SIMPLE APPARATUS FOR GATHERING AND EXAMINING MICROSCOPIC OBJECTS.

BY GEO. M. HOPKINS.

One of the difficulties experienced by the beginner in microscopy is the finding and gathering of objects for examination. As a rule, cumbersome apparatus has been used. The conventional apparatus consists of a

Fig. 1.—GATHERING MICROSCOPIC OBJECTS.

staff to which are fitted a knife, a spoon, a hook, and a net; but a great deal can be accomplished with far less apparatus than this.

The engraving illustrates a simple device by means of which the amateur microscopist can supply himself with as much material as may be required. It consists of an ordinary tea or dessert spoon, and a wire loop of suitable size to extend around the bowl of the spoon, having the ends of the wires bent at right angles and hooked in opposite directions. To the loop is fitted a

Fig. 2.—TRANSFERRING MATERIAL TO THE BOTTLE.

conical cheese cloth bag, and to the bottom of the bag, upon the outside, is attached a strong string, which extends over the top and down to the bottom of the bag, where it is again fastened. The spoon is inserted between the bent ends of the loop and turned, and the point of the bowl is slipped through the loop.

The instrument is used in the manner shown in Fig. 1, that is to say, it is scraped along the surface of objects submerged in the water, the water passing through the cloth and the objects being retained by the conical bag. When a quantity of material has accumulated, the bag is turned inside out by pulling the string, and the pointed end of the bag is dipped a number of times in water contained in a wide-mouthed bottle. The operation is then repeated. The objects thus washed from the bag are retained in the bottle for examination.

The common method of examining small objects of this kind is to place a drop of water containing some of the objects upon a glass slide by means of a drop tube, then to apply a cover glass and remove the surplus water by the application of a piece of blotting paper. This answers very well for the smaller objects, but the larger ones must be examined in a tank like that shown in Fig. 3. This tank consists of a glass slide, A, to which are attached three glass strips, B, by means of cement (bicycle tire cement answers well for this purpose), the strips forming the bottom and ends of the tank. The front, C, of the tank is formed of a piece of a glass slip attached to the strips by means of cement. To vary the thickness of the body of water contained in the tank, when necessary, one or more glass slips are inserted behind the object.

THE ST. CLAIR TUNNEL LOCOMOTIVES—THE LARGEST LOCOMOTIVE IN THE WORLD.

The engraving shows a new design of tank locomotive built for the Grand Trunk Railway of Canada by the Baldwin Locomotive Works. It is known as the "Decapod Tank Freight" type, and has a guaranteed hauling capacity of 760 tons (2,240 lb.) up a two per cent grade. Four of these engines are built to operate the St. Clair tunnel, a description of which appeared in the SCIENTIFIC AMERICAN, August 9, 1890. At either end (in the cuttings and in the tunnel) there is about 5,000 ft. of the two per cent grade.

The general dimensions and description of this engine are as follows:

Cylinders	22 in. diameter by 28 in. stroke.
Driving wheels	50 in. diameter.
Driving wheel centers (cast iron)	44 in.
Tires (standard Otis steel)	3 in. thick.
Tires, first, second, fourth and fifth pairs, flanged, 5½ in. wide; third pair, plain, 6 in. wide.	
Tires secured by Mansell retaining rings.	
Tires, first and fifth pairs, 1 in. play between rails; second and fourth, ¾ in. play.	
Boiler of ⅝ in. steel	74 in. diameter.
Rivets	1 in. diameter, 2¼ and 3¼ in. centers.
Laps—all longitudinal seams have double-riveted butt joints, with double covering strips.	
Steam pressure	160 lb. per square in.
Tubes, 281, iron	2¼ in. diameter, 13 ft. 6 in. long.
Firebox	132½ in. long by 42⅛ in. wide.
Water spaces	3 in. wide at sides, 4 in. at back.
Firebrick arch supported by top bolts.	
Side screw stays, ⅞ in. diameter; crown screw stays, 1 in. diameter, riveted over at top and bottom.	
Grates	Water tubes with drop bars.
Fuel	Anthracite coal.
Crossheads of cast steel, with phosphor bronze bearings.	
Steam chest valves	Balanced.
Cylinder lubricators	Seibert sight feed.
Injectors	Two Friedman No. 10 W. F.
Brakes—Westinghouse American, operated by air, on fronts of all wheels, with Ross-Meehan shoes.	
Tank capacity, 1,800 gallons (277 cubic in.) of water and 3 tons of coal.	
Wheel base total	18 ft. 5 in.
Gauge of track	4 ft. 8½ in.
Weight on drivers in working order	195,000 lb.
Cooke steam bell ringer.	

