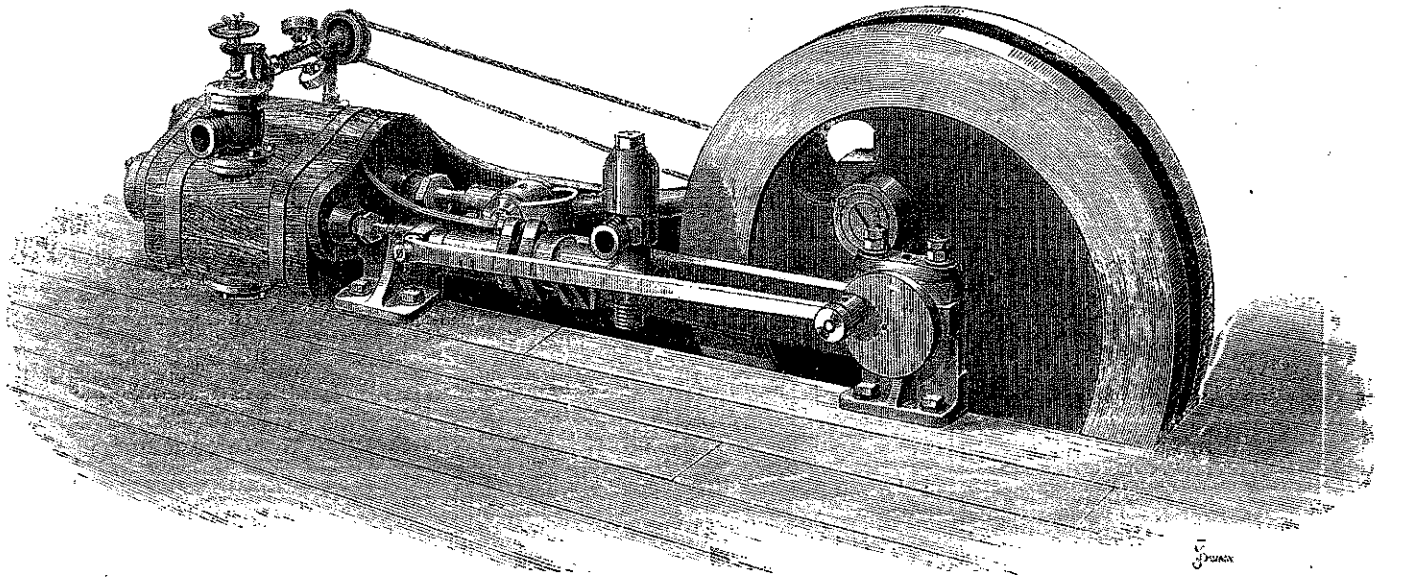
EIGHT HORSE-POWER PATENT HORIZONTAL ENGINE.

THE GENERAL ENGINE AND BOILER COMPANY, UNION COURT, LONDON, ENGINEERS.



We give above a perspective view, and at page 472 details of a somewhat novel type of engine now being manufactured by the General Engine and Boiler Company, London. It will be seen that this engine presents several peculiarities worth notice. The cylinder, valve chest, and crank shaft bearings are cast together in a single piece; this entails greater trouble in moulding, but saves several joints and planed faces. Two or three sizes of engines are made, and the smaller have a single valve cutting off steam at about half stroke. The cylinders of these small engines are carefully lagged and cleaded, but not steam jacketed. The framing is very strong and rigid, but neat in appearance, and extremely light. Instead of the usual heavy table bed-plate there are simply two flat girders laid edgeways, and joining the cylinders to the crank shaft bearings in a straight line. The thrust and pull of the piston are therefore withstood by metal placed in the direct line of strain.

