BERDAN'S BREECH-LOADING RIFLE.

Among rifles, Whitworth's has possessed a superiority over all others in range, while Clarke's has taken the lead in accuracy. Clarke's is made by contracting the bore slightly towards the muzzle, making it the smallest at about 2 inches from the end, and then cutting off the barrel at the throat. The piece which is cut off is replaced for loading, being secured in position by dowel pins, and is removed before the gun is fired. The acorn-shaped shot is made of such size that it has to be driven through the false muzzle by means of a short ram-rod having a conical cavity to fit the apex of the shot, so that the base of the shot is swaged into the grooves of the bore, and its axis is made to coincide precisely with the axis of the bore. This device has placed Clarke's rifle at the head of all small arms for accuracy of fire, and secured it so general favor among our riflemen that it has come to be known as the American target rifle.

As the shot in this gun is swaged through the patch, it has to be made of the very softest lead, and this softness of material imposes a limit on the length of the shot. For if the shot be made very long the inertia of so large a mass will cause the pressure of the gases against the base to shorten the shot, and enlarge its diameter so much, that it will press the patch so tightly as to wear it to pieces in the course of its passage out of the gun.

Whitworth overcomes this difficulty by preparing his shot beforehand so that it will exactly fit the grooves of his gun, thus dispensing with the use of a patch. He then makes his shot very long, those of $\frac{44}{100}$ths of an inch in diameter being about $1\frac{1}{2}$ inch in length. This, of course, gives very small resistance of the air in proportion to the weight of the shot; hence his superiority in range. The great length of the shot requires a very rapid rotary motion in order to keep its axis parallel to itself throughout its flight, and the Whitworth gun has one turn in 20 inches. With so short a turn the shot would strip across the grooves if it were made of soft lead; it is consequently necessary to harden it by a mixture of zinc or tin in its composition. As it is not necessary to alter its form by the action of the powder in the gun there is no objection to this hardening.

Colonel Berdan conceived that if he could combine the accuracy of the American target rifle with the long range of Whitworth's and the convenience of breech-loading, he would have a perfect gun, both as a weapon of warfare and as a rifle for sportsmen. The simple plan for accomplishing this was to continue the hexagonal form of the Whitworth bore through the counter bore or cartridge chamber, and then make the cartridge of corresponding form to fit this chamber; thus centering his shot with absolute precision. There were manifest difficulties in the way of rifling the counter bore to correspond with the grooves in the barrel, and the overcoming of these difficulties Colonel Berdan regards as the principal triumph in his invention.

On the 12th inst., there was a trial of Berdan's gun in comparison with the best known English and American rifles. A target 12 feet square, was set up at three-fourths of a mile—less 30 yards. A fixed rest was prepared for the guns with a spring to take up the recoil, and the firing was done by a disinterested expert. The rest was somewhat elevated, and the highest sight on the gun was raised, giving the whole elevation of the gun, we should judge, about 10 degrees. With Berdan's rifle, at this enormous range, 7 shots out of 27 struck the target.

All of the guns were tried for penetration also. Planed boards, one inch in thickness, were nailed together an inch apart, and placed in front of the shooters. The following is a statement of the number of boards penetrated by the shot from each gun:—

Spencer, Government charge	15¼ boards.
Whitworth, 68 grains powder, 540 lead	20
Whitworth, 68 grains powder, 540 lead	23½
Mountstorm breech-loader	15½
Clarke's Patent, 120 grains powder, slow burning	18½
Federal Swiss target, 65 grains powder, 233 lead	15
Starr's carbine, weight 7¼ lbs., 21 inches long, breech-loading. 60 grains powder, 456 lead	16
Sharp's breech-loading, Government charge, 456 lead	18
Enfield, 65 grains powder, 500 lead	15½
Enfield, 80 grains powder, 500 lead	15½
W. X. Stevens's breech-loading carbine, weight 7¾ lbs., 30 grains powder, 400 lead	14½
Springfield, 65 grains powder, 500 lead	17½
Springfield, 80 grains powder, 500 lead	15½
Berdan's carbine breech-loading, weight 7 lbs., 90 grains powder, 540 lead	26½
Berdan's rifle, weight 10 lbs., same charge	31
Whitworth, 60 grains Berdan's powder	26
Whitwo th, Berdan's charge	32

The last shot of the Whitworth was through a part of the target that had become much shattered, still it showed that the great power of penetration attained by Colonel Berdan's rifle was in part to be attributed to the excellent quality of his powder.

