IMPROVEMENT IN REVOLVING FIRE ARMS.

The engraving shows an improvement in revolvers, of the class in which the cylinder is arranged to swing outward from its place in the frame, so as to expose the chambers in the cylinder for the insertion and removal of the cartridges or shells. The improvement consists in an ejector which automatically throws all the shells or cartridges from the cylinder which may be in the chambers when it is turned outward from the frame. A part of the frame is made to serve as the center-pin on which the cylinder revolves, it being arranged to swing on a pivot, the axis of which is parallel with the axis of the cylinder. There is an ejector arranged at the rear end of the cylinder to engage the heads of the several cartridges, and mechanism operated by the outward-swinging movement of the part of the frame which supports the cylinder, to give to the ejector the rear movement to force the shells or cartridges from their respective chambers. The frame or receiver, A, is of substantially the usual outline, constructed with a recess for the cylinder B, and provided with the barrel C, hammer D, and lock mechanism, by which the cylinder is rotated to successively present the cartridges introduced into the chambers in line with the barrel for discharge.

On the swinging part E′, above the pivot E^2, parallel with it and concentric with the cylinder, is the center-pin E^3, which forms the bearing on which the cylinder turns. This pin is made tubular or hollow. At the junction of the pin and the swinging part E′, there is a projection or shield, *e*, which overlaps the adjacent part of the frame and prevents gas from entering at the joint. The cylinder is fitted upon its center-pin or bearing E^3 so as to turn freely, and the relation of the parts is such that when the swinging part is closed, the cylinder is in its place of rest in the frame; but when the swinging part is turned away, as in Fig. 2, the cylinder moves out from its place in the frame sufficiently far to expose the chambers for the insertion or removal of the cartridges or shells.

Within the center-pin E^3 the ejector-rod F is arranged so as to move longitudinally. On the rear end of this ejector-rod the ejector-plate is arranged. This plate is of star shape, its arms extending outward between the chambers, and so that, when in its place in a recess in the rear end of the cylinder, these arms or part of the ejector-plate will lie at the rear edge of the chamber, so that the heads of the cartridges inserted therein, or a portion of each, will rest on this plate, so that when the ejector is thrown outward, it will force the cartridges or shells from the chambers of the cylinder.

The ratchet by which the cylinder is rotated, is attached to or made a part of the ejector-plate. To give the ejector the required rearward movement as the cylinder is turned outward, a follower, *a*, is arranged in the swinging part E′ parallel with the axis of the cylinder, and in line with the ejector-rod F, and bearing against its forward end, as seen in Fig. 1. This follower *a* is made eccentric to the center-pin against the ejector-rod, so that the rear movement of this follower will correspondingly force the ejector rearward.

Loose on the pivot E^2 is a ring, *b*, seen front view in the small figure, which is free to turn on the spindle, yet will turn with it when the part E′ swings outward or inward. On the front face of the ring *b* is a bevel segment-gear *d*, and forward of this ring, in the swinging part E′, is an arm H, upon a pivot, *h*, the axis of which is at right angles to the axis of the ring. This arm is shown detached in the small figure.

At the lower end of the arm H, and concentric with its pivot, is a segment, *d′*, which works in the teeth *d* of the ring *b*. Their relative arrangement, as seen in Figs. 1 and 2, is so that their toothed portions *d d* work together like a pair of bevel-pinions.

As seen in Fig. 1, the arm H is in its extreme forward position—that is, in place, with the ejector home. When the swinging part E′ is turned outward, the ring *b* will turn with it, the center of motion of the swinging part being the axis of the ring. If, therefore, the movement of the ring *b* be not interrupted, it can have no effect whatever upon the arm H; but if during the swinging movement the ring *b* be stopped, then, the swinging movement continuing, the teeth *d′* of the arm H, which are swinging upon the same center as the swinging part, will be forced to travel through the then stationary teeth *d* on the ring, which will impart to the arm H a movement on its center corresponding to the movement of the swinging part on its center, which will turn the arm H rearward, in a plane parallel with the axis of the cylinder. The rear movement of the ejector must not occur until after the cylinder has been turned so far from the frame that the heads of all the cartridges are exposed outside the frame, and that its movement may commence at this time a shoulder, is made on the periphery of the ring *b*, and a corresponding shoulder on the frame below, so that as soon as the shoulder on the ring strikes the shoulder on the frame the further turning of the ring will be arrested. Then as the swinging part continues its movement to the position indicated in the smaller figure the ring will remain stationary, and the arm H will be turned from the position in Fig. 1, and force the ejector rearward from the cylinder, so as to discharge the shells. This invention was lately patented by Mr. William Mason, of Hartford, Conn.

