposed dam at Quaker Bridge was illustrated and described in the SCIENTIFIC AMERICAN of May 3, 1884



MAP AND PROFILE OF THE NEW AQUEDUCT FOR INCREASING THE WATER SUPPLY OF NEW YORK CITY.

Fig. 1 of the engravings is a longitudinal section through shaft No. 10, showing the heading, the timbering in the shaft, and the location of the hoisting machinery. Fig. 6 is an enlarged view of the same heading. Fig. 8 shows the boilers, air compressors, and hoisting engines. The shaft is 17½ feet by 8 feet in the clear, with the longer dimension parallel with the axis of the tunnel. In the shaft run two cages, operated by a double drum Dickson hoisting engine, on one of which the loaded car is brought to the surface, while on the other an empty car is lowered into the tunnel. Steam for hoisting, pumping, and compressing air is furnished by two 90 horse power Ingersoll return tubular boilers. The Ingersoll "Straight Line" air compressors and "Eclipse" drills are here used; and so well thought of are the products of the Ingersoll Company, that on the line of the aqueduct there are now in use 200 drills, 18 compressors, and 30 boilers of their make. The air compressors at shaft 10 have 18 by 30 inch cylinders, supplying air at 80 pounds pressure per square inch, the air being first discharged into a condensing air receiver, where it is freed from all moisture, and then conducted down the shaft and into the headings through 3 and 3½ inch pipe. Each heading is driven by four 3½ inch drills, mounted two on one column, to which they are attached by means of swinging arms, which can be moved up and down or around the column; thus with two columns and four machines, the entire face is commanded at one setting of the columns. From 19 to 20 holes, 5 to 6 feet deep, are drilled for the center cut and squaring up. Two drills, mounted on tripod, drill from three to five holes 8 feet deep in the bench, some being vertical and others flat or lifting. The holes are then charged with No. 1 giant powder in the cut and No. 2 in the side and bench, and exploded by electricity.

The foremen are required to have a round of holes drilled and blasted once each shift of ten hours, it being left to their judgment to decide the depth of cut they shall undertake to drill, square up, and blast in that time. By this method an average of about 10 lineal feet of tunnel is completed every twenty-four hours in each face through very hard gneiss and granite. This is a higher rate of progress than is attainable by the deep cut system, which does not permit of each shift finishing its own work.

Extending down the shaft is a rough looking square wooden box, which branches at the bottom, one part extending along the tunnel to one heading, and the other part to the other heading. At the bottom of the vertical portion, exhaust steam is admitted; this produces a strong current along the branches and up the shaft. The smoke resulting from each blast is thus drawn into the boxes and delivered at the top of the shaft.

Where the aqueduct is under pressure, special provision is made in the manholes for guarding against the upward pressure, and drain pipes are provided for emptying the shaft and air pipes for the escape of air during the refilling of the tunnel. A general idea of the construction of one of these shafts may be obtained from Fig. 7, which is a section at right angles to the line of the aqueduct.

Fig. 2 is a view of the work as it now appears at the Pocantico cut—the most extensive on the line, as it has a length of about 1,300 feet. The aqueduct here is similar in sec-