THE ELECTRO DYNAMIC MOTOR.

With the manifold adaptations of light machinery has come the demand for a motor specially adapted for such work. The characteristics which this should possess in order to comply strictly with the requirements were peculiar, and were to a certain extent governed by the conditions surrounding its field of operations. Durability of the working parts and simplicity in construction were essential, but it should, prerequisitely, be absolutely safe, perfectly reliable, and automatic, since any technical knowledge of its principles could not be expected from the majority of those who would use it. The first cost and the running expenses should, of course, be small.

For a long time electricity has been considered the most likely source from whence to obtain this power, and the Electro Dynamic Company, 121 South Third Street, Philadelphia, Pa., manufacturer of the "double induction" motor, patented by Mr. W. W. Griscom, claims for its apparatus all of the above points, and these claims are strongly substantiated by the success attending the motor.

The motor consists of two semicircular electro magnets, which together form a ring; their poles project inward, and with the wire coils form a cylindrical tube, within which a Siemens armature revolves. These coils are wound in opposite directions on each section, so that both coils unite in producing a north pole in one of the open spaces and a south pole in the other. The iron of the poles extends laterally beyond the ring, forming supports for the plates which carry the bearings of the armature shaft and the brushes of the commutator.

The disposition of the parts will be readily understood from Fig. 1, which is a perspective view of the motor. In order to reduce the effect of the wear of the journals to a minimum, the bearings of the armature are steel and the rear bearing of the surgical motor is provided with an adjusting screw with which any wear may be taken up. As the direction of the wear is away from the point of nearest approach, the poles of the armature and magnets can never come in contact from this cause, and a source of annoyance and danger frequent in former motors is thus obviated. The brushes are in pairs, and the shape of the commutator is such that one brush will always touch one-half of the commutator before its companion leaves the other.

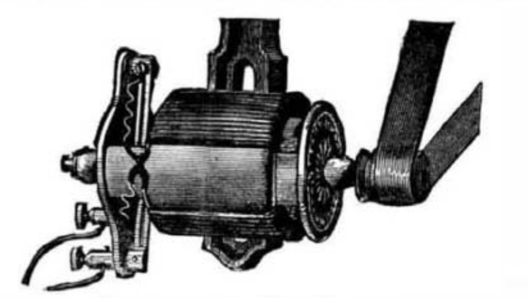

Fig. 1.—THE ELECTRIC MOTOR.

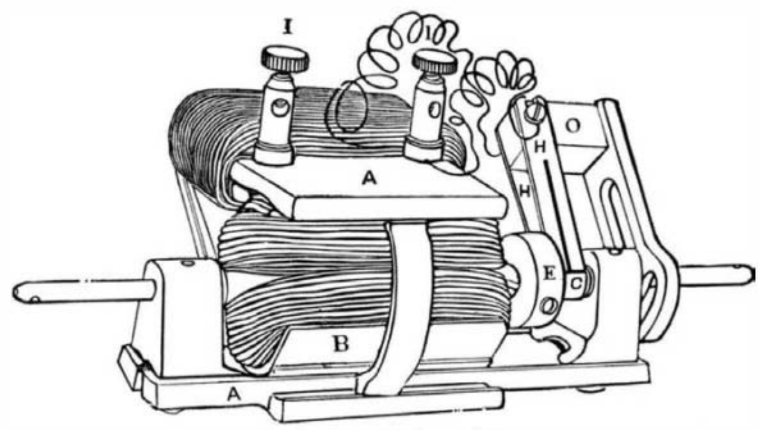

Fig. 4.—THE FAN MOTOR.

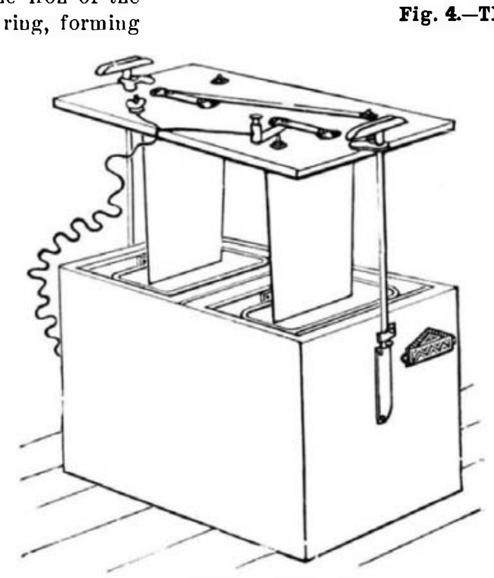

Fig. 5.—THE EDCO FAN BATTERY.

