observers are admitted on the platform, their equivalent weight must first be removed before observations begin. This swinging platform may be compared to the glass crystal of a ship's chronometer, being mounted in the same way, always maintaining a horizontal position, no matter in what direction the axis of the telescope is pointed.

From this platform, and extending through an opening in the sphere, is an electrical cable controlling an exterior automatic apparatus, by means of which the telescope may be pointed in the necessary direction for altitude, azimuth, in declination or right ascension. These specified motions may be obtained by means of a series of rubber-faced wheels, mounted on oscillating forks or levers, three wheels being necessary for each co-ordinate, and the required speed being controlled by electric motors. The cable connection inside the platform enables the observer to use any set of co-ordinates he may need, it being possible, of course, only to use one set at a time.

Following the design of the antique armilary sphere, a series of automatic-setting devices for the horizon and equinoctial system of co-ordinates is advisable, these setting-systems being gimbal-mounted and controlled by means of a pendulum. In order that the eye-piece of the finder of the telescope may be as close to the eye-piece of the great tube as possible, Prof. Todd considers a finder with a duplex Coudé tube essential.

With regard to the clockwork required for controlling the moving parts of the telescope, such as the dome and observing platform, exceptional power is needed. Prof. Todd suggests that the mechanism should consist of electric motors controlled by the observer from his chair, thus making a change of level in the floor or the observer's chair unnecessary. In the present style of mounting, the dome is separate from the rest of the structure, and means must be provided for rotating it in the required direction, while Prof. Todd's suggested form of mounting a telescope, either refractor or reflector, is one in which the telescope, observing-floor and dome, are all combined in one.

When not in use the exterior tube of the telescope is lowered nearly level with the ground, and the objective is sheltered beneath a movable roof, like that of a transit-room. In this way, the objective is accessible at any time for the purpose of adjustment or repairs. If such a telescope were placed on a high mountain, it would be possible to keep the interior of the sphere at a comfortable temperature by means of electric heaters, and within a compartment of the sphere, a barometric pressure might be maintained by artificial means.

Prof. Todd estimates the price of such a telescope, as follows:

Sphere	$175,000
Five-foot objective	75,000
Masonry and cement basin	5,000
Clock work and motion	10,000
Tubes and eye-piece accessories	10,000
Total	$275,000

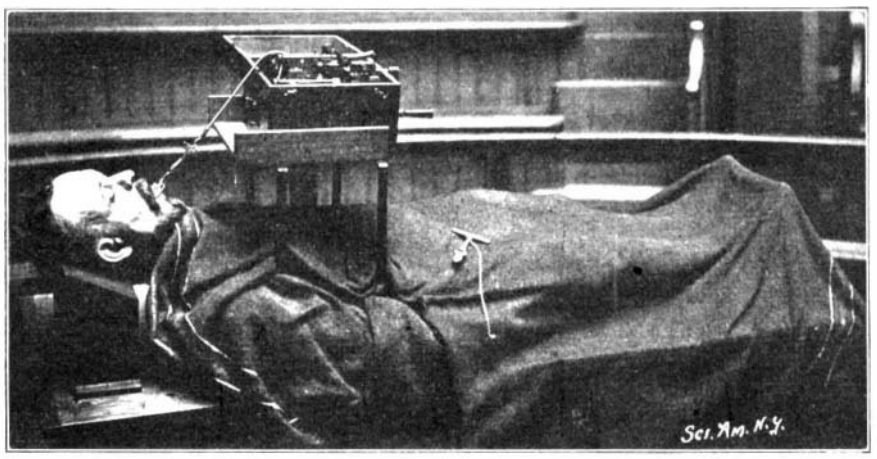
Prof. Todd is well known for his mechanical ingenuity, and has worked out the detail of his scheme very thoroughly, having had it in mind for the past twenty-five years. He had received much encouragement from expert engineers and telescope builders with regard to the efficiency of his plan.

Great telescopes have helped astronomers to make important discoveries, such as that of the planet Uranus, first seen in Herschel's reflector; the satellites of Mars, discovered by Asaph Hall in 1877, with the Washington 26-inch refractor; and the fifth satellite of Jupiter, first glimpsed with the 36-inch Lick Observatory telescope. At the time of these discoveries, these great telescopes made such celestial finds possible. What may not be the result awaiting such a telescope as Prof. Todd has planned?

TONGUE-TRACTION FOR RESUSCITATION OF THE ASPHYXIATED.

