SAFETY SELF-COCKING ARMS.

Portable firearms, to perfectly meet all requirements, should combine three essential elements—compactness, rapidity of action, and safety in handling. The only advantage of revolvers, as compared with repeating rifles, is their smaller bulk and weight, as they are inferior in rapidity of firing, and still more so in accuracy and penetrating power. Among revolvers, again, the ordinary hand-cocking revolver is superior in safety and compactness to the self-cocker, but greatly inferior to it in rapidity of firing. Self-cockers, as usually made, are clumsy and particularly dangerous to handle, and this has overweighed the advantages they present for rapid firing. A compact and safe self-cocker which avoids these difficulties is shown in the engraving.

SAFETY SELF-COCKING REVOLVER.

The usual bulky open guard and the fixed projecting trigger are replaced by a low closed guard and a folding trigger, shown in Figs. 1 and 2. The dotted lines, *a a*, show the position of the parts dispensed with, and show how much is gained in compactness by this improvement. The folding trigger, B, Figs. 2 and 4, is readily projected from the guard, C, by pressure on the lugs, *b b*, placed on either or both sides of the trigger, and assumes the usual position of the trigger shown by dotted lines in Fig. 1. The lugs, *b b*, on the trigger, and the slots, *d d*, in the guard to receive them, are placed so that the trigger cannot be folded back into the guard when the hammer is either at full cock or entirely down, but only when it is at the safety notch, or at half-cock. This impossibility of securing the trigger in the guard unless the hammer is at half-cock, is a very ingenious and effective means of preventing the many accidents which result from arms carelessly carried with the hammer in a dangerous position. The very simple device of slitting the trigger longitudinally in the manner shown in Fig. 3, transforms the trigger itself into a spring, and retains it in the guard by friction when folded up.

The face of the hammer, when at half-cock, is protected by a shield or hood, E, Fig. 1, and the usual thumb-piece being dispensed with, there are no projecting parts susceptible of catching and causing an accidental discharge of the arm. The roughened top, F, of the rounded hammer, is found to practically answer the same purpose as the thumb-piece, in bringing the hammer to full-cock by hand, as soon as the hammer is brought beyond half cock by the trigger. Altogether, a self-cocking revolver of this model is lighter, more compact, and safer than the usual revolver, and infinitely more so than the usual self-cockers. The current form of self-cocking revolvers can readily be modified to this system, which can also be adapted to other kinds of firearms, and especially to the now popular styles of so-called "hammerless" guns.

For further information address the patentee, Mr. J. N. Proeschel, at Milwaukee, Wis.

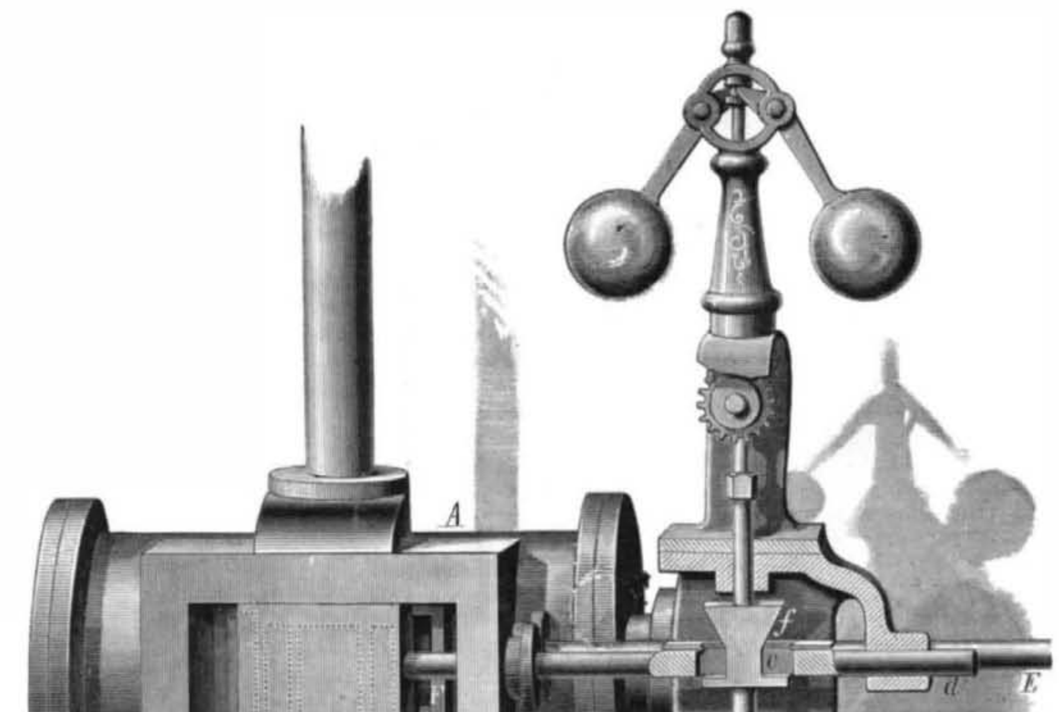
NEW ENGINE CUT-OFF.