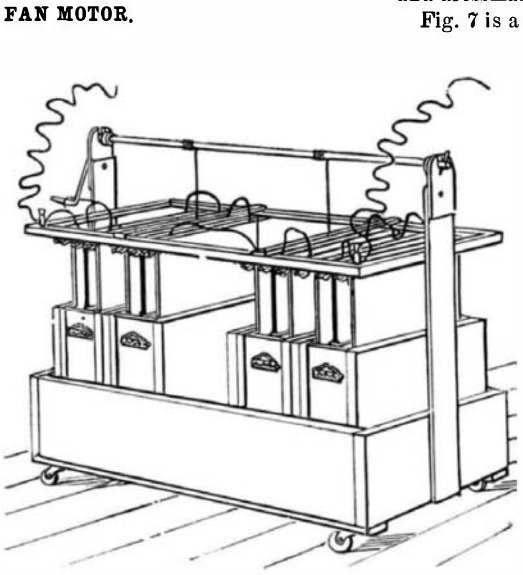

Fig. 6.—THE LARGE EDCO BATTERY.

The armature and the field magnet are connected in series, and the current enters the armature by the upper commutator brush, leaves it by the lower, and from thence passes to the field magnet and to the second binding post.

All the parts of the machine are interchangeable, thus facilitating repairs in case of accident. Each machine is thoroughly tested before leaving the manufactory.

The patent automatic battery, manufactured by the same company and specially adapted to run the motor, is of the bichromate of potash variety, and is inclosed in a neat case. It consists of six one-gallon cells, in each of which are two carbons and one zinc, and a mechanical device for removing all the plates from the liquid as soon as the pressure on the lever is removed. The degree of immersion, controlled by the lever, thus permits the perfect regulation of the amount of current supplied to the motor. The lower part of the zinc plate will be dissolved more rapidly than the upper part, and it is, consequently, sometimes made wedge-shaped, the butt being down. The battery fluid is made, according to Mr. Griscom's method, by putting three-fourths of a pound of bichromate of potash in a colander near the the top of a gallon jar, covering the crystals with cold water, and then putting two pounds of sulphuric acid upon them, which rapidly causes them to dissolve with the evolution of a little heat. With such a battery the motor can be run at any speed up to 10,000 revolutions per minute.

Fig. 3.—THE ELECTRIC FAN.

In Fig. 2 the motor is represented attached to sewing machines. The battery is of such size that it forms a convenient seat for the operator, and the lever guiding the movements of the plates is operated by the treadle. The speed of the machine can be regulated to a nicety from 20 or 25 stitches a minute to as high as 900. A special advantage is that when the foot pressure is removed the plates are automatically raised clear of the liquid and all expenditure instantly ceases. The same motor, supplied with a minute fraction of the current of an electric light system, will drive a sewing machine at 3,000 revolutions per minute at an almost inappreciable expenditure.

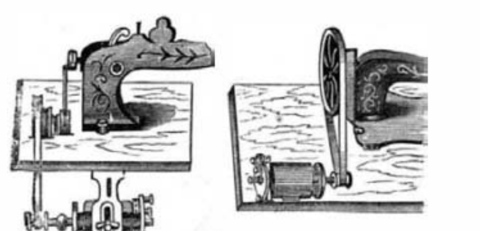

Fig. 2.—SEWING MACHINE MOTOR.

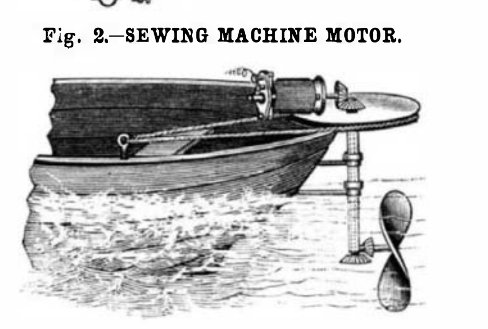

Fig. 7.—THE ELECTRIC BOAT MOTOR.

Fig. 3 represents a fan, driven by the motor, for use in apartments when a breeze is only occasionally required. The V motor, shown in Fig. 4, is designed especially for use in connection with the fan. In general principle it does not differ from the one already described, but is furnished with a reversing attachment, by which the motion can be reversed while running at full speed. The disposition of the parts will be readily understood from the cut, in which A A represent the magnets, B the armature, C the commutator, E the commutator disk, H H the brushes, I I binding posts, and ● the reversing attachment.

