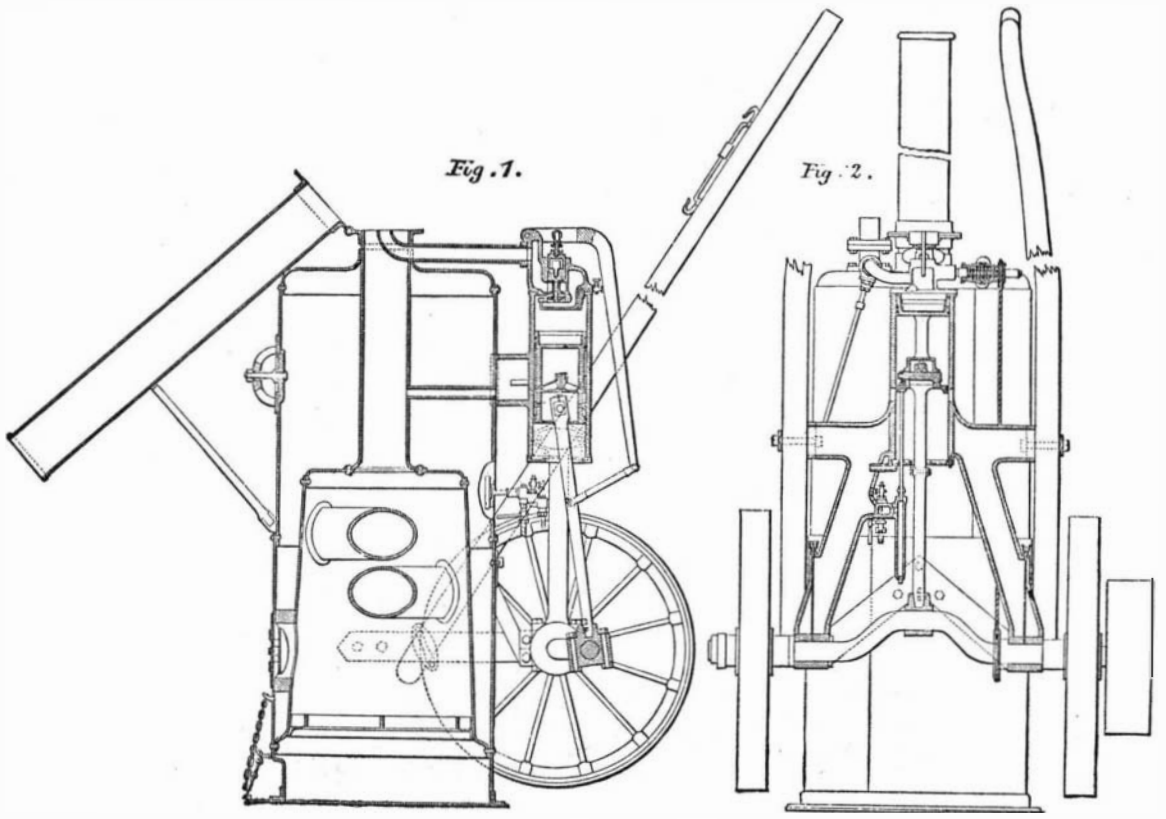
MATHER'S PORTABLE ENGINE.

We illustrate a four-horse portable engine of a very simple type. As will be seen at a glance, the crank shaft and flywheels form the traveling axle and road wheels when the engine is being transported from place to place. The cylinder is single-acting, the connecting rod being pivoted directly to a crosshead cast with the piston. The boiler has two crosstubes, and is mounted on a wrought iron foundation plate. The chimney is fitted to a pair of malleable iron joint rings, and has a movable iron fork provided to receive it when doubled back for traveling.