MASON'S IMPROVED REVOLVER.

Fine Drilling.

Professor Edward C. Pickering, of Harvard College, says that, in undertaking to measure the intensity of the light of the satellites of Mars, he had occasion to need an extremely small hole. A hole about the *twenty five-hundredth* part of an inch in diameter was finally secured.

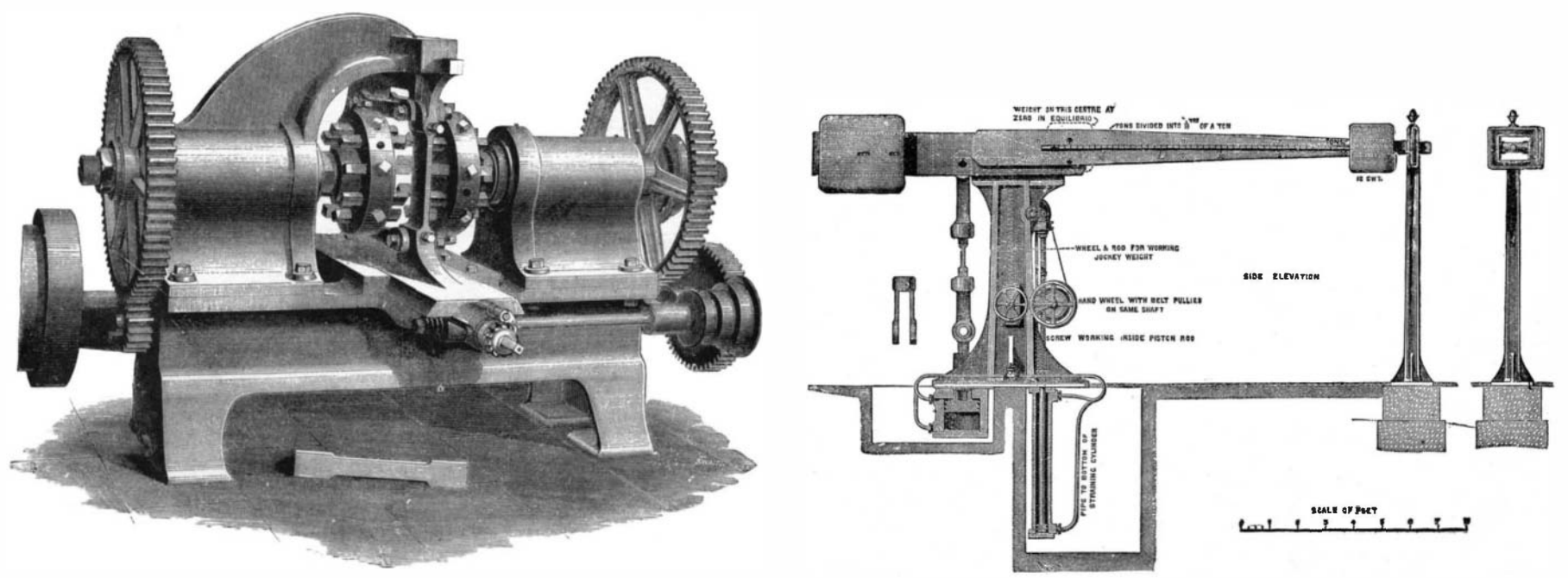
IMPROVED TESTING MACHINE.