The Edco fan battery, Fig. 5, is intended for constant use. It is 16 by 13½ by 9½ inches and consists of two cells, each having one zinc 6 by 10 inches. This battery, charged with the fluid already described, will drive a rotary fan of 7½ to 8 inches in diameter for nearly seventy hours. The large Edco battery, Fig. 6, is composed of a number of portable cells, size 13 by 20 by 7¼ inches, each one holding elements 12 by 12 inches, the trough being lined with lead, furnished with a lifting device.

Six of the small size Edco cells have sewed 4,046 yards of three thicknesses of shirt muslin on a Singer sewing machine in twelve days, at the following expenditure:

9¾ pounds of bichromate of potash	$1.95
31½ pounds of sulphuric acid	.65
4 pounds of zincs, at 7½ cents	.30
Mercury (estimated)	.10
Total	$3.00

or more than 14 yards sewed for one cent. This is the best authentic result ever obtained by battery power on a shuttle machine; and while too expensive to compete with steam, it is far cheaper than foot power, and sure to find favor with the seamstresses and dressmakers who suffer from using the treadles.

Fig. 7 is a device by Mr. Griscom for applying the motor to a boat, which, as will be readily seen, can be propelled, steered, and backed, without rudder and without reversing engine.

The motor has proved of great benefit to surgeons and especially to dentists for driving various instruments. The old style dental engines were all operated by a treadle, and they compelled the operator to remain for a long time in fatiguing positions, and to keep their foot in motion in a way which interfered with delicate manipulation. The S. S. White Dental Manufacturing Company, of Philadelphia, having obtained the exclusive agency for the United States of the motor and battery as applied to dental and surgical engines, is using this device extensively as a source of power.

The engraving, Fig. 8, represents the motor in connection with a dentist's chair. When so situated the immersion of the plates of the battery is controlled by a knob, L, projecting from the floor in a location convenient to the dentist's foot, the battery being in another apartment. The motor can be readily applied to the improved dental engine manufactured by this company. The shaft of the armature of the motor is hollow to receive the rigid end of the cable, and has a carrier pin, over which the groove in the cable passes. The end of the bearing has a thread upon which the rigid section of the sleeve is screwed. This combination prevents any vibration extending to the hand piece. The motor is shown suspended from a spring balance attached to a traveler on a crane, giving to the flexible arm a range greater than that imparted by the rocking standard of the engine. The above are only a few applications of the motor. It is serviceable wherever a small power is required. Although weighing but about 2½ lb., it gives a power of about one-sixth H. P. It affords a motion which can be stopped, reduced, or accelerated instantaneously. It incurs expense only when working.

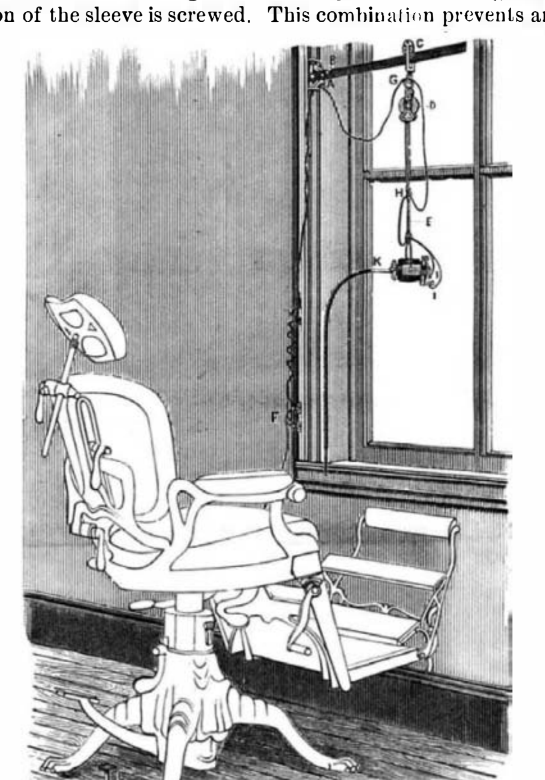

Fig 8.—THE ELECTRIC DENTAL MOTOR.

Iodide of Nitrogen.

It is well known to chemists that by merely pouring ammonia upon iodine crystals a very violent explosive is produced that explodes with a touch, a breath of air, and even of itself. It has received the name of "iodide of nitrogen," although the difficuty of purifying and analyzing it renders it both dangerous and difficult to decide this point. Bunsen, who has experimented with it, believes that it contains hydrogen, and assigns it to the formula NI_3NH_3.