It has long been known that rhythmical traction of the tongue is one of the most efficient means for the resuscitation of persons who have been drowned. Dr. Laborde, of Paris, who has carried on extensive investigations on the effect of tongue traction as a means of resuscitation, maintains that often, although the organism has apparently ceased to live externally, it still lives internally. That is to say, life is still latent; and as long as there is latent life, there is still hope of saving an asphyxiated or drowned person. The function which it is most necessary to revive is the respiratory. Experimenting upon dogs, Dr. Laborde found that two or three hours after apparent death had set in, it was sometimes possible to secure resuscitation. A vigorous half bull dog weighing 35 pounds was chloroformed to such an extent that respiration had entirely ceased; after a quarter of an hour's traction of the tongue, the animal came to. The experiment was tried again until complete asphyxiation occurred, and traction was not resorted to until five minutes after. The dog, who bears the appropriate name of Lazarus, this time appeared to be really dead. One hour and two hours of traction were followed by no result. But after another one-half hour, a respiratory cough showed that life was still present. The dog soon revived. It occurred to Dr. Laborde that it would be a good idea to substitute an automatic apparatus for the cloth-covered hand. The first apparatus made was driven by clockwork. The more improved apparatus now used is operated by means of an electric motor, the current being supplied by a secondary battery. By means of this improved instrument it is possible to subject the tongue to continuous traction for three hours.

TONGUE-TRACTION BY HAND.



TONGUE-TRACTION BY THE LABORDE ELECTRIC APPARATUS.

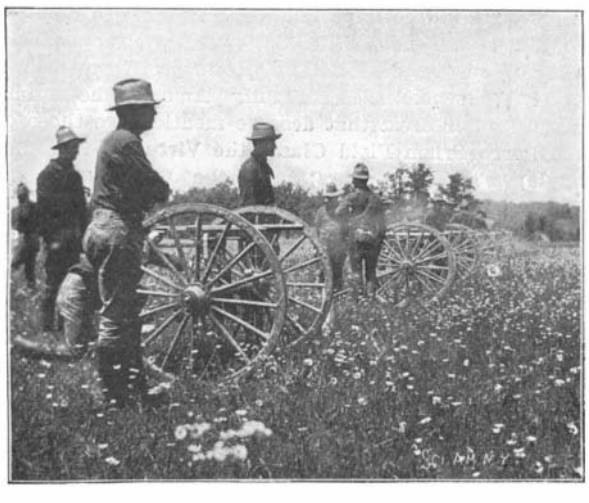
THE MILITIA AND THE COLT AUTOMATIC GUN.

BY C. E. STONEBRIDGE.

After a practice march of seven days over the roads of Long Island, the 3d Battery of the New York National Guard arrived on the eighth day at the rifle grounds at Creedmoor, and used their guns with results that left no doubt as to what would happen if the fire were directed toward an advancing enemy. This battery was formerly armed with Gatling guns, but has now been supplied with the Colt automatic rifle, one of the most deadly machines in existence. The gun weighs only 40 pounds, and the battery is provided with mounts of three kinds, so that it is only the work of a few seconds to transfer a gun from a disabled mount to a good one. One mount is on the carriage, one on the limber, and a tripod, that can be spread and set up in a few moments in any desired location, composes the third. The battery has six carriages and caissons, and six extra guns and tripods, making twelve guns in all with eighteen mounts.

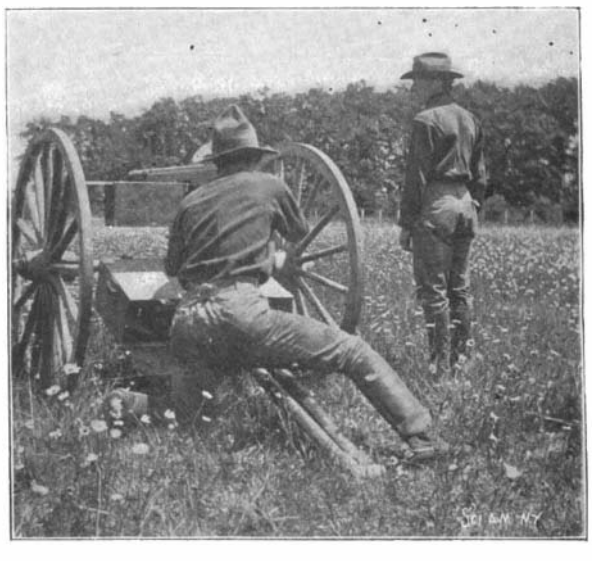
On the range at Creedmoor the battery first went into position at 200 yards and moved back by easy stages until the limit of the range was reached at 1200 yards. The cartridges, on a canvas belt, pass into the gun on the left side, and the empty belt emerges on the right side, while the shells are drawn back and ejected through an aperture near the top. On the under side of the barrel, about six inches from the muzzle, is the gas check, the automaton that does all the work. At each shot the explosion throws this lever downward, swinging it back against the gun. It is this motion that works the interior mechanism which loads, fires and ejects the shell. Eight shots per second, or nearly 500 per minute, is the usual performance of this gun. When a battery of these destroyers is viciously pouring out its rain of destruction, no living thing can stay in its arc of fire. The 3d Battery uses a .30 caliber gun, and smokeless powder. While the stream of bullets is pouring from the muzzle a faint vapor can be seen, but it vanishes the moment firing ceases, and the location of the gun cannot be detected by smoke.