In order to meet the increasing demand for mild steel ship and boiler plates, and also to carry out the requisite tests—tensile—specified by the Admiralty, Board of Trade, Lloyd's and Liverpool Registry, Bureau Veritas, etc., the Steel Company of Scotland found it necessary to have a machine capable of getting through a great number of tensile tests in a comparatively short time with precision and accuracy, and also to save the delay and inconvenience to which shipbuilders and boiler-makers were subjected when the materials had to be tested at their own yards.

Through the inefficiency of the hand-moved machine at the works, the machine we illustrate was designed by Mr. Thomas Williamson, works manager to the Steel Company of Scotland, and was made by Messrs. Westray, Copeland & Co., of Barrow-in-Furness. It has been in use for about two and a half years, and has been found to fulfill all the requirements in a satisfactory manner. The average number of tensile tests, for several months' actual work, was ninety per day of nine hours, or ten per hour, and the machine is capable of breaking one test piece every two minutes with perfectly accurate results, whence it becomes a question of measuring, checking, calculating, and reducing the strains per square inch, etc., in order to keep pace with the work of the machine. The labor has been reduced by one-half, while the work done has been increased about two-thirds per day, thus effecting a great saving in time and labor.

The machine is driven by two hydraulic rams, the small one for forcing and the large one straining. The small forcing ram—pump—is worked by a screw driven by worm gear and strap by power from line shafting, which arrangement gives a steady flow of pressure in the large cylinder, and does away with the objectionable intermittent reciprocating action of the ordinary plunger pumps, which may affect the real accuracy of a test when strain has gone beyond the limit of elasticity. The capacity of the forcing to the straining cylinder is such that the cubic contents of both are nearly equal, so that the displacement is nearly the same at either side of the piston, the one forcing and the other drawing, the water leaving the bottom side of the large ram while it is being forced down on the top side; therefore, when a piece is being tested and it breaks, the water under the ram acts as a stop and so prevents it from falling through any distance, and thus causing a sudden jar on the ram or steelyard levers, which jar is injurious to the knife edges of the machine.

The levers are compound and of the first and third orders, are graded 100 to 1, and balanced; the fulcrums have long knife bearing edges, viz., one inch equal to five tons, and are hardened to wear well. The traveling jockey weight, which is 10 cwt. standard imperial weight, runs on rollers guided by a groove, and can be worked automatically or by hand out and in on the main lever, which is just kept floating at the level of a finger pointer fixed to the column. The jockey weight is worked by a quick pitched screw through the center of the main lever, which is in turn worked by a pair of small toothed wheels, one of which is fixed to the machine column, and the other to the lever and on the dead center of the first lever. The pitch line of the toothed wheels being exactly in a line with the dead center knife edge, the motion at this point is virtually nothing. It is at the same time at right angles to the line of knife edge, conse-



FIFTY-TON TESTING MACHINES, DESIGNED BY THOS. WILLIAMSON.

quently cannot disturb the sensitiveness of the steelyard when in operation. The machine is fitted with strong steel links, the top one being on knife edges on the lever, and the bottom one receiving the screw for adjusting the length for the test pieces; the screw is secured inside the trunk of a large ram. The ends of the links for receiving the test-pieces have round sockets with circular glands let into them, into which are fitted the tapered grips, so that the grips can be adjusted and turned in either direction, either to stand across or lengthways of the machine. The machine is specially adapted for tensile testing, but can be easily made to do either compression or bending testing if required. The machine is compact and easily got at for repairs, examining and readjusting knife edges; it takes up little space, and the gearing, being a worm and screw driven by belts, is noiseless. The levers, links, and ram are made of Hallside steel.

Another machine of the same description has just been erected at the Steel Company of Scotland, Blochairn Works, Glasgow.

Along with the testing machine it was deemed necessary to have a machine capable of preparing the requisite number of test-pieces to keep the testing machine fully employed, and for this purpose the test-piece shaping machine was designed by Mr. Thomas Williamson, and made by Messrs. Joshua Buckton & Co., Leeds The pieces, about twenty-five in number, of various thicknesses, and from one and one-half inches to two inches broad, just as they are cut at the shears, are put into the frame which forms a slide working across the bed of the machine; the pieces are roughed down and finished in one operation to a breadth of one inch to three-quarters of an inch; they require no filing up, except taking off the ragged edge, when they are ready for testing.