A trial was then made with the cartridges prepared for volley firing. These contain 3 spherical balls each. It is stated by experienced army officers that the most efficient charge for infantry is one ball and 3 buckshot in a smooth bore musket. But there are serious objections to this, as the men using it are deprived of the use of rifles for long ranges, and the buck shot are effective at only very short ranges. But the 3 spherical balls of Berdan's rifle combine the range and accuracy of the rifle with the destructiveness of the buck shot charge, and the extent of the scattering can be adjusted at will by varying the windage; with a windage of $\frac{2}{1000}$ths of an inch the spread is about 5 feet in 200 yards

Colonel Berdan has invented a breech-loading arrangement to accompany his improved chamber and cartridge, and we intend soon to give an illustration of it in our columns.

Scotch Steamboats.

The blockade runners are the fastest and best boats built on the Clyde. *Mitchell's Steam Shipping Journal* says:—

"Many of our fast-sailing river steamers have left the Clyde to make, in some cases, a singular succession of fortunate runs; while others—not a few, indeed—have gone out only to become the prey of the blockading squadron, and thereafter to do duty on the waters of the Hudson or the Potomac. Nearly all our best river steamers have disappeared in this way, and were the many fine vessels built specially for this trade added to them, the list would be a surprisingly large one. The building of blockade runners is now, indeed, a regular branch of the work of our shipbuilding yards."

The fastest and latest of these boats are daily caught by our ocean steamers. The *Fort Jackson*, a heavy side wheel steamer, lately caught the *Let Her Rip* in a two hours chase. The *Let Her Rip* was built especially for speed, but in this case did not "rip" quite fast enough.

Cutting up Pork.

Have the hog laid on his back on a stout table. Clean the carcass of the leaf fat. Take off the feet at the ankle joints. Cut the head off close to the shoulders, separate the jowl from the skull, and open the skull lengthwise on the under side, so as to remove the brains fully. Remove the backbone in its whole length, and with a sharp knife cut off the skin—then the fat, leaving only about one-half inch of fat on the spinal column. The middlings or sides are now cut from between the quarters, leaving the shoulders square shaped, and the ham pointed, or it may be rounded to suit your fancy. The ribs are next removed, partially or entirely from the sides. The trimmings of fat from the hams and flabby parts of the sides are rendered up with the backbone strip for lard. The sausage meat is cut from between the leaf fat and the ribs; any other lean pieces are used for the same purpose. The thick part of the backbone that lies between the shoulders is called the chine; it is cut from the tapering bony end, and the latter part called the backbone by way of distinction. The backbones are used while fresh; the chine is better after being smoked.—*Country Gentleman.*

STARCH SUGAR has been converted into a sweet, hard, granular condition, in which it resembles ordinary sugars, by Mr. F. Anthon. He first treats the starch with sulphuric acid in the usual manner. The neutralized solution is then evaporated in a wooden vessel, allowed to rest and to solidity gradually. The mass of raw sugar is then removed and strongly pressed in a cloth, the sirup which is pressed out being reserved and boiled down in a fresh operation. After pressing, the sugar is melted and further concentrated in a water bath until the liquor reaches 43° or 35° Baume. When this point is arrived at, the melted sugar is allowed to cool, with an occasional stirring. If it is desired to obtain the sugar in small granules, the stirring is continued. When this mass has cooled to 25° or 30° Reaum., it is removed and dried in a gently heated drying-room.—*Technologist.*

Curious Application of Heat.

It is well known that the air confined under glass, if it receive the direct rays of the sun, will become much heated, far beyond the temperature of the rays owing to the action of the glass in absorbing these rays and conveying the absorbed heat to the air within. Prof. Mouchot, of Alençon, has made the following application of the heat thus acquired. He takes a bell of silver, very thin and covered with lamp-black, and places over it two bells of glass, and exposes the whole to the rays of the sun. Two curved tubes furnished with stop-cocks pass under the black bell, one of them to supply water when it is required, the other to give exit to the water; the latter terminating outside in an ordinary *jet d'eau* orifice. Being now exposed to the solar rays—whose heat is transformed into non-luminous heat in its passage through the walls of the bells, an effect that goes on accumulating without cessation—the air situated above the water dilates, and by its pressure causes a jet to rise attaining sometimes in Mouchot's trials a hight of nearly 33 feet. When the water is exhausted a screen placed before the sun will cool the interior and cause the water to return, or a new supply may be introduced through the supply-pipe. Many times the shade thrown over the apparatus by spectators caused it to stop, much to their surprise.—*Les Mondes.*

Fire-escape Patent--Heavy Verdict.