The weapon is made ready for firing by throwing down the gas lever, this action bringing the first cartridge into position. The first shot is then fired by pulling the trigger. The firing then continues until the ammunition is exhausted. The belts of cartridges are folded in layers in a small box, which is hung on the side of the gun, and which feeds unceasingly until no more remain. The empty belts, when rolled up, look like a common lamp wick and can be placed in a coat pocket. The loading tool is quite as ingenious as the gun and resembles a hand sewing-machine. One man feeds the machine with cartridges, a second turns a crank, while a third guides the loaded belt into the boxes. This little machine sews the loaded shells into the belts as fast



Five Hundred Shots per Minute with Smokeless Powder.

Charging the Belts.



A Gun in Action, Using Smokeless Powder.

THE MILITIA AND THE COLT AUTOMATIC GUN.

as a man can feed it. A full service belt holds 500 shells, but for target practice smaller sizes are used. Firing can be stopped at any desired point on the belt by removing one of the cartridges. Thus, in order to shoot five shots continuously, and then stop, every sixth cartridge is removed. The gunners are so expert that each can fire a single shot, which was done repeatedly.

An Improvement in Casting Steel.

In the present practice of casting steel ingots, atmospheric air and the moisture which it contains percolate through the defective joint of the mold, the base upon which the mold stands, the lower superheated portion of the mold, and finally through the fluid steel, rendering it plastic. The fluid steel is oxidized by the column of air upon which it rests. The oxidized particles, having greater specific gravity than the rest of the mass, are precipitated, come in contact with carbon and form carbon-monoxide gas. It is needless to say that the oxygen of the steam passing upward has the same effect.

The nitrogen of the air in passing upward forms a mechanical mixture with the steel and is retained, while the hydrogen combines chemically with a portion of the nitrogen to form ammonia gas. When it is considered that atmospheric air is composed of four-fifths nitrogen, it is evident that the amount of free nitrogen which is taken up by the steel must be considerable, especially so in large ingots. Metallurgists have long known that the effect of nitrogen is to make the steel brittle and hard. For that reason it is considered injurious. While the steel in the mold is still fluid the gases mentioned escape, so that they can do no harm. But as soon as a crust is formed they are imprisoned and form blow-holes. After partial solidification has set in, the column of atmospheric air resting upon the partially-cooled ingot begins to find its way downward through the superheated inner side of the mold, and thence passes into the still plastic steel. Thus the formation of honeycombed steel may be accounted for.

From this brief outline of the usual method of casting steel it follows that the chief difficulties to be contended with are the production of blowholes and honeycomb-like cells filled with carbon-monoxide and ammonia gas. The steel is furthermore charged with nitrogen. The molecular spaces are filled with injurious gases so that the steel cannot be readily welded.

A Newark inventor, Mr. A. J. Lustig, has patented a process in which it is sought to overcome the difficulties mentioned. In this process hydrocarbon gas or vapor is stored around and under the covered mold. As soon as the filling of the mold begins, the superheated hydrocarbon vapors enter, thus displacing the atmospheric air. The carbon or hydrocarbon is taken up by the steel independently of the freed hydrogen. After the mold is filled it is covered, and the hydrocarbon vapors are caused to pass through the steel in order to force outwardly whatever atmospheric air has entered.

It is claimed for this process that no blowholes and no honeycombs are formed. Consequently no injurious gases can be retained in the molecular spaces. It therefore follows that the steel can be welded easily after the first compression of the glowing ingot, either by rolling or hammering. From tests which have been made it would seem that there is an increase in the merchantable quantity of steel obtained of 15 to 40 per cent. The tensile strength of steel made by this improved process is 145,000 pounds in contradistinction to 125,000 pounds at present obtained. The elongation of the new steel is 4.60; that of the old 1.09. The area of reduction of the new steel is said to be about 2; that of the steel at present made is practically nil. The chief merit of the new steel, however, is to be found in the fact that it is most readily weldable.

Amazon Rubber.

The greater part of the world's supply of rubber comes from the jungles of the Amazon. The growing demand for the product has led the natives to explore regions which have hitherto never been trodden by man. These explorations have resulted in the discovery of new areas of rubber lands. Consequently the world's supply of rubber annually exported is increasing. The shipments from Iquitos during 1900 amounted to 920 tons; in 1901 the quantity sent abroad increased to 1391 tons, and this year a still larger gain is expected.

Marconi's Latest Feat.