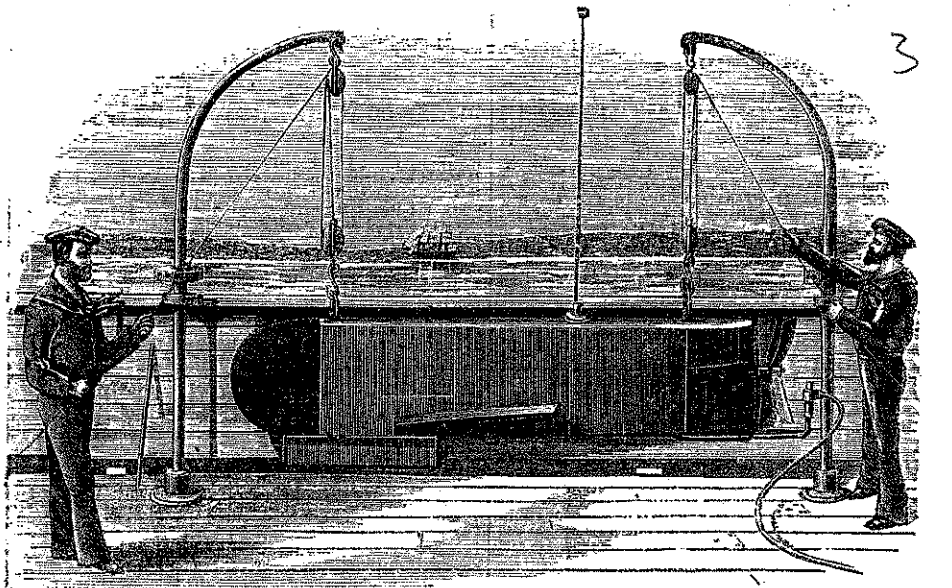
Instead also of the engine bed-plate being laid upon a built-up foundation and bolted down all along its length, the framing of this engine is simply carried down at each end, under the crank-shaft and nearly under the cylinder, so as to form two flat lugs, by which the engine is supported either upon two cast iron standards, after the manner of a lathe-bed, and upon a light brick or wooden foundation as shown. The governor is formed with light balls driven at a high speed; it is fixed horizontally, and driven by a straight gut or band. It actuates the throttle valve through the means of a cranked lever, as shown. The crank is double, the reciprocating weights are counterbalanced, and the fly-wheel is formed of two cast discs placed one each side of the crank-pin. Although the General Engine and Boiler Company do not advocate excessively high speeds these engines have been run on trial at an enormous velocity without tremor and without the bearings overheating. It is not easy to construct engines of this class with any startling novelties, but such as are introduced in'o these engines will, we think, commend themselves to the judgment of competent engineers. The larger engines are made with the same style of framing and to the same general design, but they are fitted with steam jackets and with patent automatic variable expansion gear under the control of the governor, and cutting off steam anywhere between $\frac{1}{20}$th and $\frac{1}{2}$rd of the stroke. Further particulars concerning the construction of these engines will be gathered from the detail drawings.

THE ERICSSON PNEUMATIC TORPEDO.

A good deal has been heard in this country of the Ericsson torpedo, but it is only within the last few days that drawings of the weapon have reached this country. We are indebted to the *Scientific American* for the following information:—The body of the torpedo consists of a box of thin steel plates, 8ft. 6in. long, 30in. deep, and 20in. wide. The explosive is placed at the bow. During experiments a block of wood 27in. long represented the containing vessel. A tapering block 18in. long and secured to the rear of the box forms the stern, immediately aft of which are the propellers. These are of the two-bladed type, 3ft. 2in. in diameter, with a pitch of 5ft. Both revolve around a common centre, yet in opposite directions, a necessary condition, since the powerful rotary movement of a single screw would cause the small hull to keel and probably revolve, unless retained in a vertical position by the ingenious expedient of causing the rotary tendency of one propeller to counteract that of the other. The displacement is greater than might be supposed, considering the small dimensions of the body. 2000 lb. being barely sufficient to balance the weight of the whole apparatus. The motive power is a small double cylinder oscillating engine, driven by compressed air, which is transmitted through a tubular cable, connected just abaft the stern, as shown in our engraving. The air pressure also governs an equipoise rudder, secured under the bottom and near the bow. The steering is effected by applying the force of the air against the tiller on one side, counteracted by the tension of a spring on the opposite side. The action of the apparatus is such as to be wholly independent of the differential force of the compressed air and the spring tension, and it is set in motion by admitting more or less air into the cable, thereby opening, more or less, a small connecting valve.

The submersion is regulated by two horizontal rudders turning on a transverse axle, with projects from each side near the bow. These wings or rudders are so contrived and governed that they keep the torpedo at a depth of from 7ft. to 12ft. below the surface, and are provided with automatic devices, so that the latter limit cannot be exceeded. In order to note the course of craft, a light steel mast is secured to the deck. This is 12ft. in length and terminates above in a wooden ball, the forward side of which is painted sea green, so as not to be perceptible to the enemy, and the rear white, so as to be easily distinguished above the water by those despatching the torpedo. Openings are made in the engine compartment, through which the water enters, completely filling the interior space. The machinery is made of bronze with box-wood bearings, so that the water serves as a lubricant to every portion, thus doing away with stuffing boxes at the rudders, and besides, avoiding any danger of the mechanism failing to operate through rust or neglect to oil.

To the engine power of the torpedo no precise limit can be set. The whole force of the heavy engines of the torpedo boat, from which the weapon is despatched, may be used to compress air up to almost any desired point. Captain Ericsson informs us that, small as the craft is, it towed a scow, 40ft. long by 14ft. beam and drawing 2ft. of water, without trouble. Driven at a high velocity by its large screws, it seems probable that the machine would make light work of piercing ordinary torpedo netting, or at any rate the explosion of its heavy charge of 400 lb. of nitro glycerine, at such a short distance from a vessel as the length of her lower booms, would be sufficient to accomplish its purpose. Of course the torpedo hull is destroyed by the explosion, but this would be a trivial loss in exchange for the total wreck of an enemy's man-of-war. The cable, however, remains uninjured, for it necessarily becomes detached and may be readily hauled in.