The cylinder, guides, and framing are all in one casting; the framing joins the cylinder at its lower end, and may be compared to arms and legs, all of which are cast hollow. On the back of the cylinder is cast a bracket of the same radius as the boiler, to which it is secured by bolts. On the left leg is formed a hollow bracket, to which the feed pump barrel is bolted by two bolts; the joints, which are faced, are made with paper, for easy removal. The cylinder cover, or head, contains the steam and exhaust openings and piston valve, and also carries the governors. The piston is dished, and is fitted with two rings at the upper end and with one at the lower end, under the slide plates of the crosshead, which are adjustable. The pump plunger is screwed into the crosshead flange. The crank shaft, which is 3 inches in diameter, and of Bessemer steel bent to obtuse angles, carries the two traveling wheels, one on each end. One of these wheels is keyed firmly on the crank shaft, while the other has a set screw and glut, which is tightened before running under steam, and slackened before traveling, to allow easy turning of corners without skidding. The connecting rod is withdrawn from the crank bearing before traveling by simply driving out a cotter, so that none of the working parts are in motion. The crank shaft also carries a driving pulley. There are no eccentrics; the valve is operated by a bent forked lever, which is at its lower extremity joined to the connecting rod by a link. This rod forces the valve downward against the steam pressure. The height to which the valve can rise when the lever is lifted depends upon a wedge, which is moved in and out by the governor. Thus the steam port is more or less uncovered, according to the amount of work to be done by the engine. There is only one gland in the engine, that being for the pump rod, only one-half inch in diameter. The valve is not connected to the lever, but from the latter a short rod is suspended, which works into a semicircular groove, allowing it to lift during the time the governors hold down the valve. These engines have now been two and a half years under test, and give great satisfaction. They are at present made in two sizes, 2½ and 4 horse power. As the working parts are all in compression they seldom need adjustment, as no knocking would be heard even under considerable wear. Mr. G. R. Mather, of Wellingborough, England, is the maker.—*Engineering.*



IMPROVED PORTABLE ENGINE.

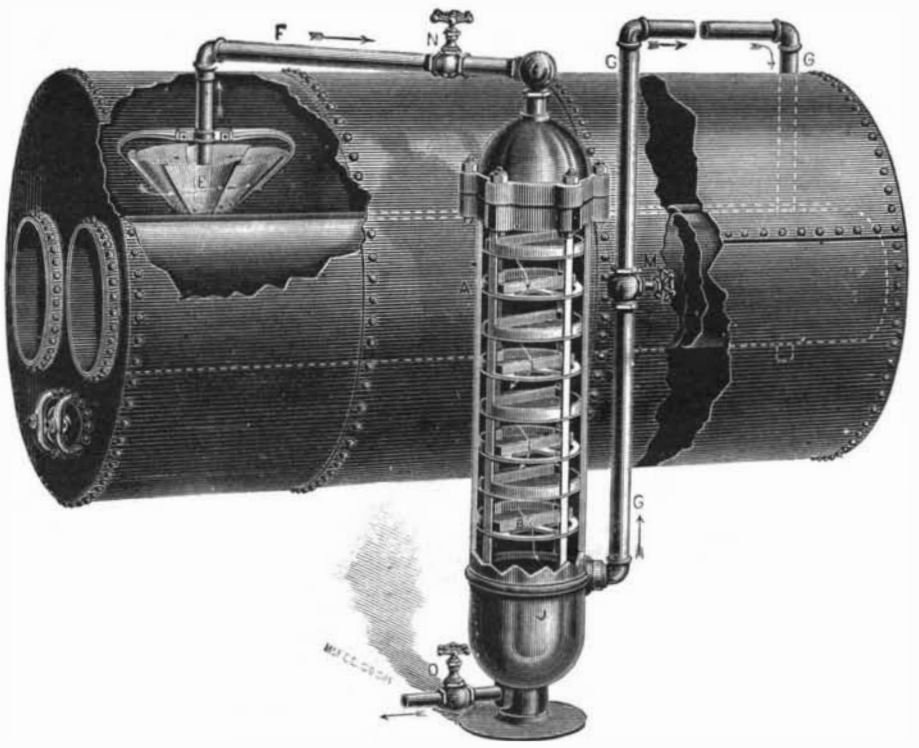
Nitrate of Soda Prizes.

The Committee of the Saltpeter Producers' Association at Iquique, Chili, offers $5,000 in prizes for essays on the use of nitrate of soda as manure. Of this amount a prize of $2,500 will be awarded for the best popular essay showing the importance of nitrate as a manure, and the best mode of applying it. It is desired that the essay should, in its theoretical part, exhibit the present state of knowledge on the effect upon vegetation of nitrate as compared with other nitrogenous preparations; and directions are also to be given for the use of nitrate as an aid to plant culture. A second prize of equal value is to be awarded for the best account of new and original applications of nitrate, based upon the researches of the author himself. A Committee of Judges, composed of leading agricultural chemists of all nations, has been nominated to receive these communications.

MECHANICAL BOILER CLEANER AND WATER PURIFIER.