Antony Guyard has recently been studying the effect of light upon iodide of nitrogen. He says (*Comptes Rendus*) that iodide of nitrogen suspended in water, or better, in aqueous ammonia, is affected by the undulations of light, heat, and sound, as well as contact with any other substance.

Under influence of light iodide of nitrogen is rapidly decomposed, nitrogen gas escapes, and at the same time iodide and iodate of ammonia are formed. In water the decomposition goes on quietly at first and ends in an explosion; in ammonia solution, on the contrary, it goes on quietly to the end until all the iodine is gone. Iodide of nitrogen is sensitive to diffused as well as direct sunlight. The decomposition takes place at ordinary temperature, and also in a rapid stream of water at 34° to 41°. The heat spectrum has no effect, only the light spectrum has a violent action; the maximum effect is produced in the yellow, and the minimum in the violet.

If iodide of nitrogen has the composition of NH_2I, it is decomposed completely in water by the action of light with out explosion, according to this formula:

$$2NH_2I = NH_4I_2 + N.$$

This agrees perfectly with the actual phenomena. But iodide of nitrogen does not always have this composition, but incloses more or less of other substances, so that the decomposition only follows this equation in part; the explosion follows as soon as all the NH_2I is destroyed. Its decomposition with the formation of iodide of ammonia is easily expressed with any formula for iodide of nitrogen. With the so-called typical formula NHI_2 we have the following:

$$5NHI_2 + 12NH_3 = 10NH_4I + 7N,$$

which agrees with the experiments. With water it forms biniodide of ammonia; with ammonia it forms the protoiodide.

Guyard tried to utilize the photo-chemical sensitiveness of iodide of nitrogen in ammonia solution for photometry or for estimating the chemical and mechanical equivalent of light. For this purpose he made use of an instrument resembling a Gay-Lussac burette. The wider tube can be closed with a ground glass stopper. He introduces 1·27 grammes of iodine, then fills it up with ammonia, and inserts the glass stopper, and places the instrument in the light. The nitrogen collects in the upper part of the burette, and its volume can be read in cubic centimeters and tenths. From 1·27 grammes of iodine 33·5 c. c. of nitrogen will be evolved; the reaction is the same whether iodine or iodide of nitrogen is employed. The following equation expresses the reaction:

$$13NH_3 + 10\,I = 10NH_4I + 3N.$$

All iodide of nitrogen compounds are decomposed by sulphuric, hydrochloric, or sulphurous acid, even very dilute, with violent explosion, and they dissolve without decomposition in hyposulphite of sodium.

Paper Pulp from Cedar Bark.

A new use of cedar bark has been undertaken at New Bedford, Mass. According to the *Northwestern Lumberman*, the Acushnet Paper Mill, at that point, is nearing completion, and was built for the express purpose of manufacturing pulp and paper of cedar bark. It is the first enterprise of the kind ever undertaken, though the process has been satisfactorily tested on a small scale. An agent of the company is now in Maine purchasing a supply of bark. There is a large quantity at Bangor, Calais, and St. John, N. B., where large quantities of cedar shingles are sawed. The bark is taken from shingle butts, that are 16 inches long, and are bundled for shipment like lath. The Acushnet Mill will work up three cords of bark a day. The first product will be used for carpet linings, but the paper is said to be equally adapted to other important uses. For carpet linings it will be unequaled, on account of its quality of keeping off insects. Eastern ingenuity is bound to devise an endless variety for the utilization of woods, this invention for making paper of cedar bark being the latest evidence of it.

To Attain Long Life.

Some one wisely says that he who strives after a long and pleasant term of life must seek to attain continual equanimity, and carefully to avoid everything which too violently taxes his feelings. Nothing more quickly consumes the vigor of life than the violence of the emotions of the mind. We know that anxiety and care can destroy the healthiest body; we know that fright and fear, yes, excess of joy, becomes deadly. They who are naturally cool and of a quiet turn of mind, upon whom nothing can make too powerful an impression, who are not wont to be excited either by great sorrow or great joy, have the best chance of living long and happy after their manner. Preserve, therefore, under all circumstances, a composure of mind which no happiness, no misfortune, can too much disturb. Love nothing too violently; hate nothing too passionately; fear nothing too strongly.

THE RE-ENFORCEMENT OF DEFICIENT WATER SUPPLY IN WELLS.