George B. Mickle, of this city, brought an action against the Corporation of the city of New York to recover the sum of twenty thousand dollars and interest from Nov. 10th, 1860, on account of a purchase from the plaintiff, by the city, of a patent fire-escape and hook and ladder apparatus. The plaintiffs proved the passage of two distinct resolutions by the Common Council in 1860, appropriating the above amount, and both of which received a three-fourths vote of both boards; also the passage of another resolution requiring the Street Commissioner to advertise bids for applying the plaintiff's improvement on one of the city trucks; also the advertisements made and proposals issued by the Street Commissioner. The plaintiffs further proved that they had demanded payment of Comptrollers Haws and Brennan, and the tender of the assignment of the patent right to the city, and that payment was refused, and the assignment not received. The defense was that the Common Council had no right to make a contract for the purchase of the patent, and that there has been no money in the city treasury since 1860 to meet the appropriations passed on the subject. The jury, under the instructions of the court, rendered their verdict for the plaintiff for the sum of $25,632 23.

Diamonds in Australia.

The *Technologist* says:—"If any doubt existed on the subject of Australia being a diamond-producing country, it is now removed. A successful digger, named Williams, from the Yackandandah district, submitted to Mr. Crisp, jeweller, Queen street, a collection of small stones which he had picked up while washing out gold. Amongst these was a diamond, the largest yet found in the colony, so far as is known, and of purest water. Its natural facets are perfect; its color is a pale green, but approaching much more nearly to the pure water of the East Indian diamond than the stone which was the subject of a conversation not long ago in the Legislative Assembly. It weighs $2\frac{3}{4}$ 1·32 carats, or nearly three carats, and was found at Wooragdy, near the Magpie, Yackandandah, in auriferous earth taken, about four feet deep, from a hill-side."

Temperature of the Sexes.

The theory of Aristotle that a man possessed more warmth than a woman, had been disputed; and it had been held by some, as the result of modern research, that the temperature of women was slightly superior to that of men. Taking the average, the temperature of males and females was as 10·58 to 10·13. The result of some elaborate experiments recently instituted was that the temperature in the case of the men varied between 99 and $99\frac{1}{2}$, that of the women was between $97\frac{3}{4}$ and 98. An examination of other animals gave still a somewhat higher temperature for the male than the female, six fowls showing the proportion of 108·33 for the former to 107·79 for the latter.—*Proc. Brit. Assoc.*

