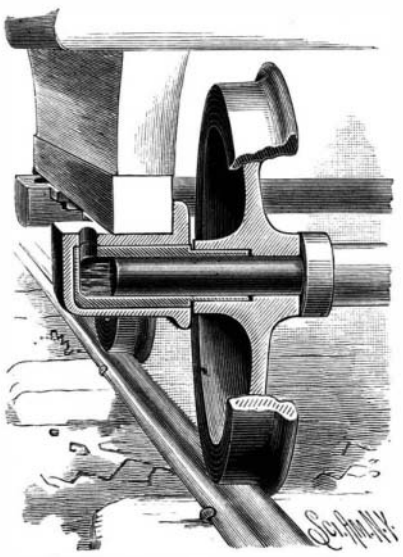
AN IMPROVED CAR AXLE BOX.

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



GALLAGHER'S CAR AXLE BOX.

AN IMPROVED STEAM FIRE ENGINE.

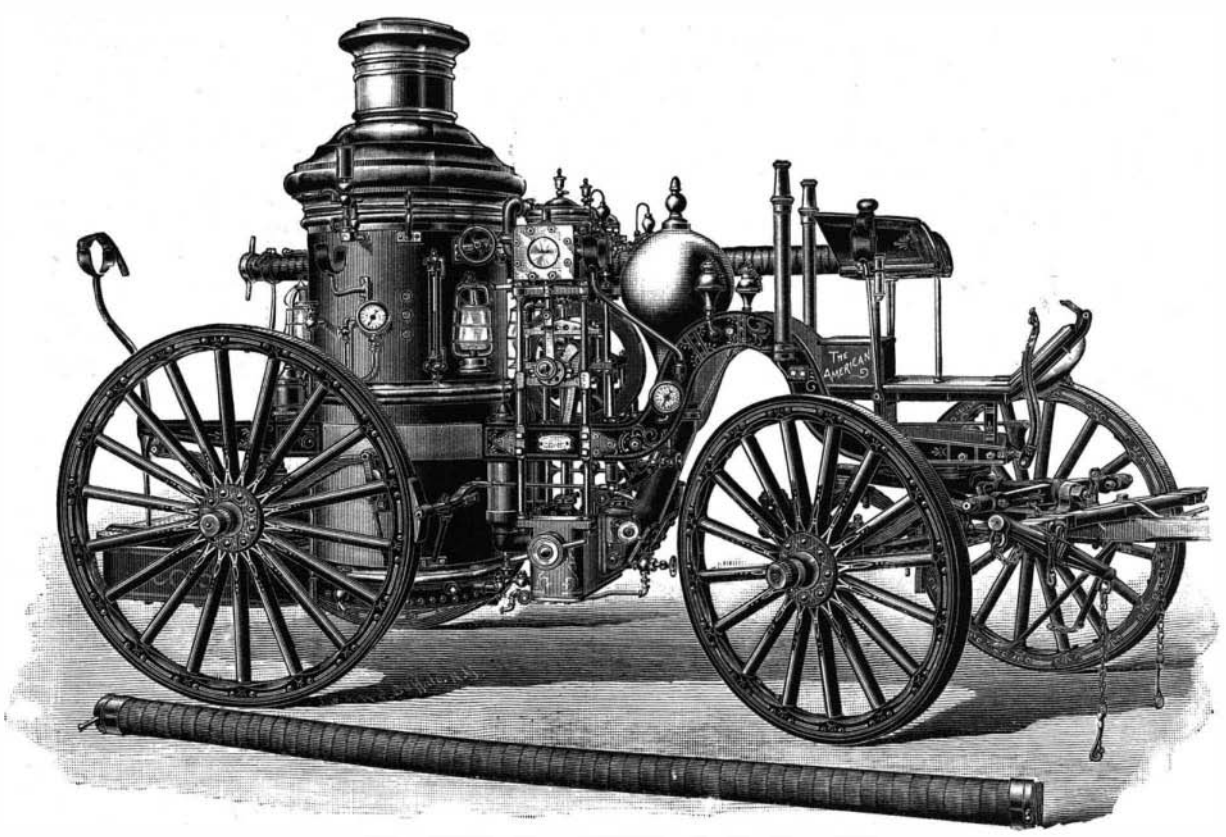
The American Fire Engine Company, with manufactories at Seneca Falls, N. Y., and Cincinnati, Ohio, are about to introduce a new and improved steam fire engine, an illustration of which is presented herewith. It is claimed by the makers to embody the best features yet obtained in these engines. Clapp's 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.