This invention relates to a variable cut-off for the ordinary slide valve steam engines, which is rendered automatic by connection with the governor, the combination being very simple and effective.

In the engraving, A represents the cylinder, and B valve chest of an ordinary steam engine. The eccentric rod, E, is connected to a gridiron valve, F, having steam ports, *a b*, and an exhaust port, C, working in conjunction with the steam ports and exhaust ports of the cylinder, as usual. On the back of the valve, F, is a plate, G, forming the cut-off valve, this plate or valve being held firmly against the back of the valve, F, by the pressure of steam, and being dependent for its movement upon this frictional contact with the valve, F.

A stem, *d*, projects from the plate or valve, G, through a stuffing box in the valve chest, and this stem is provided with a yoke, *e*, which embraces a wedge-shaped block controlled by the governor. The wedge, *f*, thus acts as a stop to limit the extent of movement of the cut-off plate or valve, G, the movement being contracted as the wedge is depressed, and an increased movement being permitted as the wedge is raised, the variations in the movement of the plate, G, are caused to regulate the cutting off of the steam to the cylinder. The wedge exerts no control, practically, over the movement of the valve, G, the latter moving with the valve, F, throughout the entire throw of the latter, so there is no resistance of the entrance of steam into the cylinder from the beginning almost to the end of the stroke, hence there is no labor on the governor except to raise and depress the wedge; the wedge shortens the throw of the valve, G, and thereby cutting off the steam proportionably with its position.

Further description being unnecessary, except that if the governor should stop from any cause, such as the breaking of the belt, the wedge-shape block has an enlarged portion, so that its position in that case will be inside of the yoke on the valve steam, *d*, and shorten the stroke to limit the speed of engine. Further information can be had by addressing Orr. Hess & Morgan, 1219 Callowhill street, Philadelphia.



IMPROVED ENGINE CUT-OFF.

A Mediæval Guillotine.

The Chapel Bridge, at Lucerne, contains a mediæval painting representing the persecutions of the Helvetian Christians under the pagan Emperors of Rome. On the right side of the picture a number of Christians are being hurled into a river, perhaps the Reuss. On the left side a very evident guillotine is erected, one Christian lies with his head on the block, and the huge iron is just about to be let drop upon him, while a number of headless bodies lie around with the heads close beside them. It is commonly believed that this decapitating machine was the invention of Dr. Guillotin, a French physician, and member of the National Assembly of 1789. The Lucerne painting was made at a much earlier date.

Engineering at the Washington Monument.