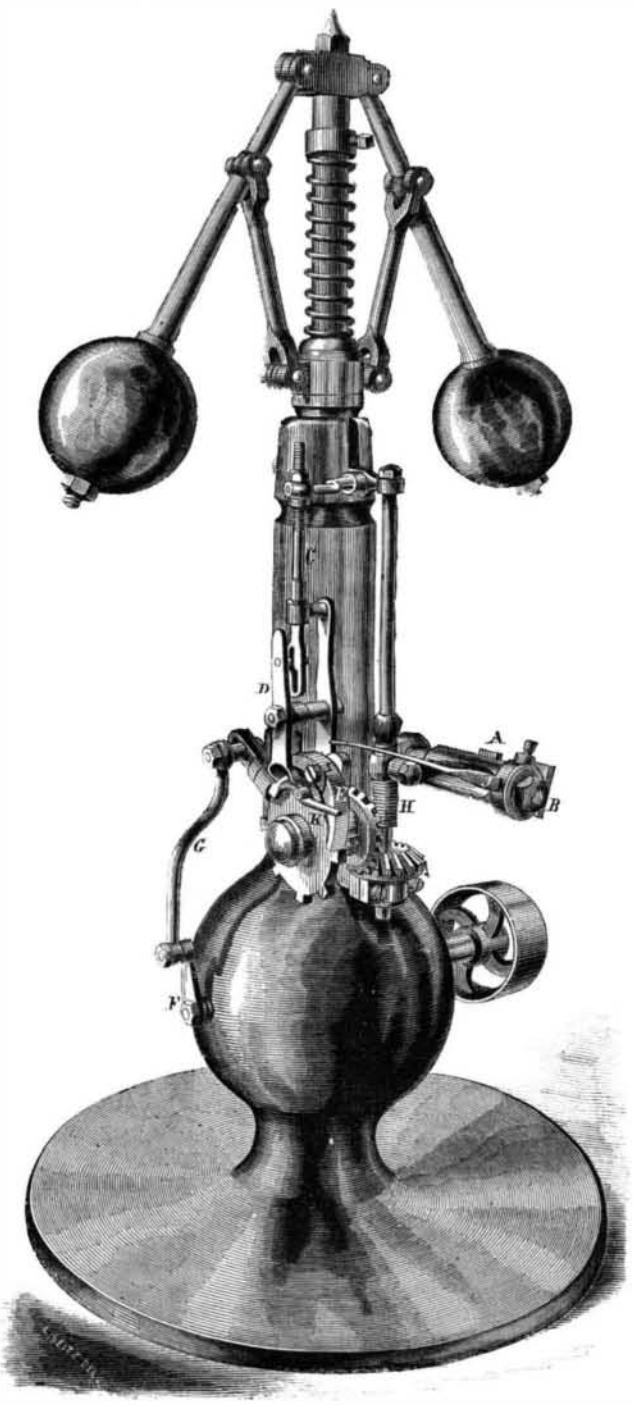
Improved Governor.

This governor is designed to regulate steam engines, having cut-off motions attached, as in the Corliss or other engines of any kind, including engines that are regulated directly by the main valves.

"The object of this governor," say the inventors, "is to obviate the violent changes and consequent fluctuations in the quantity of steam admitted to the piston by ordinary governors. This improvement is to admit the right quantity of steam to the cylinder so that the balls will assume one position, let the resistance be what it may; consequently the governor has a more perfect action and the engine a steadier speed than with common governors. The toes, A, on the rock shaft, B, to the right, bear on the cut-off levers and depress them so as to cause them to take greater or less hold on the valve levers of the engine, and thereby remain longer in connection with them, opening the valves to a corresponding greater degree. The ordinary governor gives speed to the engine, corresponding in some degree with the quantity of steam admitted into the cylinder, and the variable resistance, power or labor of the engine; consequently the speed of the engine is fluctuating, arising from the balls being rigidly connected with the cut-off motion or main valves. When the balls on the governor fall, they lower the rod, C, which has a slot in it of peculiar shape. This slotted rod acts on the lever, D, through a pin placed therein, and throws one of the pawls, E, into connection with the ratchet wheel. These pawls are always rocking back and forth, being driven by the crank, F, and the rod, G. When either of the pawls are thrown into contact with the wheel, the screw shaft, H, is turned by the gears, L, which causes the main rock-shaft toes to be elevated or depressed, as the case may be, thus increasing or diminishing the amount of steam let on to the piston of the engine. When the engine is running at its regular speed, the slotted rod, C, remains in the cross, of the slot or a point of no motion, but the least variation in the speed causes the slotted rod to rise or fall, and thus to act on the pawls which rotate the screw shaft, H, through the gear and ratchet wheel. When the engine stops the arm, J, on the rock shaft comes in contact, as the balls fall, with the arm, K, on the lower part of the lever. This arm, K, is part of a shoe which, being operated on by the arm, J, places the pawls in such a position that they will not touch the ratchet wheel. By this provision the escapement motion stops, and the screw rod cease to turn, and also at times when the engine is overloaded and the valves opened to their full extent. This improved escapement governor is self-adjusting and needs no particular attention from the engineer. The speed of the engine is easily regulated by this governor. It is only necessary to raise or lower the slotted rod, C, to make the engine run fast or slow, whereas, in the common two-ball governor the size of the driving pulley must be increased or diminished to effect the same object.

"This governor has been running in a cotton mill in Forestdale, R. I., for some months, and its action has been found to be a great improvement in regulating machinery, especially on cotton or woolen looms."

A patent is now pending on this governor through the Scientific American Patent Agency, by Oliver A. Kelly and Estus Lamb. For further information address them at Slaterville, R. I.



KELLY AND LAMB'S GOVERNOR.