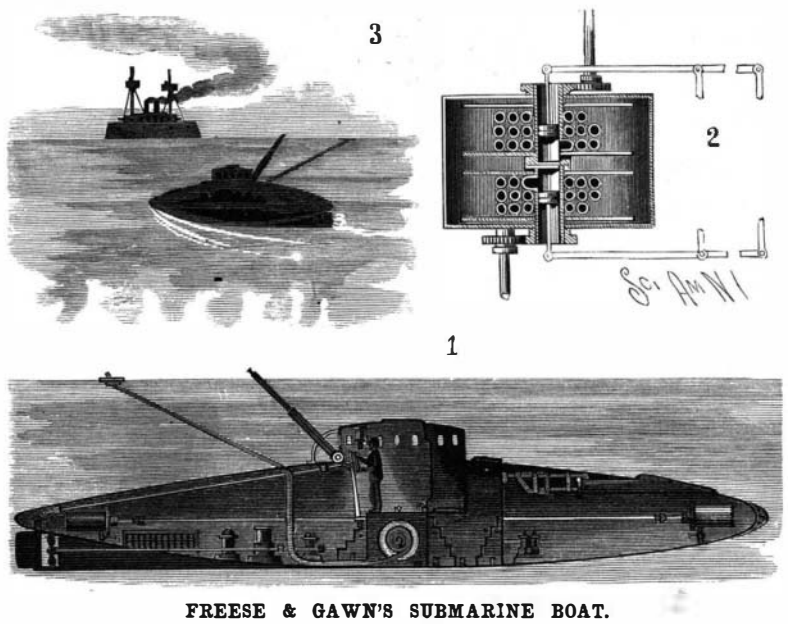
AN IMPROVED STEAM FIRE ENGINE.

Electrical Muscle Making.

Some recent scientific researches, which the Electrical 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 shrunken 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 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.

The Thermogen.

In writing of the last Royal Society conversazione, the Lancet mentioned as an exhibit of particular interest to the medical man an invention by Mr. C. T. Snedekor for heating by electricity a quilt or cushion. It was obvious that such a quilt could be used in private or in hospital for many therapeutic purposes. This quilt, which he named the thermogen, the Lancet has since had an opportunity of putting to practical trial under more lengthened observation, and has no hesitation in reporting upon it thoroughly favorably as an appliance that might be of great value in all hospitals, or, for that matter, in all private houses where an electric main is handy. The quilt contains a coil of wire consisting of a special alloy of known composition and electrical resistance, and bent in the fashion of a gridiron. The coil is inclosed in suitable insulating and non-conducting material, the whole being embedded in cotton wool or other soft substance provided with a silk or woolen covering.

The resistance offered by the coil to the flow of the current—the friction set up, so to speak, by the passage of the current through the wire—produces the heat in accordance with the laws of Ohm and Joule, in the same way that heat, and eventually light, are produced in the filament of the electric incandescent lamp when a current is forced through it. The coil contained in the quilt which was examined is constructed to admit of connecting with the terminals of an ordinary installation supply of 100 volts pressure, which effects a uniform temperature in the quilt of about 150° Fah. In the event, however, of the temperature rising beyond that point, which would be the case if there were an increase of pressure in the electric mains, a safeguard is provided in the end of the coil in the form of a "fuse," which would instantly melt, and so automatically shut off the current. The quilt may be readily attached to wall plugs, pendants, or still more conveniently to table lamp terminals. In places where the electric current is not supplied for lighting purposes an accumulator may be substituted with equally satisfactory results. The direction in which such an invention might be medically useful is first, and our contemporary thinks in chief, on the operating table. In lengthened operations, or in those necessarily attended with much hemorrhage, where artificial means to sustain the patient's temperature are required, most surgeons can recollect cases when the blankets and hot water at present in vogue have proved a decided nuisance. In such cases this quilt would be found literally invaluable as a soft, dry, warm, and convenient covering. Again, in cases of chronic rheumatism, or of that undefined neuralgia generally called lumbago, the quilt might prove comforting. Also, in cases of senile slowness of circulation, attended with general chilliness, such an appliance would be very useful.

A Tax upon the Beard.

An Italian journal, in view of the financial difficulties against which the government is struggling, proposes a tax, which, despite its seeming novelty, has precedents. It is a question of the tax upon beards that was in operation for a long time and under various forms in Russia. Peter the Great, knowing the attachment that his subjects had for the hirsute adornment of the face, introduced a tax upon the beard in his empire. The beard is a superfluous and useless ornament, said he, and, starting from this principle, he imposed a tax upon it as an article of luxury. This tax was proportional and progressive, not in proportion to the length of the beard, but to the social position of those who wore it. Each person upon paying the tax received a token, which he had to carry upon his person, for the guards were inexorable, and, always provided with scissors, ruthlessly cut off the beard of those who could not show their badge.

