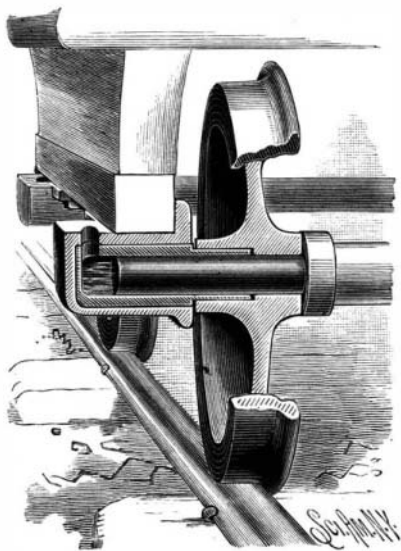


AN IMPROVED CAR AXLE BOX.

The box and bearing shown in the illustration enables a sufficient quantity of oil to be supplied to keep the bearing well lubricated for a long time. The improvement has been patented by Mr. John F. Gallagher, of Forest City, Pa., and is designed principally for use on mine cars. Within the box is held a bearing adapted to slip over the spindle, the bearing being closed at its outer end, but having in its upper side a hole in which oil may be poured into a receptacle formed by the outer end of the bearing and the end of the spindle. The axle and wheel are held in the



GALLAGHER'S CAR AXLE BOX.

correct relative positions by a collar rigid on the axle and abutting with the wheel hub.

AN IMPROVED STEAM FIRE ENGINE.

The American Fire Engine Company, with manufacturing facilities at Seneca Falls, N. Y., and Cincinnati, Ohio, are about to introduce a new and improved steam fire engine, an illustration of which is presented herewith. It is claimed by the makers to embody the best features yet obtained in these engines. Clapp's coil tube boiler is used with the American Company's patented improvements. The special feature of the boiler consists of spiral coils of water-circulating tubes, ingeniously arranged around the fire box to insure not only safety, but also the greatest possible steaming efficiency. These spiral coils are made of seamless copper tubing, and their form permits free expansion and contraction without causing them to strain any of the steam joints. The spiral pitch or bend of each tube is sufficient to permit of the use of five others of same diameter, so there are in each circular row six of these coil tubes, the number of rows, as well as the diameter of the tubes, depending upon the size of the boiler. Each coil tube is connected at its upper end with the crown sheet and at its lower end with the fire box wall, so that the water in circulation always flows over the crown sheet, thereby preventing its becoming overheated. The connections at ends of tubes are carefully made, by means of jam nuts and corrugated copper washers, so as to insure absolute tightness, and at the same time admit of the tubes being readily removed in case of repairs. The advantages of these spiral coil tubes over any other form, such as straight tubes or a cluster of the same, are numerous. The circulation is more perfect, and the heating surface is more effective; a longer tube can be used, and there is abundant freedom for expansion and contraction.

The pump is of an entirely new double-acting type, invented and designed by Mr. Charles H. Fox, the superintendent of their Cincinnati works. In point of general excellence, and particularly with regard to convenience and facility for examination and repair, the company claim it to be superior to any pump heretofore produced.

The pumps are united in a gun-metal casting, which forms a single body for both, and permits them to be placed much closer as to centers than could otherwise be done, there being an ample suction chamber common to both. In cross section,