JUDGMENT AGAINST THE "GREAT EASTERN" IN FAVOR OF MR. TOWLE.

It will be remembered that the *Great Eastern* steamship, in September 1861, when two days out from Liverpool on her way to New York, met with a violent gale, in the midst of which her rudder post twisted off, leaving her at the mercy of the waves, and that after floundering in the trough of the sea for two days, a steering apparatus was devised by one of the passengers, Mr. Hamilton E. Towle, an American civil engineer, by which the great ship was rescued from her perilous situation. A narrative of the affair with an illustration of the apparatus was published on page 263, Vol. V, Scientific American. The owners of the *Great Eastern* refusing to recognise in any way Mr. Towle's services, he commenced an action for salvage in the United States District Court, and attached the ship while she was in this harbor. The case was decided on the 12th inst., in favor of Mr. Towle. The decision rendered by Judge Shipman was an elaborate discussion of the law of salvage, concluding as follows:—

"The authorities cited show that officers and crew, pilots and passengers may all become salvors when they perform services to the ship in distress, beyond the line of their duty. The duties of passengers are much more circumscribed than those of sailors or pilots; and it would seem that all the law imposes upon them is to assist in the ordinary manual labor of working and pumping the ship, under the direction of those in command of her. If they assume extraordinary responsibilities, and devise original and independent means by which the ship is saved, after her officers have proved themselves powerless, I see no reason, and know of no authority that can prohibit them from being considered as salvors. I think it follows, from the principles laid down by the authorities,

"1. That a passenger on board ship can render salvage service to that ship when in distress at sea.

"2. That in order to do this he need not be first personally disconnected from the ship; but,

"3. That these services, in order to constitute him a salvor, must be of an extraordinary character and beyond the line of his duty, and not mere ordinary services, such as pumping and aiding in working the ship by usual and well-known means.

"That the services of the libellant in the present case were of an unusual character cannot be denied. After the officers of the ship had exhausted their means of getting control of the rudder, he devised, and with the aid of a large number of men put under his directions by the captain, executed a plan which, in the judgment of this court, was the efficient means of rescuing this great vessel from peril. The whole work of accomplishing this result was entrusted to him and to his directions. If it is said that he got his main idea of the plan he carried out, from witnessing an experiment of the engineer, which, I doubt, still the effort of that officer had entirely failed and was an abandoned experiment. The merit of the libellant in overcoming the obstacles which had proved insurmountable to the engineer, is, in my judgment, enhanced rather than diminished by the unsuccessful effort of the latter. That the service rendered by the libellant was a very difficult one, is proved by the fact that the able and experienced officers of this ship had failed to accomplish the result which he finally secured. They had spent two days of fruitless effort, though stimulated by motives as powerful as can be addressed to the minds of men. It required no little moral courage for this libellant to interpose to arrest the unscrewing of the nut on the rudder-shaft, and then assume the responsibility of a new and different experiment, which would consume precious time, and might thus produce appalling consequences. Had he failed, the consequences to him would have been injurious and humiliating. The whole circumstances of the case are so extraordinary as to leave no doubt in my mind that the services which he performed were wholly beyond his duty as a passenger, and therefore entitle him to salvage compensation.

"In fixing the amount of compensation, it must be considered that, though the service was one of conspicuous merit and the amount of property saved large, yet the personal danger encountered by the libellant was not very great; and the only things contributed by him were personal skill and labor. He supplied no materials and risked no property, though his labors were protracted and exhausting. On the other hand, he rescued the ship from great peril by his own ingenuity, courage and skill. That the peril of the ship was great, and her position critical in the judgment of her commander, is evident from the fact that he entrusted to this stranger a work upon the success of which her salvation depended, and which for nearly two days had utterly baffled him and his engineers. The case is so novel a one, in all its leading features, that little light can be derived from precedents to guide me in fixing the amount to be awarded; but I have concluded, on the whole, to allow fifteen thousand dollars. Let a decree be entered for the libellant for that amount with costs."

As the agents of the ship were obliged to give bonds before she was allowed to leave the harbor, Mr. Towle will probably have no difficulty in collecting his $15,000.

At Fort Gaines, Mobile Bay, a saw-mill has been put in operation, and everything gives evidence of a people who have come to stay. Under the direction of the Engineer Corps all the damage done these forts has been repaired, and they are to-day stronger than when the fleet passed them.