The weight on drivers is greater than that of any other locomotive which has come to our knowledge. It is believed to be the largest locomotive in the world, and with a coefficient of friction on the rail of 600 lb. per ton would give a hauling force on the drawbar of 58,500 lb. The resistance of 760 tons on a two per cent grade is about 39,400 lb. Add to this the resistance of

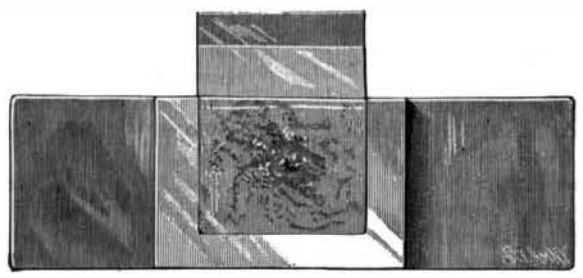


Fig. 3.—TANK FOR MICROSCOPIC OBJECTS.

the engine itself—about 5,000 lb.—and the total resistance to overcome is about 44,400 lb. This is with the liberal allowance of 7 lb. per ton of load for friction. Hence it is seen that this engine has a considerable margin in which to work with a clean rail. The rails used will weigh 100 lb. per yard.

Builder.	Road.	Date.	Type.	Cylinders.	Weight on drivers, lb.
Central Pacific	C. P.	1884	El Gobernador.	21×26	121,600
Baldwin	Brazil	1885	Decapod.	22×26	128,000
Beyer, Peacock & Co.	Mersey Tunnel.	1886	10 wheel tank.	21×26	115,556
Baldwin	Phila. & Reading.	1888	Consolidation	22×28	138,000
"	B. & ●	1889	"	20×26	112,900
"	North'n Pacific.	1889	"	22×28	135,000
"	St. Clair Tunnel.	1891	10 wheel tank.	22×28	195,000

This is a particularly handsome engine and represents very forcibly the lines which American builders are following to reach the most economical type of heavy freight engine.