The Washington monument is too near to be ever regarded by Washington people as anything out of the ordinary run of things. Few people here ever stop to think what a feat of engineering has been undertaken in the construction of this monument. "There is nowhere in the world such mechanical appliances as we have in the monument," said Colonel Casey to a *Star* man. "The last course of stone laid weighed 170 tons Now this 170 tons was raised vertically a distance of 245 feet, and the course was laid in fifteen hours. In other words, two feet of the monument was built in that time. You haven't any idea of the amount of stone and the amount of work required to build the monument. The stone we have laid since the work was resumed, if taken down and spread out, would cover the entire monument lot. At a distance the monument looks small; the yardarms on the derricks on top look like broom splints; but when one gets nearer them and sees how large they are, how wide the structure is, he gets some notion of the work."

If the monument was being constructed in France, or some other European country, the name of the engineer would already be famous, and when his work was finished, if it was approved, he would receive a fortune as his reward. It is doubtful whether the engineer connected with the Washington Monument will ever have any special recognition by the government. He will never receive any pecuniary recognition. An old engineer officer, speaking of this matter, said: "If Colonel Casey was not in the army, and had charge of one of the several works for which he is now responsible, his salary would be $10,000 or $15,000 a year ; as it is now, he draws $3,000 a year. The government pays too high figures for services rendered in inferior places, and much too little for professional services. —*Washington Star.*

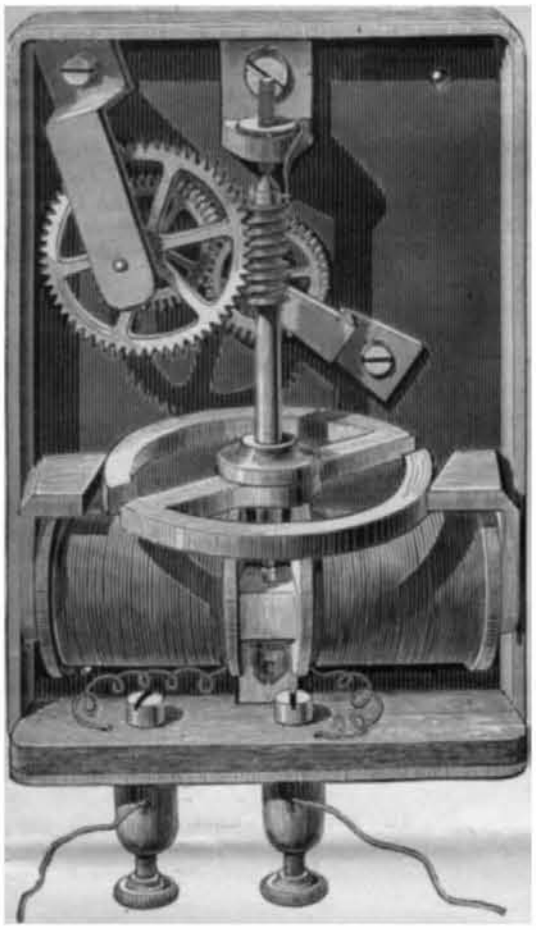
The Severn Tunnel.

After some rather formidable difficulties, the two main headings of the Severn tunnel, in course of construction for the Great Western Railway Company, were united on the night of September 26 last, and a clear passage thus made under the bed of the river. The difficulties have been brought about chiefly by the flooding of the headings, which occurred now nearly two years ago. Water from springs in the surrounding hills on the Monmouthshire side drove in a large mass of the somewhat fractured pennant sandstone through which the tunnel passes, and so filled the workings on that side. The heading on the Gloucester side also filled, and the work was stopped, as described in our impression for the 24th October, 1879. There was at that time only 120 yards of the heading remaining to be driven. Very powerful pumping machinery was then put to work under the contractor, Mr. A. T. Walker, to whom the completion of the tunnel was let, and the work of driving the heading was resumed after several months' delay. The meeting of the two headings shows but three inches of divergence, and considering that the distance driven has been upward of two miles, that the headings are 7 feet high, with a width of 7 feet, started from a base of only 15 feet, the work, it will be seen, reflects great credit on the skill and attention of the engineering staff. It should be mentioned that the heading from the Monmouthshire side was driven 11,000 feet from the bottom of a shaft 180 feet deep. This was a very wet shaft, and there was very great difficulty in seeing down or getting plumb lines steady on account of vibration caused by the pumps. The Great Western Railway Company constructed the heading on the Monmouthshire side by its own officers, and up to the time of the stoppage on the Gloucestershire side, Mr. Oliver Norris, then contractor, had driven 1,680 feet, this heading being driven on a decline of one foot in a hundred. The remaining portion was carried out by Mr. A.

