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

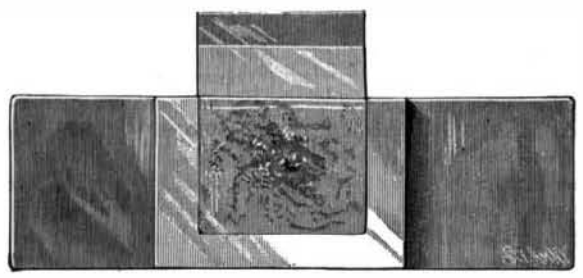


Fig. 3.—TANK FOR MICROSCOPIC OBJECTS.

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.

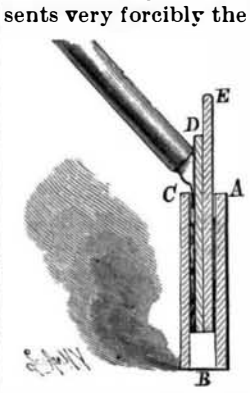
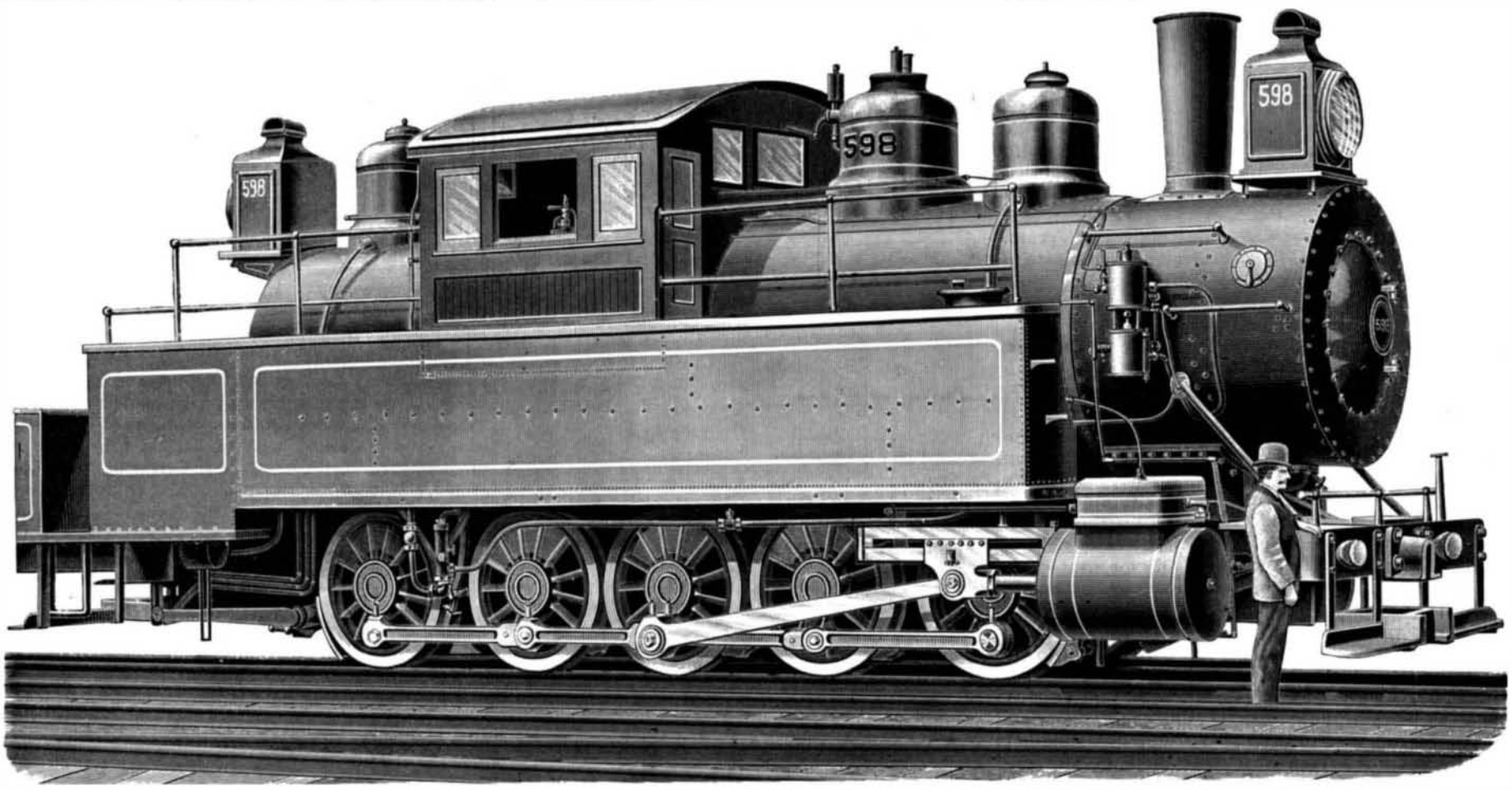


Fig. 4.—CROSS SECTION OF TANK.

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.



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