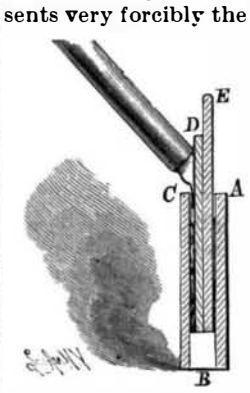
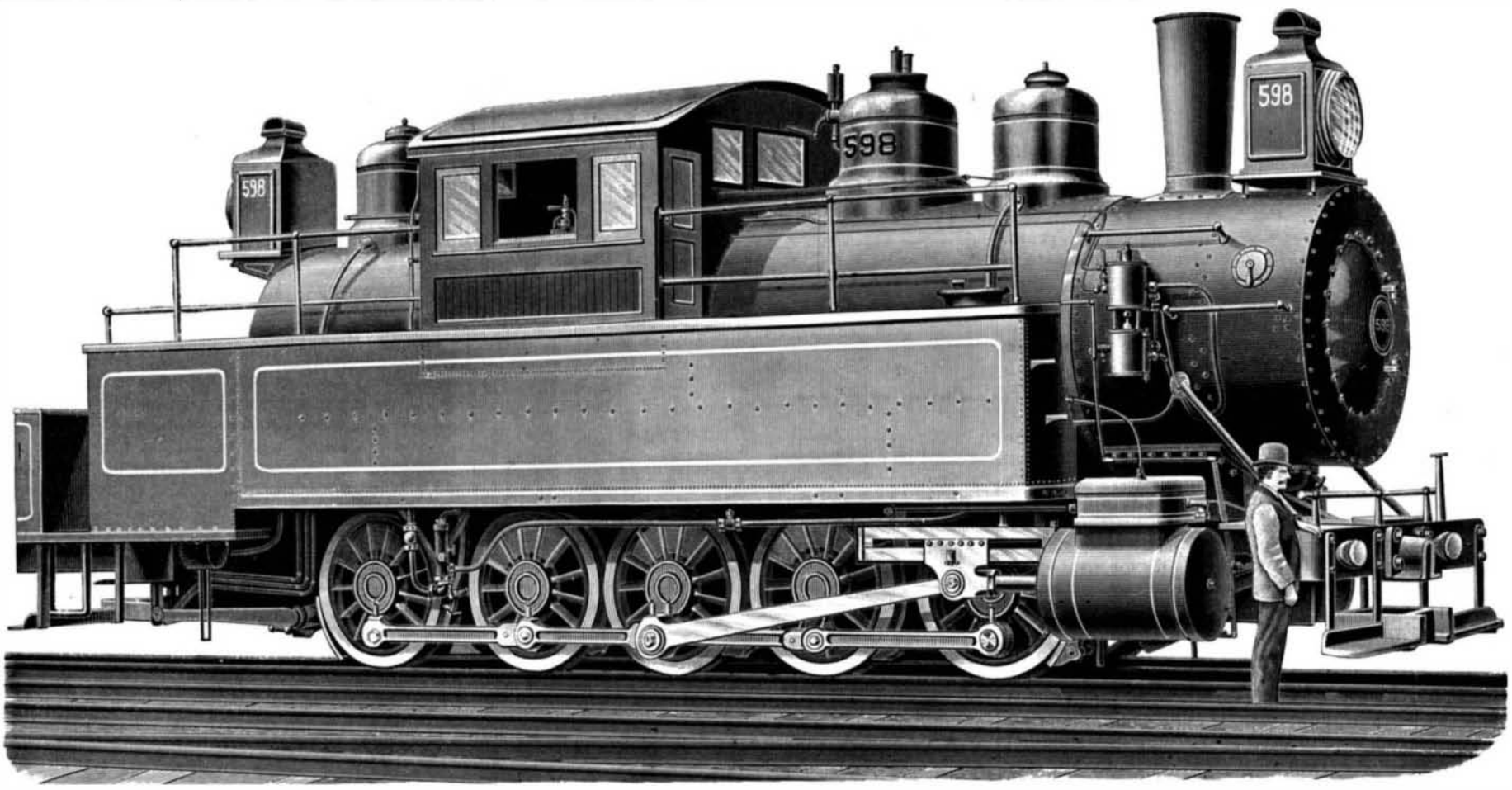


Fig. 4.—CROSS SECTION OF TANK.

The boiler fronts are of pressed steel, and of an excellent design, easily repaired and kept tight. The guides are short and heavy, with large wearing surfaces at the crosshead, an excellent example of the Laird type. The side rods have solid ends and all of the latest improvements. The boiler is one of the largest, if not the largest, that has ever been constructed for a locomotive; it is 74 in. diameter and is made of ⅝ in. steel plates.

The table above gives the weights and other particulars of the largest engines built in the last decade. We are indebted to the *Railroad Gazette* for the foregoing particulars.



THE ST. CLAIR TUNNEL LOCOMOTIVES—THE LARGEST LOCOMOTIVE IN THE WORLD.

The Prophylaxis and Treatment of Diphtheria.

At the recent meeting of the American Medical Association, Washington, D. C., Dr. J. Lewis Smith, of New York, read a paper on this subject. The room should be disinfected by adding to one quart of simmering water one to two fluid ounces of the following mixture :

℞ Oil of eucalyptus..... 3j.
Carbolic acid ..... 3j.
Turpentine, q. s. ad..... 3vj. to 3viij.