The average working of the machine is 150 test-pieces per day of nine hours. It is a strong, substantial machine, and has given great satisfaction both at Blochairn and Newton, and can prepare more than double the usual number of test-pieces at half the former cost, so that it forms a valuable adjunct to the lever testing machine.—*The Engineer.*

Comparative Studies of American and European Oysters.

There is promise that many doubtful points in the natural history and physiology of oysters will be cleared up by the work now going on at the Philadelphia Academy of Sciences under the direction of Prof. John A. Ryder. The observations of Prof. Brooks (already described in these pages) seemed to show that the reproduction of American oysters—some of them at least, is a radically different process from that of the European oyster, or else that European observers had erred in deciding the oyster to have both sexes in one animal. Professor Ryder has been supplied with Chesapeake oysters by Mr. Ferguson, Commissioner of Fisheries for Maryland, and with a variety of European oysters by Mr. Blackford, of the New York Fish Commission, including those known as Mulford natives, Burnham natives, Mulbles, and Colne oysters, coming from England, and the Scotch, Dutch, French, and Anglo-Portuguese oysters.

The Dutch oysters have a thin covering, the lower valve quite convex, the upper flat, and the outline fairly circular, while the Burnham and Mulford natives the French and Scotch shells, approach more nearly to our own forms. As a rule, there are, however, marked differences in the shell when opened, so much as to make them quite evident, though even to this there are exceptions.

In the American oyster the great muscle has a distinct purplish color on the shell. In the majority of European oysters there is no color. A French or Dutch oyster may be opened, and, although just where this muscle has been imbedded on the nacre a slight depression is visible, there is no color. Again, the outline of this muscle on the shell differs in European oysters. It is not broad, like a thumb-mark, as it may be roughly described, as found in our own oysters, but it is elongated, longer than it is broad. The exception to this want of color on the shell was found in oysters of Portuguese origin. There does, however, exist some slight differences in the structure of this muscle, and it appears to adhere on both sides in European oysters rather more tenaciously than in American oysters.

The Portuguese oysters transplanted into English waters presented the greatest differences of shell. The lower valve is exceedingly deep, resembling a miniature gravy boat. An oyster about three inches long had at its hinged end a depth of over an inch. This cup-like base necessitated, on the part of the oyster, a complete upward turn of the covering valve, so that in a perfect specimen the curve in the outline was very conspicuous.

In the structural form of the oyster it is said that Prof. Ryder has made some important discoveries, which will undoubtedly attract the attention of microscopists. The reproduction of these oysters is still under investigation. It would seem, however, that in the Anglo-Portuguese oysters transplanted to English from Portuguese waters—the reproductive organs are the same as those of American oysters as observed by Prof. Brooks.

The Protective Effect of Vaccination.

