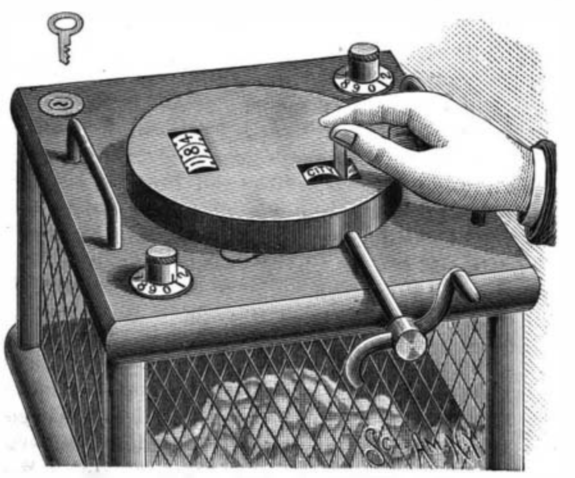
## THE NEW JERSEY BALLOT BOX.

We illustrate the new style of ballot box used in the late election in the State of New Jersey. It was ordered to be used by State enactment. The bill which bore the serial number 317 was introduced into the lower house on March 17 of the present year. It passed the house March 29, and on April 6 passed the senate. So far nearly $20,000 have been expended by the State upon the boxes. From all accounts their use does not seem to have been an unmixed blessing.

The box is of general cubical shape, with glass sides,



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protected by wire netting. Its top is secured in place by three locks. One of these opens with a key which is held by one of the inspectors. The other two locks are keyless combination locks. Each of the other inspectors locks one of these, using a private combination known only to himself. Thus the box cannot be opened except by concurrent action of all three.

About the center of the cover is the aperture for introduction of the ballot. This is a small opening filled up by portions of two tangential rollers or wheels. To introduce a ballot it has to be thrust endways between the two rollers. Then on turning a handle it is drawn down, and the voter can see it fall into the box beneath. In effecting this rotation, an inscription is printed upon the ballot. The desired word, the name of the county, for instance, is carried in raised characters by one of the wheels that draw the ballots down. As the wheel rotates and feeds the ballot into the box, it also impresses upon it the inscription.

By this rotation, registering machinery is put in operation that registers one for every ballot introduced. At the same time a bell is rung, thus notifying all within hearing that a ballot has been received. This multiplication of precautions is designed to prevent fraud. Thus every ballot had to show printed upon it the inscription upon the feeding wheel. This prevented the mixture of additional ballots. The total number introduced were recorded by the counting mechanism. This number was supposed to tally with the total number in the box. No ballot could be introduced surreptitiously, as the bell was arranged so as to ring for each rotation of the feeding wheel.

In practice, however, the box was found somewhat deficient. The men who had to manipulate it did not always possess the due degree of intelligence, and sometimes a deadlock was threatened. The ballot box company supplied instructors to teach the proper manipulation at three dollars per day. In some instances, it is said, the boxes were fully locked and the combinations were forgotten. In other cases the inspectors could not cope with the combination locks, and the keys alone were used. Sometimes the ballots proved too long to pass into the box at one revolution of the feeding wheel. This left two courses open to the inspectors. One was to leave the ballot between the rollers, and only to introduce it with the next one. This, of course, was objectionable. The other course was to turn the handle until it dropped into the box. This gave a double registry on the counter and two rings of the bell for one ballot.

All these troubles indicate that the box is far from being a perfect success. But it serves to indicate an advance, and certainly presents some excellent features. It would certainly seem that, with all its deficiencies, it would tend to secure the ballots from alteration or disturbance, and would operate to a considerable extent to procure a more perfect protection against fraud. All that can be said of it is that perfection has not yet been attained.