Everything and every person not absolutely necessary for the comfort and management of the patient should be excluded from the sick room. Physicians undoubtedly conveyed the disease. They should always examine the fauces by standing behind or at the side of the patient, so that no ejected mucus may come upon them. After each visit they should wash thoroughly, in a sublimate solution, hands, face, and beard. Walking cases without fever, anorexia, or malaise diffused the disease. Daily inspection of the fauces of school children had been proposed. Convalescents should not mingle with healthy children for four weeks. He admitted the full claim of the Klebs-Loeffler bacillus to be the cause of the disease. It was a surface microbe—never penetrating the interior of the body, but attacking only mucous surfaces or cutaneous abrasions. It produces a ptomaine containing carbon, hydrogen, azote, sulphur, and oxygen, which, by absorption through both blood and lymph channels, causes the nephritis-granulo fatty degeneration of heart muscle and paralysis.

The treatment should embrace hygiene, diet, and alcohol. Rectal alimentation could be followed for a time. Failure of appetite rendered the outcome doubtful. Diet could embrace milk with sarco-peptones, beef tea, or meat juice, and the various predigested compounds. Large and frequent doses of alcohol were positively necessary. It is quickly eliminated, and often will save life unless blood-poisoning has actually set in. In the proportion of one to five it has been shown to have a destructive action on the growth of the bacillus.

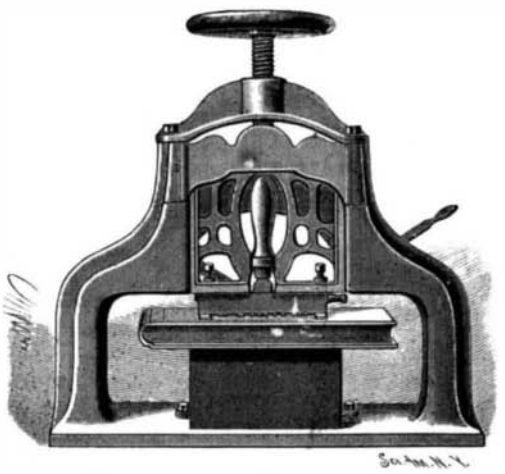
Locally we should remember that normal epithelium was a barrier to the germ's entrance, and hence our remedies should be such as not to destroy the epithelial covering. Denuded or diseased surfaces were favorable starting points for the disease. Corrosive sublimate, 1 to 8,000; carbolic acid, 1 to 50; salicylic acid, 1 to 80; had proved of service in arresting the germ growth. Potassic chlorate was useless in this direction, and he had come to discard its internal employment entirely. It had undoubtedly caused nephritis in many cases. The corrosive sublimate could be given by nasal injection, gargling, and internally. Where the false membrane was very thick and tenacious, equal parts of tincture of iron and glycerine should be given three or four times a day. Loeffler himself uses a mixture of carbolic acid, alcohol, and distilled water for the mouth. Our local remedies should be penetrating. Therefore, glycerine and water, never sirups and mucilages, should be our vehicles for all local applications. The officinal solution of iron chloride might be diluted three or four times for this purpose. While it undoubtedly contracted the vessels, it was often painful. It congeals the muco-pus of the fauces. Carbolic acid, Monsel's solution, and glycerine could be advantageously used in this way. For nasal disinfection a saturated solution of boric acid was preferable.

For internal treatment, iron assisted the anæmic condition. Vegetable tonics, including quinine, were probably useless, as were also quinine insufflations in the oral cavity. The main reliance was to be placed on the bichloride. He was in the habit of giving a two-year-old child $\frac{1}{13}$ grain every two hours; four years, $\frac{1}{10}$ grain; six years, $\frac{1}{8}$ grain; ten years, $\frac{1}{4}$ grain. His solution was made by dissolving the sublimate in alcohol and adding elixir of bismuth and pepsin. Sublimate solution, two grains to the pint, could be used for the nose. The mercurial should be continued at least one week, unless diarrhœa supervened, but not longer. Calomel had been suggested. Many gave an initial dose, and some continued it through the entire disease. It undoubtedly increased the anæmia. Of late it had been given in the New York Foundling Asylum by sublimation, from ten to forty grains being used, under a tent made over the patient's bed. The indication for its use was the supervention of hoarseness. The attendants had been salivated in several instances, but the patients were apparently not injured. It seemed to lessen the necessity for intubation. The process might be repeated in three or four hours. The percentage of recoveries from intubation where necessary was better in the calomel cases than in others. For the nephritis he gave iron, and for the paralysis tonics, strychnine, and electricity.