Our illustration represents the mode of launching the torpedo from the deck of the vessel. To this end the apparatus is hoisted upon swinging davits, the arms of which are previously turned over the deck. When lifted clear of the rail, the torpedo is carried out-board by revolving the davits, by bars inserted in the sockets in the broad portion of the davits, as shown. Nothing remains but to lower the machine into the water by the falls. The whole operation, we are informed, is accomplished in one minute.

A series of trials with the Ericsson pneumatic torpedo has lately been conducted on board the Intrepid, Commander A. P. Cooke, U.S.N., commanding, which has demonstrated the invention to possess a remarkable degree of efficiency. If further experiments, soon to be instituted from another torpedo boat, the Nina, prove, with slightly modified steering gear, as successful as the initial tests above referred to, we may fairly conclude that that long-sought weapon, a reliable fish torpedo, has at length been devised. As to the probable result upon naval warfare, it is only possible to surmise. Against the attack of the torpedo, there is practically no defence, for its approach cannot be seen. Armour plating, even did it extend to the keel, would prove no shield, and the Inflexible's one hundred and twenty water-tight compartments, which the English constructors hope will render her proof against such attacks, would fare badly under the terrible effects of 1200 lb. of gun cotton, with which Captain Ericsson says he could break any ironclad completely in two. We do not doubt but the same ingenuity which can devise a weapon of offence is equally competent to provide a means of defence, at least such has been the experience of the past, as evidenced by the almost uniform progress in guns on one hand and armour on the other; but what defence, save that of giving an enemy the widest berth possible, and fighting at enormously long range, is likely to prove efficacious, we are at a loss to conjecture.

Deep Mining.—Many of the leading mining companies on the Comstock lode are now down to the depth of 2000ft. and a few still deeper. When mining first began on the great lode, such a depth was not thought of, or, if thought of, no one expected to see mining operations carried to such a depth as 2000ft. in less than fifty years. Now we not only do not feel startled at hearing of the great depth of 4500ft. spoken of, but when we see preparations in actual progress, for sinking that far, we think but little of it. The Savage Company, whose works we yesterday visited, have broken ground for the foundations of new machinery, which is to be sufficiently powerful to sink their main incline to a depth of 4000ft. This incline is already some distance below the 2100ft. level, and is still being vigorously pushed downward. The new hoisting machinery will be supplied with two 24in. horizontal cylinders, of 4ft. stroke, and will be of over 400-horse power. The foundations of these engines are being laid about 80ft. to the westward of the present hoisting works. A building, 50ft. by 60ft. in size, will be erected over the new hoisting engine and the machinery connected therewith. The carpenters are already at work framing the timbers for this building. The steel wire rope to be used is to be 4000ft. in length, and will weigh about 24,000 lb. It is now being manufactured by John Roebling Sons, Trenton, N. J. It will be a round rope, and the upper end will be 2in. in diameter, but 2500ft. of its length will be tapered, and the lower end will be 1¾in. in diameter. The reel on which this cable will wind and unwind will be conical, and the cable will wind about it spirally. The Ophir Company contemplate the erection of similar machinery, and propose pushing their works to a like depth. The Crown Point Company already have in operation machinery of much the same character as that being erected by the Savage folks, and having a cable of sufficient length to sink to the depth of 3500ft. The Hale and Norcross Company, Consolidated Virginia Company, and other leading companies at this end of the lode will erect similar powerful works, and will at once plunge down into the great unknown "depths profound," in which lie hidden the silver roots of the Comstock.—*Virginia Enterprise.*

The Alexandria correspondent of an Italian paper gives the following details with regard to the Suez Canal:—"The canal company are busily engaged at the present time in lengthening the western mole, and clearing away the deposit which, on that side of the entrance, was fast encroaching upon the already somewhat narrow channel leading to the port. It is intended to carry the breakwater on that side out into six fathoms of water, when its total length will be something like 3100 metres. Sixty metres were completed last year, but the whole will not be terminated for another six years at the least. The breakwaters, as barriers to the sea, are everything that can be desired, but unfortunately, below water mark, there are numerous small spaces, through which the sand and soil brought down by the Nile finds its way, and thus banks are formed under the inner side. The company have had a powerful dredger at work since last July clearing these banks away. So great, however, is the amount of this stuff which is carried along the coast eastward from the mouths of the Nile, that the deposit on the outside of the western breakwater at Port Said is causing the shore line to advance seaward at the rate of about 30 metres every year. The breakwater beacons are now no longer upon the extremities of the moles, but whilst the works are in progress the company have stationed two large lighters at each side of the entrance to the channel."