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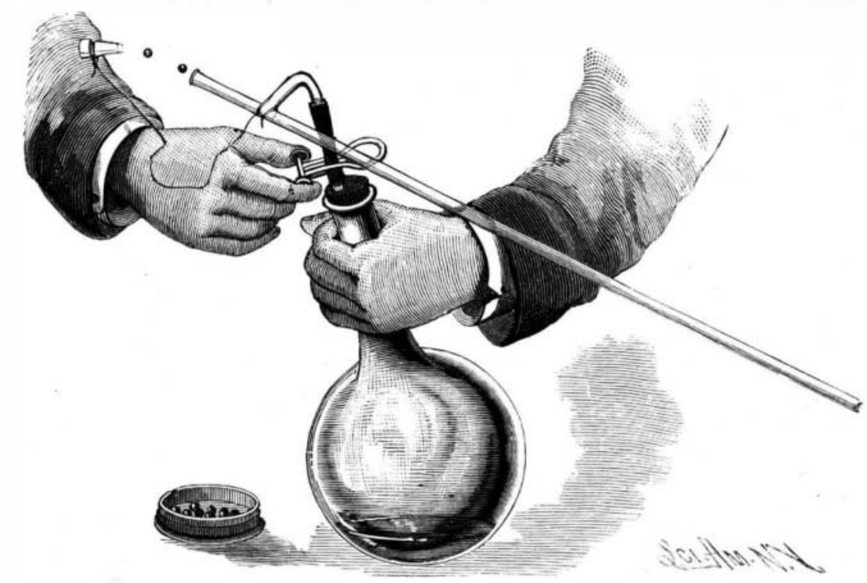
THE Reno *Journal* says that the practice of smoking opium is becoming almost as prevalent among the Pacific coast Indians as among the Chinese from whom they have learned it.

## OTTO VON GUERICKE'S VACUUM GUN.

T. O'CONOR SLOANE, PH.D.

The ingenious old burgomaster of Magdeburg is renowned as the inventor of the air pump and as the originator of many experiments in natural philosophy. In his curious book on the Magdeburg experiments, a work published in the latter half of the seventeenth century, the experiment is illustrated, of which the one we here describe is a simplification. In many of his experiments on the pressure of the air and the effects of vacua, he first produced by the air pump a vacuum in a spherical vessel, and used the vacuum thus obtained for some operations conducted without or away from the air pump. In one instance he connected his exhausted sphere to the base of a cylinder which a piston tightly fitted. On opening communication between the two, the piston was held down by atmospheric pressure so as to resist the efforts of a very great number of men, who are depicted in one of the quaint wood cuts as attempting to pull it up. For his gun he adopted the same system. As he shows the apparatus, it is constructed of metal, with a large spherical vacuum chamber. As illustrated here, it is supposed to be constructed of glass, a round bottom flask maintaining the vacuum.



OTTO VON GUERICKE'S VACUUM GUN.

The experiment illustrates in an interesting manner the laws of momentum of solids and the atmospheric pressure. It is an example of the scientific work of over two hundred years ago. It is described in the same book in which the description of the Magdeburg hemispheres was first given. The version of it here shown is somewhat simplified. By atmospheric pressure, bullets are driven through a tube and out of its end with high velocity. The tube from which the bullets are projected is about three feet long. It may be made of metal or of glass. It must be of even diameter and have a smooth interior. Near its front end a short piece of tube is connected at right angles to it. This tube may be bent, but such bending is not absolutely necessary. The object of its curvature will be seen later. The other end of the long tube is slightly reduced in diameter. This should be as slight as possible, provided it is sufficient to prevent a bullet which fits the tube from falling out.

A round bottom flask is provided. It should be of three pints capacity for a tube three feet long by one-quarter inch diameter. A tightly fitting cork with a short piece of glass tube of the same size as the piece projecting from the longer one is adapted to the flask. A rubber connecting tube with pinch cock, a plug of wood fitting the end of the projecting tube, and some bullets, complete the apparatus. The plug should be secured by a short cord, to prevent its loss when the bullets are discharged. It must fit air tight, yet be easily expelled. This result is best secured by giving it a conical shape or by inclining the sides considerably. The bullets should fit the tube so as to run up and down it freely, yet should not have much windage.