Dr. A. Seibert, of New York, remarked that we must see way down to the epiglottis in order to have our examination amount to anything. Children should not be allowed to kiss each other when there was any sore throat about, and very young children should not be allowed to creep around on the floor. They scraped up the dust with their fingers, which they would afterward put in their mouths. Thus the germs which settled on the floor were conveyed to the sensitive membranes. The experiments of Gebhardt, of Bonn, had shown that false membrane could be dipped in a sublimate solution, and then, after drying and teasing, cause a bacillus development in a culture medium. It was, therefore, especially under the conditions of diphtheria, slow in germicidal action, but thorough if once brought into perfect contact with the affected areas. A five per cent solution of acetic acid had been shown to be quickly penetrating.

A BOOK FINISHER'S LETTERING MACHINE.

A machine to facilitate the placing of a design or title upon a book cover is shown in the accompanying illustration, and forms the subject of a patent which has been issued to Mr. George H. Reynolds, of No. 352

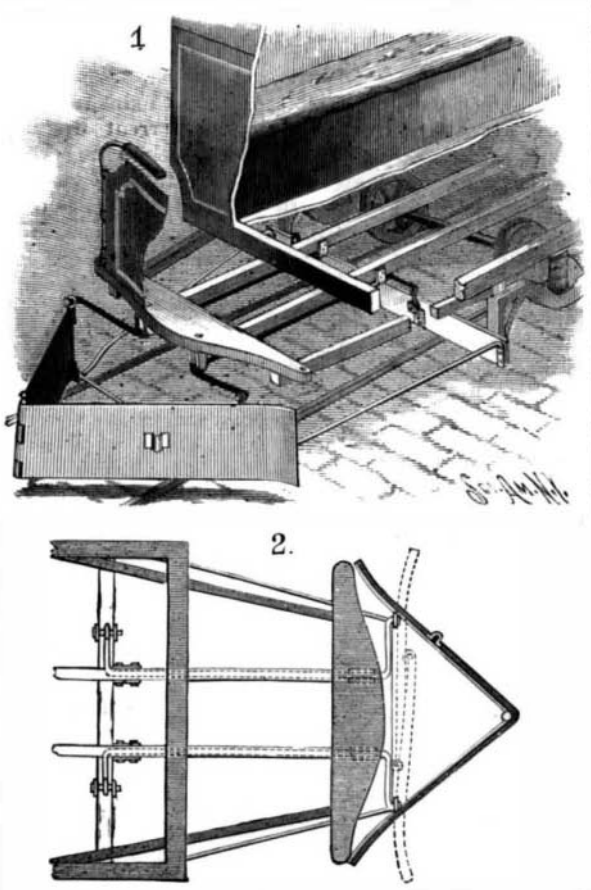


REYNOLDS' BOOK FINISHER'S MACHINE.

East Eighty-sixth Street, New York City. The standard has a vertical housing frame having opposite parallel guide grooves for the reception and support of a sliding head block, in two side limbs of which the pallet is adjustably held, the handle of the pallet extending upwardly in a central opening of the block. The head block is adjustably connected to the housing frame by a coarse-threaded screw, by the manipulation of a hand wheel on the upper end of which the block is vertically reciprocated in the guide grooves. The pallet or hand tool is of ordinary form, such as is used by bookbinders in finishing the backs of bound books to be lettered or ornamented by type impressions. After the desired name or type design is assembled and secured in the heated pallet frame, the pallet is secured in position between the limbs of the sliding block, when the required impression is given by turning the hand wheel. A guide is also provided, for regulating the placing of the book in proper position in the machine, and, to hold the book down in place, when the cover may be warped, or for convenience at any time, a simply operated hand lever is provided at the rear.

THE HITCHCOCK LIFE GUARD FOR ELECTRIC CARS.