T. Walker, the present contractor. The accuracy with which the lines were taken and the engineering work carried through thus far is, of course, due to the engineering staff—Mr. Charles Richardson, assisted by Mr. A. W. Gooch and Mr. John J. Geach. The land portions of the work remain to be completed, and will, no doubt, occupy a considerable time. The tunnel will also have to be widened to a width of thirty feet, with a proportional height. The completion of the headings is, says the *Engineer*, a fact of great interest from an engineering and geological point of view, and gives every hope that the tunnel will now be completed by Mr. Walker, at a speed which will satisfy even the railway company.

ELECTRIC CLOCK-DIAL MECHANISM.

The construction of a perfect electric clock involves several difficult problems, and it is this which explains in part the existence of a large number of electric clocks varying in



ELECTRIC CLOCK-DIAL MECHANISM.

efficiency according to the attention paid to the fundamental principles which should control their construction.

Electricity actually plays three very distinct characters in the electrical clock, and the Paris Electrical Exposition presents numerous examples of this:

1. Electricity is made use of as a motive power, to swing a pendulum and replace the springs or weights of an ordinary clock.

2. Electricity is employed for transmission. A central clock sends an electric current every second, half minute, or minute, to one or more dials placed at a distance, which causes the hands to advance respectively a second, a half minute, or a minute.

3. Electricity is employed to regulate clocks and dials propelled by ordinary weights and springs, and adjusts the hands every hour, every six hours, or every twenty-four hours. It is this system of synchronism which has been adopted by the city of Paris for the public clocks.

We do not wish to discuss here the respective advantages of the two systems of distribution of time in a city by electric transmission or by electric adjustment effected at fixed intervals. The electric distribution of time has some special advantages which are not possessed by the system of electrical adjustment, and the disadvantages disappear in proportion as the apparatus is perfected and simplified. The pneumatic clock established in Paris two years ago has a transmitter operated by compressed air.

The engraving represents a simple electrical dial mechanism which exactly fulfills the requirements, working surely each minute under the action of the current sent by the central distributing clock.

All of the earlier forms of electrical dial apparatus are operated by an oscillating armature, moved by an electro-magnet and retracted by an antagonistic spring, or two electro-magnets acting upon a polarized armature. The movement of the armature is transmitted to the gearing by the levers and pawls, which must be very perfectly adjusted, as they cease to act if there is a little play, wear, or oxidation. In order to give a slight movement to the armature it is necessary to lengthen the lever immoderately.

All of these inconveniences are avoided in the very simple apparatus of M. Thomas, the mechanism of which is represented in the engraving. It is composed of a horizontal electro-magnet, the poles carrying two armatures, between which is placed a polarized armature in the form of an S, fixed upon a vertical axis. This axis carries an endless screw, which operates the minute hand and gearing. The transmitting clock sends into the electro-magnet alternate positive and negative currents at every half minute. The current sent is such that it develops in the poles of the electro-magnet alternate positive and negative polarity, so that the polarized S-shaped armature is first attracted and then repelled, causing a half revolution of the S-shaped armature for every electrical impulse. The current should continue from two to three seconds, in order that the polarized armature may be maintained in position. The endless screw carries along the gearing and causes the hands to advance each time.

In consequence of its inertia the polarized S shaped armature tends to pass beyond its half revolution, and the speed acquired toward the end of the half revolution is checked by means of a spring against which a pin carried by the vertical spindle strikes at each half revolution.

This simple and ingenious apparatus requires no regulation. The rotation will be produced, whatever may be the distance from the extremities of the polarized armature to the electro magnet, and this distance may vary from one to two millimeters.