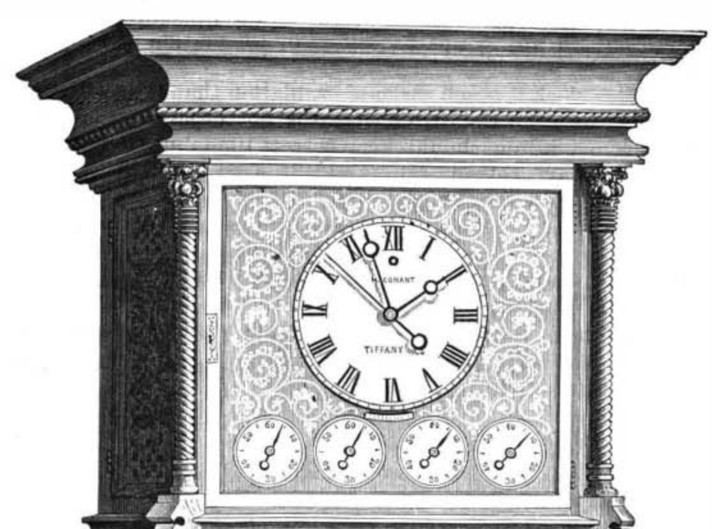


Fig. 1.—CONANT'S ISOCHRONAL CLOCK.

To perform the experiment, a vacuum is first produced in the flask. To do this a little water is introduced, the cork is put in place in its neck, the rubber connecting tube is slipped over the tube passing through the cork, and the pinch cock is removed or wedged open. The water is now heated until it boils. After a few minutes' ebullition, steam will issue from the rubber tube. When this has continued so long that it seems certain that all the air is expelled—five minutes should be enough—the pinch cock is put in place and tightly closed, and at the same instant the flask is removed from the source of heat. It is allowed to cool. The cooling may be accelerated by pouring cold water over it, or by dipping it into the same. It is now connected to the long tube as shown. If the projecting tube to which the rubber one is joined were straight, there would be danger that the bullets would drop into it or even into the flask. It is therefore better to have it curved.

Two or three bullets are now introduced and allowed to roll down to the lower end of the projection tube, whence they are prevented from escaping by the slight contraction already spoken of. The plug is put into the other end, and all is ready. The tube is pointed in such a direction that the escaping bullets will do no harm, and the pinchcock is suddenly opened to its full extent.

The air at once rushes into the flask from the lower end of the tube, driving along with its current the bullets. With a pressure of nearly fifteen pounds to the square inch to actuate it, the air enters the flask with high velocity. The bullets go along with the current as far as the communicating tube that leads into the flask, and then, owing to their high momentum, rush past the opening, strike the end of the plug, expelling it from its place, and fly out of the tube. This is all done in an instant, of course. The bullets pass through the tube and are driven out with such velocity that the eye cannot follow their course. They can be projected thus to a great distance. They may even possess sufficient energy to pierce pasteboard.

A simpler way of illustrating the experiment is to use the long tube with bullets and plug alone, the mouth and lungs producing the suction. By placing one or two bullets in the lower end, inserting the plug in the upper, and giving a quick, strong inspiration, the bullets may be easily thrown fifty feet. But out of compliment to the burgomaster, and in order to see the experiment in its perfection, the vacuum method should be adhered to.

### NEW ISOCHRONAL CLOCK.

There is some doubt as to when the first clock was made, but historically we find mention of the production of a clock in 1232. All of the early clocks subsequent to this show a great inventive skill and wonderful constructive ability; but until the discovery of the isochronal property of the pendulum by Galileo, the mathematical investigation of the pendulum by Huygens, and the adaptation of the pendulum to the regulation of the motion of the clock by Harris, about 200 years ago, nothing like a perfect time-keeping clock was known.

Probably no single machine was ever made in so many forms or in so great numbers, nor at so small cost, considering the great number of parts, the accuracy with which the parts are made, and the care with which they are assembled. Of course the great majority of clocks only approximate accuracy. A few are reasonably accurate, but even these have errors which must be compensated.

Recognizing the fact that an absolutely perfect clock did not exist, Mr. H. Conant, of Pawtucket, R. I., has devised and patented a clock in which an average of time as kept by a number of pendulums and escapements of the most perfect construction is indicated by the main hands and dial. This clock is shown in the annexed engraving. It is a fine piece of mechanism, made by Tiffany & Co., of this city.