BY G. D. HISCOX.

The water supply in many parts of the country is beginning to assume an aspect that is causing much apprehension, especially in dry seasons, when it becomes a common complaint that wells not only run low, but actually dry up. At such times towns and cities are put upon short allowance as the only means of weathering a drought.

It therefore becomes a matter of importance, to those having little or no resource beyond the supply of their wells, to have at hand such information as may be applicable to the various conditions of water supply, as will enable them to know what can be done to increase the flow of water in their wells in the most economical manner.

After a well curb has been settled into place and the earth settled solidly around, it is a matter of no little difficulty to deepen the well by the old methods of digging out and sinking an inside curb, for in most cases it is premised that well curbs are at first sunk as far as practicable.

In wells having a substratum of gravel, sand, or quicksand, much can be done toward obtaining a deeper supply by materials and appliances that can be furnished by any tin or sheet iron worker or even a blacksmith.

For this purpose let a tube be made of galvanized sheet iron of Nos. 18 to 20 wire gauge (about $\frac{1}{32}$" in thickness) of from 4 inches to 6 inches in diameter, with riveted or lock seam, as convenient; open ends, with a band riveted upon each of the ends to stiffen them. Put the tube upon an iron mandrel or bar, in such a manner as to allow of cutting with a sharp cold chisel a series of slots, as represented in the cut, Fig. 1.

These slots must be cut as evenly as possible by driving the chisel just through, leaving the cuts no wider than will admit a piece of thin tin to pass. If a slot should be inadvertently cut too wide, it can be partially closed by moving it to the end of the mandrel and pressing the edges together.

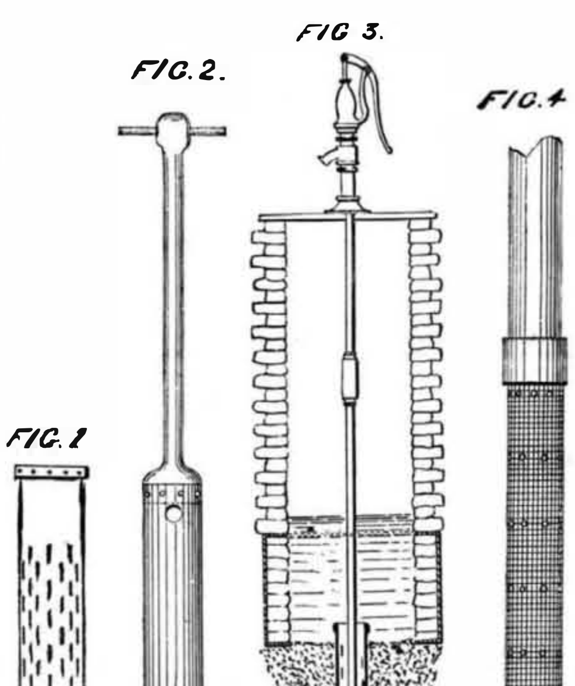

FIG. 1. FIG. 2. FIG 3. FIG. 4.

The next appliance is an auger to bore out the sand from the inside of the pipe. This may be made of galvanized sheet iron, the same that the strainer tube is made of, and from one to two inches smaller and about two feet long. The boring end should have a spiral lip which can be made of a disk of galvanized sheet iron, slotted and hammered into the proper shape, and then soldered into the end of the auger tube; make a hole at the upper end to facilitate the discharge of the sand from the auger.

A wooden or iron handle will complete it, as illustrated in Fig. 2, making the auger three or four feet longer than the strainer tube for convenience of handling. The operation of sinking and boring out the strainer tube can be most conveniently done by the use of two ladders standing upon the bottom of the well, with a board across the rungs near the water, which will enable a person to operate the auger with facility and safety.

The strainer tube is to be placed in position near the center of the well, and gently crowded down into the sand by the weight of the person, and by vibrating the tube a little, so as to get it down as far as possible before commencing with the auger. Then with the auger in hand bore a charge from the inside of the strainer and pass the auger out of the well to be emptied. As you bore upon the inside below the bottom of the strainer, continue to push down the strainer, and at last strike it lightly with a wooden ram or block, which can be done by the hand, moving the ram in vertical line, so as to keep the strainer also vertical.

In this manner the strainer may be sunk until its top is nearly even with the bottom of the well, and the sand bored out flush with the bottom of the strainer.

The pump pipe or suction may be placed within the strainer and terminating near the bottom, as this will enable the full depth of the well and the re-enforce to be utilized.