The power of the apparatus is determined by the dimensions of the S shaped polarized armature of the electro-magnet, and by the size and length of the wire which surrounds them.

By using a high tension current of electricity a large number of these electrical dial movements may be placed upon the same circuit and made to operate dials of two meters in diameter.

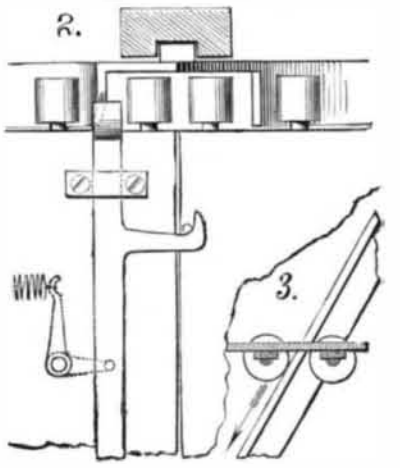
At the Exposition of Brussels, in 1880, where the electric dial mechanism of M. Thomas was in operation for the first time, he had in the same circuit a large dial of 1·80 meters in diameter and eighteen other smaller dials of 0·50 meter and 0·40 meter. They worked perfectly, excepting the five or six interruptions proceeding from the stopping of the transmitting clock caused by the moving of the platform on which the clock was placed.—*La Nature.*

Fire Risks and Tall Buildings.

We have frequently called attention to the fact that modern architecture was the greatest peril with which our large cities is threatened. During the present year, thousands of new buildings are being erected in this city, and of these a large number are tall buildings, seven, eight, and nine stories high, insecurely built from the foundation to the mansard roof, having granite foundations to support cast iron columns, which in turn support iron girders, upon which the floors are laid. Such a building is dangerous for a fireman to enter when a fire is raging within, as the granite foundation is liable to melt away under intense heat, and the iron columns and girders to twist and break, precipitating the floors above, with all their contents, into the basement. Put on top of such a building a mansard roof made of pine, and introduce an elevator shaft to carry the flames almost instantly from one floor to another, and you have a modern death trap that could scarcely be improved upon as a fire hazard, threatening the surrounding buildings and the lives of whoever may venture near it. In the lower part of the city there is one building whose roof is 185 feet above the sidewalk—away out of the city limits—and near by are many others nearly as tall. A fire in that roof would be wholly inaccessible to the firemen, while a high wind would scatter the blazing brands upon the roofs of lower buildings for many blocks.—*Fireman's Journal.*

IMPROVED HATCHWAY DOORS.

The accidents and dangers chargeable to open hatchways are too familiar to our readers to need recital, and it must be acknowledged that the various trap doors, gates, and other appliances in common use for rendering hatchways safe, are deficient in one way or another



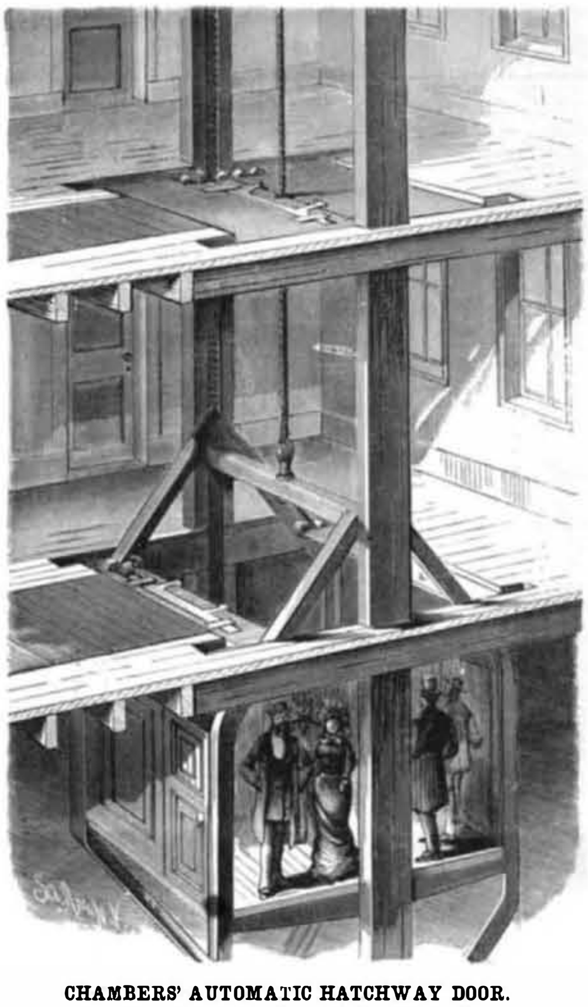
CHAMBERS' AUTOMATIC HATCHWAY DOOR.