This clock is provided with four pendulums and four escapements arranged in pairs, as shown in Fig. 2. Each pair of scape wheel arbors carry pinions, which engage in the large spur wheels, which are placed loosely on their supporting shafts, and act as intermediates to transmit power from the main train to these several escapements. Fig. 3 shows in detail the arrangement of these wheels. Power is received by the middle wheel, B, and it is transmitted to the wheels on each side of it by means of the little planetary bevel wheel, C, which is fixed with its axis radially to the supporting shaft, and is carried around as the wheel, B, revolves. This arrangement will allow one of the pinions being stopped, or to move at a speed different from the wheel, B, or its mate on the opposite side of B, and is known to mechanics as a compound or differential gearing. In this case it acts to average the motions of the side wheels, A A, into the middle wheel, B, for it will be seen that if another pinion wheel be acted upon by the wheel, B, that this pinion would move at the average speed of the pinions driven by A A, which is the half of the speed of each added together. Then calling the assemblage of wheels in Fig. 3 an intermediate mechanism, it will simplify the description to say that the second pair of pendulums and their escape wheels receive their impulse by a duplicate mechanism, and that these two pair of pendulums are impelled by a third mechanism, whose central wheel is impelled by the pinion on the shaft of the sweep seconds shaft on the main dial, said pinion being a part of the main train, which is made correspondingly heavier and stronger, and is driven by a heavier weight than ordinary, inasmuch as the four escapements require four times the weight to give them proportionate effect. Thus it will be seen that the seconds hand of the main dial moves at an average of that of the four pendulums, and responds to the ticks of each.

To show fully the action of the clock, we will suppose that it is all ready to run, and the seconds hands, both of the pendulums, and the main dial are all set at 60 or zero, and the pendulums are at rest. We will now start pendulum No. 1. The pendulum ticks seconds, and the second hand of that escapement will revolve once in exactly one minute. But the seconds hand of the main dial, although it responds to the ticks of that pendulum, only moves forward one-fourth of a second, and will not complete a revolution until the first has made four revolutions. This shows that the value of the ticks of each pendulum is but a quarter of a second to the main seconds hand. Now, in corroboration, starting another pendulum will increase the speed of the main hand by another equal factor, and three pendulums moving will give three-fourths speed, while the four will impart a speed equal to one-fourth of each added together, consequently an average of the speed of all.

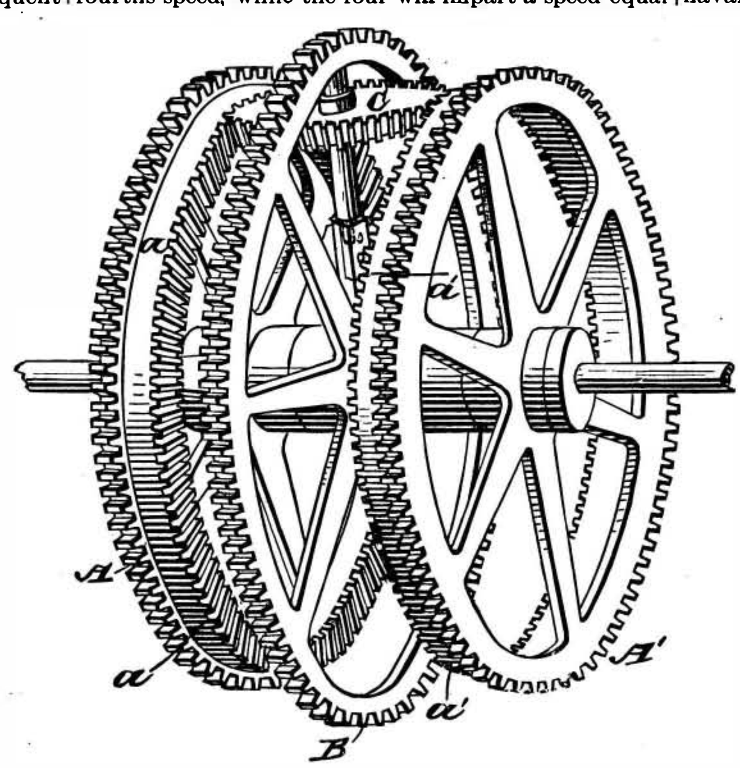



Fig. 3.—THE AVERAGING WHEELS.

To give room, the clock is made rather wider in its case than ordinary, and two pendulums are in front and two are in back. A plate of thick glass is put between the front and back pendulums, and is intended to cut off any sympathy caused by the motion of the air.