A re-enforce of this kind, as illustrated in Fig. 3, will relieve most wells in sandy soil of their short supply.

Where it is found desirable to sink a strainer for a deeper and larger supply, a stronger pipe is recommended, such as a boiler tube drilled with $\frac{3}{8}$ inch holes in rows about $1\frac{1}{4}$ inches apart for a distance of 3 to 4 feet from the bottom; after which it may be galvanized and covered with two layers of brass wire cloth or gauze No. 40 upon the inside or next to the pipe, and No. 50 upon the outside.

The gauze must be soldered at the laps and also to the pipe in spots between the holes, and well soldered to the pipe at the ends or top and bottom, to keep the gauze from being displaced by the process of sinking.

With this material a re-enforce of from 10 to 20 feet in depth may be made which will meet the requirements from nearly all ordinary wells. In large wells the strainer pipes may be *duplicated* to the full extent of the water resource for the area of the well. Where as small pipes as 2" bore are used, as many as five have been sunk close to the curb in a well 6 feet in diameter, and seven or eight in a nine foot well with the most satisfactory results.

Where there is uncertainty as to the character of the lower stratum, or below the bottom of the well, or a clay stratum that may require to be passed through, it is better to make the re-enforce of a more substantial material, say of the ordinary galvanized iron pipe with screw joints; using a little more precaution in fastening the wire gauze strongly to the perforated pipe, which may be no longer than is required for the strainer, for convenience of handling in making, with a coupling firmly screwed upon both ends.

This being ready to attach to a pipe of the desired length, the wire gauze may be fitted closely between the couplings and soldered, as described above.

For large pipes, say of from 6 to 10 inches in diameter, machine screws may be used to fasten the gauze to the pipe, and a spot around each screw head soldered to it; also a row around the bottom to keep the gauze from slipping, as illustrated in Fig. 4.

For re-enforcements to be made without boring out the sand through the inside of the pipe, the strong wrought iron pipe with screw joints should be used in every case, and in addition to the pipe as represented in Fig. 4, a point or chisel end should be screwed into the lower coupling; this can be made by drawing a short piece of pipe to a point, or flatten the end, weld, and sharpen. The upper end requires a heavy iron cap for receiving the blows of a hard wood ram, which may be a stick of timber handled by hand or slung to a rope over a pulley.

Where there is an opportunity of using a lever to press the pipe down, it makes the work much easier. The fulcrum may be a piece of timber thrown across the well and loaded with stone.

This process of sinking well pipes is much used, and a variety of plans of application may be suggested by the situation of the well and the means at hand, a pole being often used to transmit the lever power from the top to the bottom of a well.

Some of the salt wells near Syracuse have pipes driven 200 feet by levers with weighted fulcrums.

There are many wells in New York and vicinity that have been re-enforced in the manner above described, with a large addition to their old supply, and here and there a dry well is brought to new life. The great well of the Long Beach Improvement Company, at East Rockaway, which is 22 feet deep and 40 feet in diameter, is a notable instance of the enlargement of flow of water into a well without for a moment disturbing or interfering with the constant and necessary supply for the use of the great hotel at Long Beach, at a time when a day's suspension of the water supply would have been disastrous.

In this well two strainers of 6 inches in diameter have been sunk to the depth of 30 feet below the bottom of the well, or over 50 feet below the surface of the ground, and touching the bed rock; having passed through a stratum of clay at a depth of 8 feet below the bottom of the well and entering a substratum of sand which is supposed to be fed by the rain fall upon the central part of the island; judging from the fact that the clay stratum crops out at Pearsall's and along the line of the water works conduit.

Upon trial the pressure from the new source of supply sustained a hydrostatic pressure of 4 feet above the level of the water in the well.

The tops of the re-enforcing pipes terminate about two feet above the bottom of the well, and indicate a strong flow of water when the surface is pumped down to within a few inches of their open ends. The present supply capacity of the well is over 130,000 gallons per day.

The great well in Prospect Park, Brooklyn, was re-enforced with pipes driven horizontally beyond the walls near the bottom. This was evidently a mistake, as the practical working of this well shows; for as the surface of the water is pumped down and below the open ends of the pipes, the flow gradually lessens and finally ceases altogether at a time that it is most required, and at which a re-enforce, tapping a lower stratum, would yield the largest supply.

THE draught at the Mexican mine at Virginia City, Nev., through the upraise from the 2,900 foot level, is so strong as to constitute a sort of subterranean tornado. It has been found impossible to keep lights burning in some parts.