Catherine I. confirmed this tax. In 1728, Peter II. allowed the peasants to wear a beard, but kept up the tax for the other classes under the penalty of work on the galleys in case of nonpayment. Czarina Anne rendered life still harder to bearded men, for not only were they obliged to pay the special contribution imposed upon them, but also had to pay a double tax upon everything else for which they were assessed. This tax was not abolished until the reign of Catherine II.—La Nature.

ELECTRIC ILLUMINATION OF AN ORANGE.

Mr. C. Limb, preparator to Professor Lippmann, at the Sorbonne, has shown us a beautiful lecture experiment which we shall describe.

Upon an insulated support there is placed an orange, into whose poles are inserted movable needles which, through the intermedium of sleeves, are carried by glass standards. One of the needles communicates with the external armature of a strong battery of Leyden jars charged by means of a Holtz machine. Fig. 1 shows the arrangement of the experiment, the orange being seen upon its support in the foreground. After a sufficient quantity of electricity has been accumulated, one of the arms of an exciter is applied to the needle, while the other is placed near the interior pole of the jars. A strong spark bursts forth, and at the same time the orange becomes illuminated with a bright red light that gives it the aspect of a globe of fire (Fig. 2, to the left).

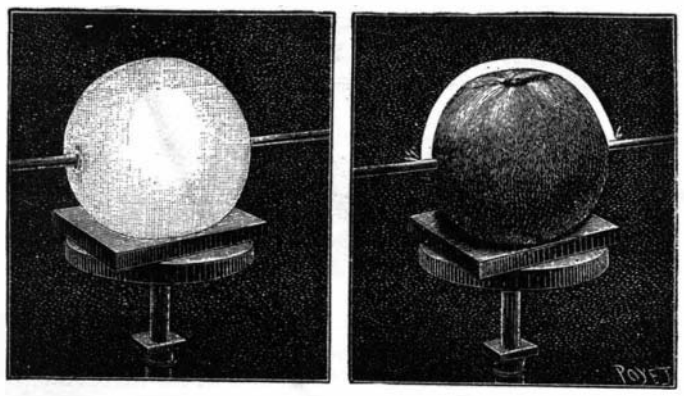


Fig. 2.—THE ELECTRIFIED ORANGE.

To the left the orange has the aspect of a globe of fire, while to the right the discharge is seen passing around the fruit without illuminating it.

If, in a repetition of the experiment, the orange be so turned that its axis shall be at right angles with the direction of the needles, the discharge will pass around it without illuminating it (Fig. 2, to the right).

This latter phenomenon is explained by the difference of resistances of the fibers in the various directions. It is not an isolated one, but, on the contrary, constitutes a general property of ligneous bodies.

The difference in the result of the two experiments shows that the greater part of the discharge passes into the interior of the orange. In fact, if it passed through the skin, or even immediately beneath it, the position of the needles would be indifferent.