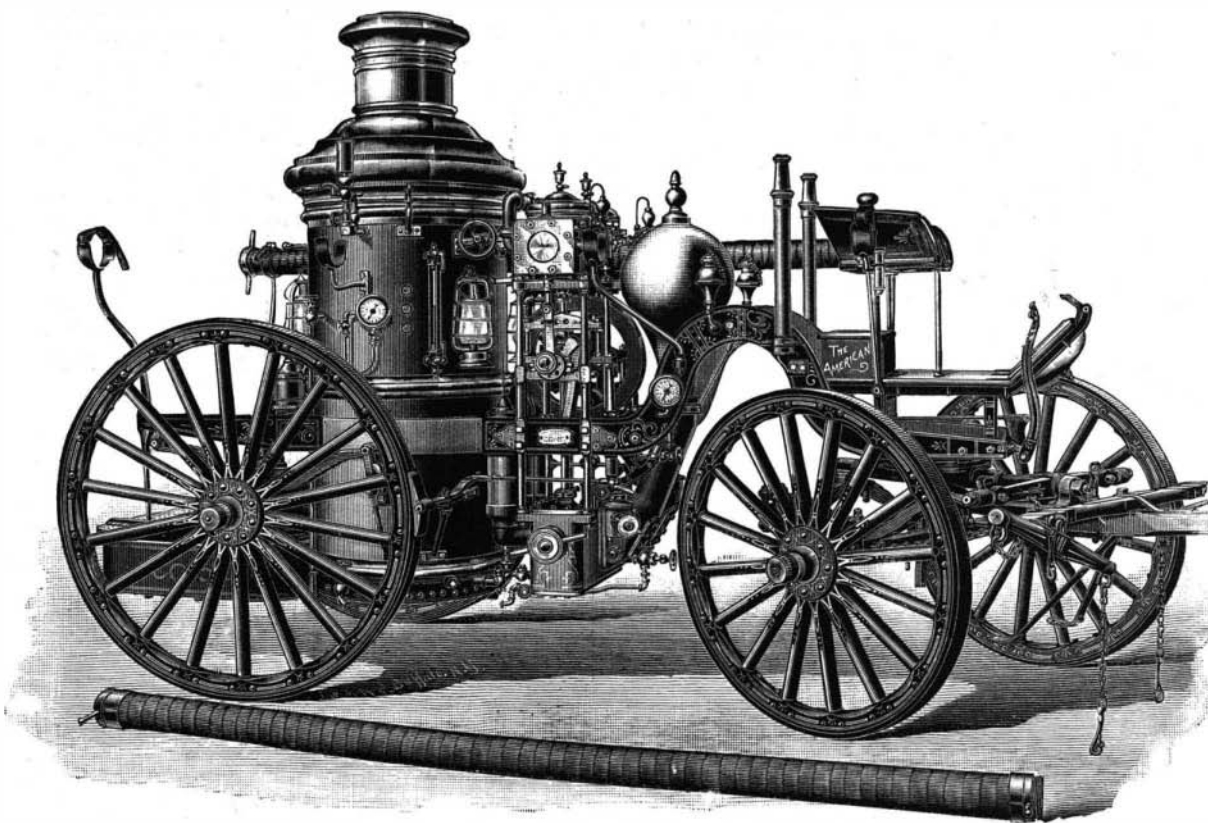
the pump somewhat resembles a box girder, thus furnishing a rigid base for the entire structure, simplifying the driving mechanism, and enabling it to endure extraordinary strains without vibration.

In providing facilities for the exposure of the pump's interior mechanism, the prime importance of perfect waterways has been fully recognized; although these passages are simple and direct, every detail of the pump's interior is thoroughly accessible without dismounting the same or disturbing the exterior attachments. Any of the valves can be easily and quickly examined, and if necessary replaced, by simply removing the caps and heads, and all joints required for this purpose are made between flat surfaces planed perfectly true. The suction may be connected to either end of the pump. The pump barrels are provided with removable linings, which can be readily replaced with new ones when worn. These, as well as the valve seats, are made of gun metal, no cast iron or other material subject to corrosion by water being used in any part of the pumps. A new piston for the pumps is introduced, which possesses the merit of keeping tight under any pressure without excessive friction, and the friction is not increased, no matter how great the pressure may be. The suction valves are cone shaped, so that the water enters the pump with but very little change in its course. The discharge valves are in a separate chamber. With a view to realizing the highest piston speed, the valve area is greatly increased and the lift of the valve diminished. The cylinders and pumps are detached from the boiler, and are separated therefrom sufficiently to allow every facility for getting at each and every part. All connections, both steam and water, are made outside of the boiler.

The engine, as a whole, is designed to meet the most severe exactions of the hard service in the best modern fire departments, affording the largest degree of efficiency with the minimum of liability to get out of order and having to be sent to the repair shop.

Electrical Muscle Making.