This clock is much easier of regulation than the ordinary clock, for the reason that it is not necessary that each pendulum should keep correct time, but that it should have a steady rate, and if it is too fast, it is corrected by another going correspondingly too slow; and the inventor believes that pendulums will have a steadier rate when thus associated than when isolated, quality and other circumstances being equal.

It will be readily understood from this description that these instruments can be made with two, four, eight, or even sixteen pendulums, or marine escapements, as desired for accuracy. This one here described was made for the purpose of exemplifying the invention and testing the workings of different compensating pendulums.

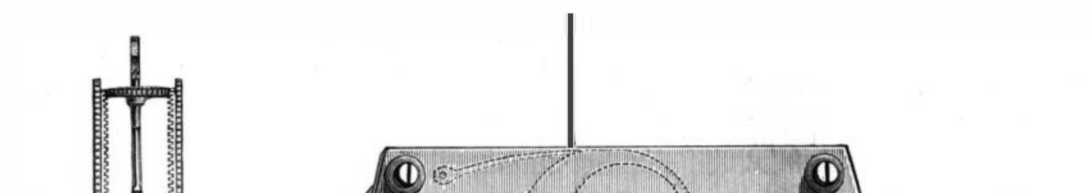


Fig. 2.—TIME AVERAGING MECHANISM OF CONANT'S CLOCK.

### New Secondary Battery.

A new type of secondary battery was employed on the electric launch recently tested by the French naval authorities at Havre. The inventor is a M. Desmazures, and the cell is constructed as follows: A cylinder of tin plate forms at once the containing vessel and a portion of the negative electrode, which is a sheet of the same material. The positive electrode is made from a plate of porous copper, obtained by subjecting the metal in a state of powder to a pressure amounting to several tons on the square inch. This plate is separated from the negative element by a partition of parchment paper supported on glass rods, the object being to prevent copper oxide reaching the negative element and causing a film of metallic copper to be there deposited. The cell is filled with a mixed solution of zincate of soda and sodium chlorate, and is then hermetically sealed. The charging is effected in the usual way, the result being a deposition of metallic zinc on the negative electrode, which is redissolved on discharging. The number of cells used at Havre was 132, which furnished a current of from 87 to 89 amperes under a difference of potential of 100 to 104 volts, and the weight per horse power per hour was about 73 pounds.

### Wild Geese in Dakota.

A traveling correspondent now in central Dakota says they had a cold snap there in the latter part of October, when the temperature quickly fell to 12° F. below zero. One curious effect of the cold was to bring down immense flocks of wild geese. Seen from the car windows, when they alighted on the stubble fields they looked like great snow banks, covering many acres of ground. Mr. Goose unlike Mr. Buffalo seems to augment in numbers. They are exceedingly shy and difficult to shoot. The best way to capture them is to dig a pit near where they feed, stick up two or three dozen decoys made of sheet iron painted up, and when a flock flies over they come down out of curiosity. If a man is sunk in the ground up to his shoulders, they don't recognize him. Another way is to approach a feeding flock with a team of horses, of which they are not shy. They don't seem to see a man if he remains in a wagon. Skirt the flock as close as possible, then suddenly turn and run the horses straight for them at top of speed. They rise slow, and one can get directly under, oftentimes, and bang away with results.

Two men brought fifty-seven in half a day. They are fine, large game, about the size of domestic geese, and nice eating.

Artesian wells are growing quite fashionable in this central part of Dakota. I meet them quite often. Any town that makes any pretense to be a town must now have its artesian well. They all seem to be about 900 to 1,100 ft. deep, and cost from about $3,500 to $4,000 each, with a pressure of 180 to 200 lb. to the square inch. W. Y. B.

### Ostriches.

A correspondent at Cape Colony, South Africa, writes us as follows: A curious habit of these birds was witnessed on the farm Guilford, in the Queenstown district, by the proprietor and some of his family and servants during the late rains.

The nest, which is merely a large, flat, saucer-like hole in the ground, became flooded; and when the water did not directly drain off, the two parent birds began to drink it up till the nest was drained dry.

The poor hen bird was so full that she seemed quite sick; the cock, however, drank his full share as in duty bound, being the most assiduous in all matters pertaining to the incubator, always sitting on the eggs himself by night.