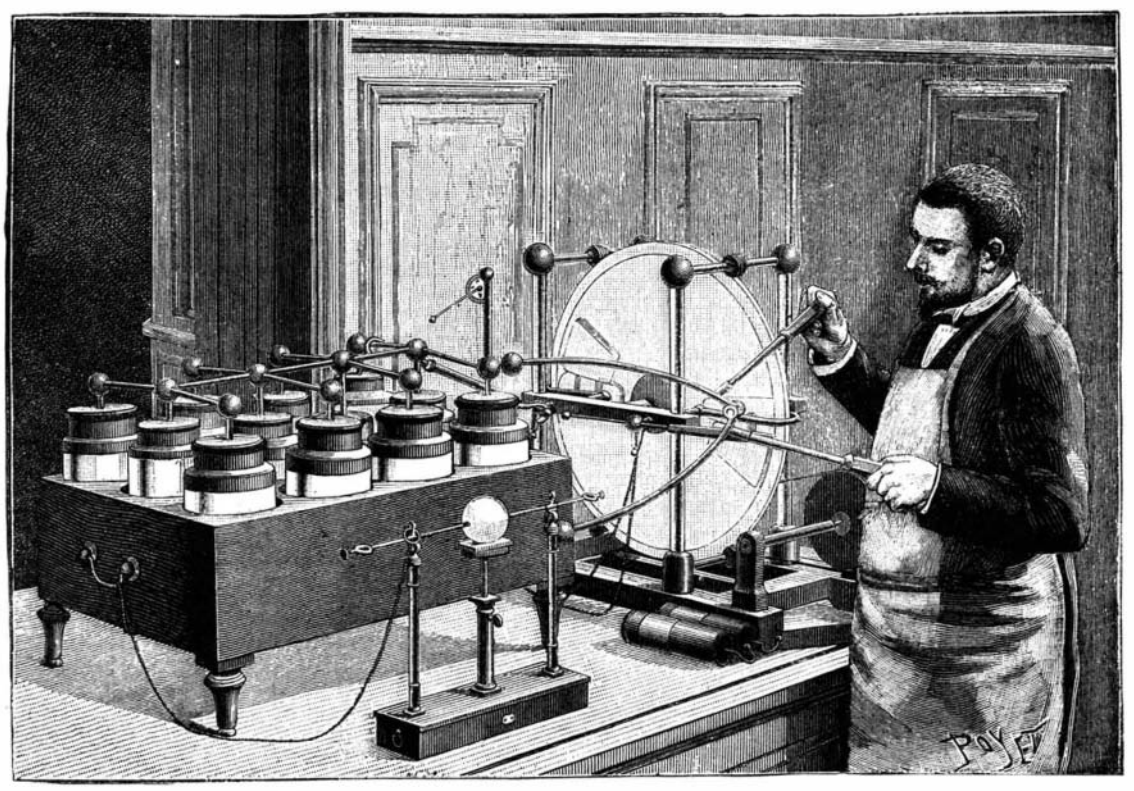


Fig. 1.—ELECTRIFICATION OF AN ORANGE.

It appears probable, therefore, that the light is produced in the interior of the fruit and entirely traverses the skin, which thus shows itself more transparent at the level of the spark than would have been believed at first sight.

The discharges in the direction of the axis damage the orange but slightly. On the contrary, when, by exception, a spark traverses the fruit in a perpendicular direction, it tears it in pieces and destroys it. The experiment succeeds nearly as well with other fruits, which become illuminated with various tints.—La Nature.

Storage Battery Impossibilities.

Occasionally we read, says the Electrical World, in newspapers, predictions of the possibilities of the coming storage battery, and some enthusiasts have even prophesied that when "perfected," ocean steamers will be propelled by this popularly misunderstood apparatus. While, of course, every one with an iota of electrical knowledge recognizes the absurdity of such a claim, yet an illustration of how absurd it is may be of interest, and to furnish this we will apply the necessary calculations to the case of the new Cunarder Campania. The best transatlantic time of which we have a record made by this ship, whose displacement is 18,000 tons, was 5 days 12 hours and 15 minutes, during which the average speed was 21 knots, corresponding to about 26,000 average horse power and a consumption of coal for the trip of about 2,700 tons. Assuming storage batteries of 50 pounds to the hourly horse power, the entire weight of batteries to do the same work, and allowing for no reserve, would be 76,750 tons of 2,240 pounds, or more than four times the entire displacement of the ship. To determine the weight per horse power that a storage battery should have to compete with steam in the case under consideration, we will assume that the entire weight of the boilers and machinery of the Campania is 3,750 tons, which is probably near the actual weight. Adding the coal consumption for a trip, 2,700 tons, we have 6,450 tons as the entire weight of the electrical plant. Assuming the weight of the electrical propelling machinery to be 1,500 tons, we have finally for the total weight of the battery 4,950 tons. With these data we find that the weight of a battery, allowing for no reserve, would have to be 3·16 pounds per hourly horse power. How small this is can be appreciated from the fact that a 150 ampere-hour cell would weigh on this basis only about 1¼ pounds, really about the weight of its lugs. A similar calculation would show the impossibility of storage batteries displacing locomotives, yet the writer knows of a company formed several years ago which spent several thousand dollars in attempting to perfect a battery for such a use. Much of the misconception in regard to the power of the storage battery must be ascribed to the sensational manner in which it was introduced to the public by a very great scientist, his statement in regard to holding "one million foot pounds of energy" in his hand not yet having lost its effect. The great value of the storage battery in its proper field, which is of vast extent, and as yet scarcely entered in this country, should be sufficient to satisfy its most sanguine friends. Only harm can come from making claims beyond its power to fulfill, and much harm in this way has been done, aside from the absurd instances we have here considered.

Mysterious Powder Explosions.

In the manufacture of many of the modern military and sporting gunpowders, says the Electrical Review, London, a substance called nitro cellulose plays an important part. This substance, whether in the form of grains or in sheets, becomes highly electric if exposed to friction by being shaken up, for example. In this condition the grains or sheets will adhere to each other and to almost everything. If they are faced or glazed with graphite or plumbago, the surfaces become conductive for electricity, and the phenomenon described does not take place. It is not the custom, however, to glaze all powders in this way, and it has recently been suggested by Mr. W. F. Reid that many of the mysterious explosions which have taken place in government and other factories may be traced to the ignoring of the electrical excitation which may occur. In government factories it is the rule to exclude all metal from the interior of the sheds where the powder is dried, or, at least, to cover up all metallic surfaces, such as those in the shape of pipes and fittings. Such a shed is often in effect a Leyden jar which becomes charged with electricity when the powder is moved, or the air warmed and set in motion for drying purposes. It is easy to imagine conditions arising in which a spark would occur; the only method of preventing this is by recognizing the necessity for metallic connections everywhere.