Some recent scientific researches, which the *Electric World* says can doubtless be trusted, show that the weight of muscles of animals was increased 40 per cent by a proper periodic application of an electric current, the growth being a true development of the muscle. According to this it will now be possible to increase to order size of any desired muscle without tiresome gymnastic exercises, by simply lying in a soft chair and having the current applied. This, we suggest, might be done at night by an automatic apparatus, thus saving time. Persons who are improperly developed may now be balanced or "trued up;" muscles shrunk by age may now be made plump again. Calves, which nature or exercise has failed to develop sufficiently, will now no longer be a drawback to wearing knee breeches, or the short bloomers of the female bicyclist. The question naturally suggests itself, What will happen if this process of developing muscles electrically is continued still longer? If some way is then found to

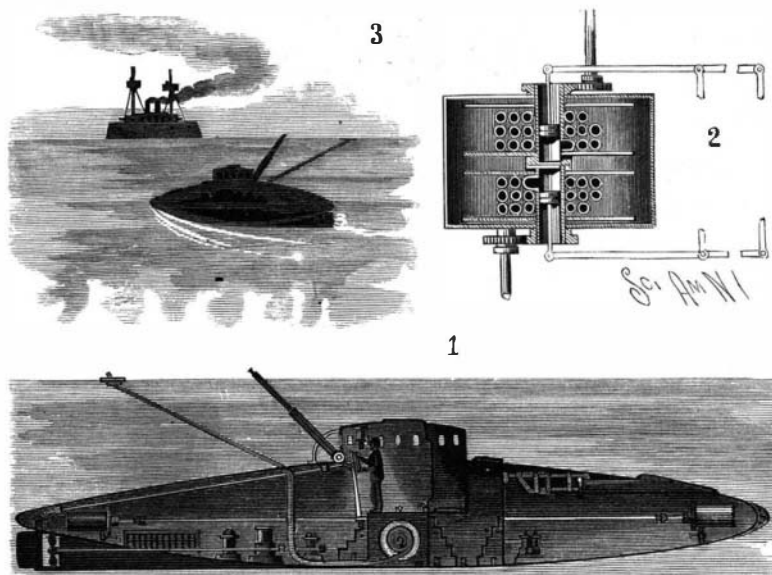


AN IMPROVED STEAM FIRE ENGINE.

develop the bones, the manufacture of giants by electrical means will be an easy matter.

AN IMPROVED SUBMARINE BOAT.

A boat designed to be submerged with facility to such distance below the water level as may be desired, and which is fitted with appliances for constantly supplying fresh air to the occupants, is shown in the illustration, and has been patented by Messrs. Daniel T. Freese and James D. Gawn, of North Amherst, Ohio.



FREESE & GAWN'S SUBMARINE BOAT.

Fig. 1 is a sectional view of the boat submerged, Fig. 2 being a sectional view of the combined hose reel and air pump, centrally located in the bottom of the boat, while Fig. 3 illustrates the possible employment of such craft. There are near the center of the boat four or five chambers to which more or less water is admitted when the boat is to be submerged, one of these chambers extending up at the side of the air chamber occupied by the operator. Air pressure is relied on to maintain certain equilibriums in the boat in the presence of water, and the operator, having first put on a diving suit, passes from the turret-shaped central air chamber into an adjoining chamber, where the water is kept down by air pressure, thence through a trap door in the bottom of that chamber to the deck of the vessel, when the latter is submerged. The air supply is pumped through a hose extending from the surface of the water down through the shell of the boat, the hose reel having a central cylinder in which a pump piston is operated by suitable machinery to force the air under pressure to the different chambers of the vessel. The hose at its outer end is connected with a float, of sufficient size for the purpose, and adapted to travel along on the water with the boat, but of such construction as to be as little noticeable as possible. The distance of the boat below the water level is shown by an indicator consisting of a tube in which slides a spring-supported piston, whose outer face is pressed upon by the outside water. To make observations when the boat is submerged, a telescopic tube is extended to the surface of the water, the lower tube being supported on pinion jointed bearings, and the outer and inner ends of the tubes having mirrors set at the proper angles. To facilitate balancing the boat lengthwise, the piston in a cylinder at each end is connected

with a power lever under control of the engineer, in such way that water may be admitted to one cylinder and at the same time forced out of the other one, these cylinders being large enough to make a difference in the balancing of the boat. For power to drive the boat and work the machinery, an electric storage battery is preferred, a vapor engine being used if desired when the boat is at the surface.

MUFFS first came into use in 1540. They were introduced by doctors, who wanted to keep their hands soft and warm while riding from the house of one patient to that of another. Women soon copied the doctors, and the latter at once abandoned the fashion and began to use great fur gloves instead.