The illustrations show a form of life guard or fender designed for use on electric street cars. The body of these cars is subject to violent oscillations, so that a



THE HITCHCOCK LIFE GUARD FOR ELECTRIC CARS.

fender attached to the end of the car vibrates up and down to such an extent as to be of little use. In the structure we describe, the weight of the fender is carried by the motor guard or some other attachment of the truck. A pair of bars run longitudinally and each bar has two crank arms at each end. The straight portions of the bars are attached to the car body, being journaled thereto. The rear cranks have their outer ends attached to the motor guard or to some part that maintains a fixed level. The front cranks carry the fender by attachment to their outer ends. Thus arranged, although the car body may vibrate through a distance of seven inches or more, the fender never changes its level. At the same time its weight is carried without exercising any destructive leverage upon the truck. The construction is shown in perspective in Fig. 1, and in plan in Fig. 2.

Another feature of the fender is that it can be folded back so as to occupy no storage room in the car sheds. The center angle is a hinge joint. By withdrawing the hinge pin the wings fold inward, as shown in dotted lines in Fig. 2, and the car requires no additional room.

This fender is the subject of letters patent granted to Arthur B. Hitchcock and Charles S. Gooding, of Brookline, Mass., to whom inquiries for further particulars may be addressed.

American Armor Plates for American War Ships.

A new naval ordnance proving ground, which has been established at Indian Head, on the Potomac, will soon be the scene of a test of ship armor worthy to be ranked with the great trial of last September at Annapolis. In some respects it may be considered still more important, according to particulars given in an Associated Press account, since it is intended to definitely settle what kind of plates shall be put on our new war vessels.

The magnitude of the coming trial is further shown by the number of plates that will now be put in competition, each of the standard dimensions, 8 feet long, 6 feet wide, and 10½ inches thick. All these are under construction by Carnegie, Phipps & Co., of Pittsburg. They will represent steel, steel with nickel alloy, steel treated by the Harvey carbonizing process, and nickel-steel treated by this process. Those that are to be hardened on the surface by the Harvey system will have it applied to them, it is said, at the Washington ordnance yard.

It will be seen that the forthcoming trial is to be of the same general character as the one which took place a few weeks ago on the Annapolis proving ground, but with the important difference that plates three and a half times as thick will now be used, and will be fired at by 6 inch and 8 inch guns. A further interest will be lent to the trial by the use of some American-made projectiles, as furnished by the Carpenter Steel Company, which is manufacturing them for the Navy Bureau of Ordnance on the Firminy system. As a competition in which American-made armor, guns, and shells are employed, it will have an unprecedented importance for this country at least.

An Improvement which Failed to Improve.

Mr. Metcalf, in a discussion at the late meeting of the American Society of Civil Engineers, concerning water supply, said: "We have had at times a great deal of trouble in getting a water supply for our establishment because of the floods in the Allegheny River, and a couple of years ago I thought I would make a great improvement. I had the Philadelphia Company send their dredge up and dredge a place some 10 or 15 ft. deep in the bed, and near the mouth of the Allegheny River. I then had a heavy timber crib built in the space thus dredged, and sunk our suction pipes into this crib. We got a beautifully clear water, and thought we had done a very great thing, but in a few days our whole concern was up in arms. A great many complaints were made, and they told me they could not get the boilers clean. The man in charge of the boilers said if he had to use that water he would give up the job, because he knew the result would be an explosion. Of course, I thought they were simply pumping out a little loose sand, but I had Professor Langley take up the matter and analyze the water to see if there was any real cause for trouble. The Allegheny River water is a very soft, delicious water, and we found that we had in that short distance of 12 or 15 feet struck a sub-river of lime water some 12 feet below the Allegheny, which contained thirteen times as much impurity as the muddiest river water we could get from a dirty flood stage in the river. So we were obliged to destroy the crib at considerable expense."—*The Railway Review.*

DOVER, N. H., is one of the few towns in New England, or, indeed, in the country, that operates its electric street railway system without the aid of a steam engine. The Salmon Falls River, which flows near the town, turns a 500 horse power water wheel, which supplies power for the dynamos that operate the street line, the electric lights in the place, and electricity for several neighboring towns as well. There seems to be no difficulty in obtaining a sufficient amount of power at all seasons of the year.