Dr. Henry Tomkins, medical superintendent of the fever hospital belonging to the Manchester Royal Infirmary at Monsall, in a paper which he read recently at Owens College, said: "The most striking of all evidence is, perhaps, that derived from the smallpox hospitals themselves. Here the protective influence of vaccination is seen and proved in a manner beyond all cavil. At Highgate, during an experience of forty years, no nurse or servant, having been revaccinated, has ever contracted the disease, and evidence of the same character I can myself bring forward, for during the whole time that I have had charge of the fever hospital, more than a thousand cases of smallpox have passed under my care, yet no servant, nurse, porter, or other person engaged there has, after revaccination, ever taken it, though exposed daily to infection in its most concentrated form. One woman, a laundress, who escaped vaccination, took the disease and died; one nurse, who some years before had suffered from smallpox, and was then considered protected, had a very mild attack; and this summer a workman, who did not live on the premises, but came in to work as a painter, was not vaccinated, and had rather a severe attack; and still more recently a servant, who by an oversight was allowed to go about her work three days before being vaccinated, had, before the latter had run its course, a slight abortive attack. Again, among all the students who, during the past two years, have attended the hospital for clinical instruction, not one has suffered, all having been revaccinated before being permitted to enter the smallpox wards. And in their case the false argument which opponents of vaccination have brought forward to explain the immunity enjoyed by nurses and others in attendance on the sick, viz., that constant intercourse and exposure to infection renders them proof against it by the system becoming inured to the poison, cannot be applied, as these gentlemen attend the hospital only a few hours once a week. I defy the most enthusiastic or conscientious of anti-vaccinators to produce evidence like this on his side of the question, or to bring forward even half-a-dozen persons, choose them whence he may, who have not been protected against smallpox, and expose them as the students are exposed, without more or less of the number taking the disease. Facts such as these should convert the most ardent anti-vaccinator from his folly, and convince him that a weapon of defense so powerful as vaccination should not be left to the pleasure of the individual, but that the State has the right and duty to look after its most thorough performance.—*London Times.*

Improved Secondary Battery.

We learn from the *Metallarbeiter* that a modification of the Planté battery has been constructed by M. De Pezzer, in which a maximum of intensity is combined with a minimum quantity of lead. The negative electrode is a very thin sheet of lead, not exceeding one millimeter in thickness, while the positive plate is not more than two-thirds of a millimeter thick. The projecting portions of the plate which serve for connections are, however, somewhat thicker. Besides, two like pairs were employed, each consisting of two leaden plates of the same thickness, but one of them had twice as large a surface as the other. These pairs were both charged in the same manner, but they were so arranged that in one case the plate with the larger surface served as positive element, and in the other pair it was made the negative element. Repeated experiments made in this way showed that the pair in which the plate with the larger surface formed the negative electrode collected more electricity than the other pair in four consecutive continuances, and that the discharge of the pair with the large negative plates took at least an hour, while in the pair in which the positive plate had the larger surface it only lasted for half an hour.

Finally, what seems more surprising at first sight, in a battery in which both plates were as large as the big plates in the battery just described, the results were not so good as the pair with the large negative and smaller positive plates.

Acting upon these results, De Pezzer changed the construction of his battery as follows: The surface of the positive leaden plate was only made half as large as that of the negative, and at the same time a number of cuts were made in it. The arrangement of the cells was the same as in Planté's secondary battery, but the weight of battery to collect a certain quantity of electricity is less than with the former construction. Ducretet uses plates with indentations made by the rolls.

RECENT INVENTION.

An improved wheel cultivator has been patented by Mr. Francis O. Williams, of North Cohocton, N. Y. The object of this invention is a sulky or wheel gang cultivator or shovel plow for tilling corn or potatoes, or anything planted in rows. It is light, durable, of easy draught, and can be turned around within small space, and is capable of being easily used upon side hills.

Antimerulion.

Dr. Zerener has given this classical name to a preparation much used and recommended abroad for preventing mould, mildew, and dry rot. When properly employed it hinders the appearance of dry rot, *merulius destruens*, and serves to destroy it. The substance is made in three forms. The liquid preparation of 30° B. is made of boracic acid, common salt, and silica, and is applied by means of a brush or pencil to woodwork and masonry. In factories where moist fumes and vapors are evolved, which favor the production of mould and fungus, this acts as a protection for the building. The so-called doubly prepared antimerulion consists of infusorial silica, with the addition of 20 per cent of boracic acid; it is to be scattered in moist or damp places. The simple dry antimerulion contains, besides the infusorial earth, only 8 per cent of boracic acid, is less active, and used specially for protecting moist places from mould, for insulating material, and to exclude the atmospheric air and terrestrial warmth—that is for ice cellars, ice chests, water pipes, and heating arrangements. In places where mould and dry rot are feared the dry antimerulion is packed in. It is better to expose these places to the air and paint them thoroughly with the liquid substance and then repeat the application annually. The two first-named substances are furnished by the chemical factory of G. Schallehn, in Magdeburg, at 57 cents per 100 pounds; and the last named, or solid compound, at half this price.