The foaming of water in boilers has been the cause of ruining the well finished surfaces in cylinders and valves of many engines; and the engineer has been often perplexed to know just what to do when using muddy and impure water in the boiler, for it is well known that when mud and fine sand get into the cylinder, they penetrate to the innermost recesses of the piston packing and valves, and also the stuffing box glands, where they will remain for a considerable time, doing injury to the parts. The working of oil through the cylinder partially remedies the evil, but does not prevent the sand from cutting the surfaces of the inside of the cylinder and valves; and as the friction of these working parts is greatly increased, it requires an increased pressure in the boiler to keep the engine up to the usual speed, and more pressure with same speed requires more fuel.

In the ordinary manner of getting the mud and sediment out of a boiler there is a loss in fuel, by the waste of heat contained in the water. Take, as an illustration, a boiler in which river water is used. Such water generally contains a more or less quantity of mud, sand, and vegetable matter. At night, before stopping, the engineer will usually pump the boiler full to the top gauge, and in the morning, before starting up, he will open the blow-off valve, in order to get rid of the sediment supposed to have settled on the bottom of the boiler. The water thus blown out carries with it an amount of heat equal to that required to heat an equal amount of fresh feed water, which will have to be pumped in to take its place. This blowing-off is usually repeated every few hours, each repetition being accompanied by loss of heat. These losses are additional to that caused by the sediment forming a covering on the inside of the shell and flues. This sediment, or scale, being a very poor conductor, keeps the heat from passing from the iron to the water, thus preventing the rapid generation of steam. It follows that a device which would remove the mud, sand, and vegetable matter held in suspension, and also the scale-forming matter held in solution, and return the water in its heated, but purified, state to the boiler, would not only cause a saving in fuel, but would protect the boiler and engine from injury arising from their presence. The device herewith illustrated claims to accomplish this result.



VAN DUZEN'S MECHANICAL BOILER FEEDER AND WATER PURIFIER.

The body, or reservoir, A, of the cleaner is made in two parts. Inside of the reservoir are from eight to nine settling tables, B, three-fifths of the upper surface of each one being formed into a basin or pocket, in which sediment collects; the other two-fifths being pierced with holes for the passage of the hot water which flows through the pipe, F, from its mouth in the centrifugal skimmer, E. The water is discharged into the opposite end of the boiler through the pipe, G. The mud and sediment are removed from the hopper, J, through the blow-off valve, O. The valves, M and N, are used only when washing out the cleaner. The skimmer is placed near one end of the boiler, with its bottom half an inch above the flues. The end of the pipe, F, is placed 1¼ inches above the inside of the bottom of the skimmer, and the open end of the pipe, G, is placed 15 inches below the top line of the flues. The arrows denote the course of the water through the pipes and cleaner. By the action of heat, currents of hot water rise and flow into the skimmer, and pass through the pipe, F, into the cleaner, where, being kept free from the agitation of the currents in the boiler, all impurities are deposited either on the settling tables or in the hopper at the bottom. The pure water then enters the other end of the boiler. To remove the sediment from the cleaner, the valves, M and N, are closed to shut off connections with the boiler, when the water and sediment on the plates may be discharged through the valve, O. Upon the valve, N, being opened, water from the boiler is forced upon any sediment remaining in the cleaner; the openings in each plate act as nozzles, through which the water is dashed into the basin of each settling table, and finally into the hopper at the bottom and out through the blow-off. Such a cleaner is automatic as long as the water in the boiler is hot, and creates a continuous circulation; it has a large settling capacity, and the mud and sediment can be rapidly discharged.

Any further particulars regarding this boiler cleaner may be had by addressing the inventor and manufacturer, Mr. E. W. Van Duzen, of 104 E. Second St., Cincinnati, Ohio.

New Mode of Hardening Plaster of Paris.

M. Julhe describes a new process for hardening plaster of Paris, so that it may be used, among other purposes, for floor parquetting (*Comptes Rend.*, c., 797). It consists in mixing the plaster before using it for casting with one part in six of finely sifted recently slaked lime, and saturating the well dried casting with solution of a sulphate of a base giving an insoluble precipitate with lime. Sulphate of zinc and sulphate of iron are both suitable. The zinc sulphate gives a white material, while that containing iron is at first greenish, but upon drying takes the characteristic color of ferric oxide. A coating of burnt linseed oil converts this into a mahogany color, and a coat of copal varnish gives a fine surface. The casting should be well dried before treating it with the sulphate solution, and after being immersed not longer than two hours it should be again dried; it may then be replaced in the solution until the saturation is complete. The product is said to resist atmospheric influences, and when sulphate of iron is used, the resistance to fracture is said to be twenty times greater than in ordinary plaster.