Section showing angle irons, rollers, and fastener.

Our engravings represent improved automatic hatchway doors, which are opened and closed by the elevator car as it passes through the floor on which the doors are placed.

The doors are made of heavy boiler iron or of wood, and are placed either under or on the floor, or under the ceiling, as choice or convenience may require, and are so constructed as to easily move or slide horizontally upon rollers or tramrails. Their operation is positive and automatic. The apparatus is simple, and can readily be applied to any platform elevator already in use. It consists in the attachment of angular irons about the cab or platform so as to form cam braces above and below it, as is indicated in the engraving; and as the platform passes up and down these angular irons run between two wheels or rollers attached to the doors, causing the doors to open as the platform approaches them and close as the platform passes through, making a complete covering for the hatchway—preventing any one from falling through—cutting off draught in case of fire, and when opening conveying safely off any one who may inadvertently stand in the way. Open hatchways become flues, conveying fire and smoke from floor to floor, with uncontrollable rapidity. The improvement shown in the engraving will confine to the floor where the fire originated.

In storerooms requiring heating these doors are found very efficient in preventing the escape of heat from one floor to another. The improvement also prevents the floods of dust and dirt which are constantly pouring through open hatchways.



CHAMBERS' AUTOMATIC HATCHWAY DOOR.

For further information address the Chambers Elevator Company, 145 Central avenue, Cincinnati, Ohio.

Electrical Measures.

At the late Electrical Congress in Paris a committee on electrical units made the following recommendations, which were unanimously adopted: 1. The fundamental units be the centimeter, gramme, and second (C., G., S.). 2. The practical units, ohm and volt, to retain their present definitions. 3. The unit of resistance, or ohm, to be represented by a column of mercury of a square millimeter section at the temperature zero Centigrade. 4. An international commission, to be charged with the duty of determining by new experiments, for practical purposes, the length of the column of mercury, of a square millimeter section at zero Centigrade, which represents the value of the ohm. 5. The name ampère to be given to the current produced by a volt in an ohm. 6. The name coulomb to be the name given to the quantity of electricity defined by the condition that an ampère gives one coulomb per second. 7. The name farad to be given to the capacity defined by the condition that a coulomb in a farad gives a volt. Until something better is discovered than the English candle, the French *Carcel bec,* and the German standard for the measurement of the electric light, preference will be given to the Carcel lamp.

A Can Soldering Machine.

Mr. Henry R. Robbins, of Baltimore, Md., has patented an improved machine for soldering the heads of tin cans to the bodies thereof. In this machine the cylindrical body of the can, having its heads applied, is held in horizontal position, and rotated by vertically moving supports and rotary holders or clamps, while the molten solder is discharged upon the joints of the can heads from an upper receptacle by hollow pistons or chargers which are controlled by the operator. A liquid flux is automatically supplied to the joint and soldering irons brought in contact with the can by the same motion which brings the latter up against the discharge tubes of the molten solder receptacle containing the chargers. A single rotation of the can holders will suffice to secure a firm soldering of the heads to the body of the can, which may then be removed by sliding one of the rotary can holders away from its end of the can. The machine is very ingenious and complete in all its details.