The name, of course, is derived from *merulius*, a kind of dry rot or powder post, against which it claims to be a specific.

Purification of Naphthaline.

BY PROF. G. LUNGE.

It is well known that the whitest naphthaline turns red by a longer or shorter exposure to the air, and this indicates impurities. The naphthol manufacturers, however, demand a naphthaline which is as pure as possible chemically, and which remains white. The author published in the *Berichte*, of Berlin, a simple method of purification based upon the assumption that reddening of naphthaline was analogous to that of phenol (carbolic acid). The very purest phenol does not turn red, and it is only in the presence of traces of the higher homologues that the redness appears in a longer or shorter time. Therefore the use of an oxidizing agent seemed to be indicated for use in purifying naphthaline, and it led to the desired end in a simple manner.

The crude naphthaline is mostly obtained from the oil that remains after treatment with soda lye for the purpose of separating the phenol. In such oils the treatment with acid can be begun at once, but naphthaline which has been obtained directly from the tar oil by crystallizing it out, should first be treated with alkalies.

The crude naphthaline is melted and a certain quantity of sulphuric acid added to it. On a large scale 5 or 10 per cent of acid, of 66° B., is sufficient; but if acid of 60° is used of course proportionately more is required. When the liquid naphthaline and acid have been well mixed and stirred, 5 per cent of finely ground pyrolusite (binoxide of manganese), or, better still, the regenerated oxide of manganese (from the Weldon process) is gradually added and the mixture heated fifteen or twenty minutes in a water bath. It is then allowed to cool and the cake of naphthaline is washed several times with water, then a little soda is added to the wash water, and then it is again washed in clean water. The naphthaline thus prepared is finally distilled. When purified in this way it has kept perfectly white, according to Lunge, for eight or nine months.

In this country, where the water gas process is so extensively employed, a comparatively pure naphthaline is obtained as a waste product, and if treated as directed by Prof. Lunge would, no doubt, be an excellent material for making naphthol and other derivatives.

A Theater Smoke Escape.

A Chicago paper describes the recent testing of a smoke escape in use in one of the theaters in that city:

"A number of caldrons, such as the one used by the witches in the cave scene of 'Macbeth,' were loaded up with red and blue fire, and a quantity of combustible material thrown in, creating a dense smoke, sufficient to spread terror throughout any audience. The curtain was lowered until the entire space behind it was enveloped. Then, at a word given, it was lifted, the doors of the auditorium were thrown open, the valve was pulled open, and at once the thick mass of smoke began to pour upward through the aperture. The quantity of smoke which found a way into the auditorium was trifling, and in less than two minutes the stage itself was relieved of what had collected. The experiment was repeated once more, and with still more satisfactory results. A brief explanation will suffice to acquaint the public with its value. An immense funnel rises from the ceiling above the stage to some twenty feet above the roof, and is securely fixed there by a beam running crosswise. At the lower end of this funnel is a valve, which is opened by means of wire pulleys, two extending to the side doors of the stage and one to each of the entrances to the auditorium, the handles being so placed that any one can pull them. In case the stage should be wrapped in flames so that the stage hands could not reach them, the handles at the auditorium doors can be worked. And even should these fail, the woodwork in the valve would be the first to give out. The result would be that a tremendous draught would be created, throwing the volume of smoke and flame up through the funnel, and giving the audience time to escape before the fire began to reach the body of the theater."

George Jardine.

George Jardine, the well-known builder of church organs, died recently at his residence in this city, at the age of eighty-one. Mr. Jardine was of English birth. He came to this country in 1837, where his brother, John Jardine, had already established himself as a piano manufacturer. The organs built by Mr. Jardine alone, or associated with his sons, are known in every part of the country. Among the larger and finer examples are those in the Fifth Avenue Cathedral, St. George's Church, and the Fifth Avenue Presbyterian Church, of this city; the Brooklyn Tabernacle; and the Mobile and Pittsburg Cathedrals.