News comes from England that Marconi, while at Cronstadt, Russia, succeeded in receiving wireless signals from the Cornwall station. The distance was about fourteen hundred miles, and the signals were transmitted partly overland and partly over water. Messages were received as far as Skagen, Denmark, about eight hundred and fifty miles from the Cornwall station.

Correspondence.

Volcanoes and the Sun and Moon.

To the Editor of the Scientific American:

Referring to your comments on my communication about "Volcanoes and the Sun and Moon," published on June 21, you have apparently misunderstood my theory, as I do not maintain that volcanic and seismic action should be greatest where the tide is highest and least where it is lowest. The abnormally high tide in the Bay of Fundy is evidently caused by the "contour of the continents," as you state, for the moon's attraction is of course no greater at the Bay of Fundy than elsewhere in the same latitude, and therefore volcanic and seismic action is not expected to be greatest there.

The influence of the moon and planets in causing and intensifying seismic and volcanic disturbances is not altogether tidal action—gravitational; it is partly, or mostly, electrical, and seismic and volcanic action is an electrical disturbance. This is the reason why sultry weather, which always accompanies thunderstorms, also goes with volcanic eruptions and often with earthquakes. Hence, sultry weather is popularly called "earthquake weather," and in the Hawaiian Islands it is known as "volcano weather." It is a remarkable fact that "when Mont Pelée blew up, magnetic needles two and three thousand miles away quivered on their pivots."

The effect of the moon's crossing the earth's equator is electrical disturbance, not at all gravitational, and a little observation and reading of the daily papers will prove that electrical storms, and in fact severe storms of all kinds, are more frequent at about the time of the moon's equatorial passage than at any other time. In proof of this, note the terrific storms that occurred about May 3, 16, 31 and June 13 and 27, even in this country alone, and also notice what occurs on and touching the following moon-on-the-equator dates the rest of this year: July 10, 24; August 6, 21; September 3, 17, 30; October 15, 27; November 11, 23; December 8, 21. Some interesting experiments by Prof. Elmer Gates on "The Electrical Causes of Changes in the Weather" were described in the Scientific American of August 10, 1901.

I cannot agree with you that a relation must be established between planetary positions and "moments of volcanic outbreaks or severe earthquakes," for the planetary cause is not the sole cause (as it is with tides); in some cases where a volcano is almost strong enough to burst forth of its own accord, the planetary influence is strong enough to precipitate the outbreak a good many hours, or perhaps a whole day, before the actual moment of the conjunction, perigee, etc.; the planetary influence comes on gradually and is cumulative, my observations indicating that volcanic and seismic disturbances are more likely to occur shortly after rather than before, or at the moment of, the planetary positions.

Following are some more "coincidences:"

The volcano of Kilauea, in the Hawaiian Islands, began eruption on July 4, 1901—the day before the opposition of Saturn—and continued through the moon's equatorial passage on the 6th, perigee on the 11th, and new on the 15th, ceasing about 30 hours after the moon crossed the equator again on July 19.

An Associated Press dispatch of April 17 stated that Albrim, Lopevie and Tingoa volcanoes, in the New Hebrides Islands, were in eruption on March 10—another moon-on-the-equator date.

In Alaska, Mount Blackburn erupted on April 11—the next day after perigee—and Mount Redoubt on May 3—the same day that Mont Pelée began eruption—caused by the moon on the equator.

A dispatch states that the seismographs of W. A. Eddy, the Bayonne (N. J.) seismologist, recorded earth tremors from the east-southeast on the night of May 15-16, leading him to predict new eruptions in the West Indies, and that "this is the first motion of the seismograph needles since March 22." On referring to my almanac I find: moon on equator May 16 and March 23; also full 23d; perigee and equinox, 21st.

Some coincidences omitted from my first letter were the perihelion of Mercury on May 4, with the first eruption of La Soufrière next day, and the occultation (direct conjunction) of Mars by the moon on May 7, when that volcano was at its worst.

The predictions in my communication of May 18 were verified by the eruption of Mont Pelée on May 30, earthquakes in Hawaii on May 31, two eruptions of Kilauea June 1, a "violent outburst" of Mont Pelée June 6, and again on the night of June 13-14.

If scientists will not admit any influence of planetary conditions in causing seismic and volcanic disturbances, they must then account for simultaneous disturbances of this kind in different parts of the world by supposing that distant volcanoes are connected, and that, therefore, a large part of the interior of the earth is molten matter—which they cannot deny must be subject to the same gravitational influence that causes the tides.

Elmer G. Still.

Livermore, Cal., June 29, 1902.

The Largest Watch in the World.

At the American Waltham watch factory, the largest watch ever designed was recently completed. To build this gigantic timepiece cost several thousand dollars and several weeks' time. Special machinery and tools were required for its construction. The watch is a model of the new model 16-size Maximus, three-quarter plate watch, enlarged ten times, perfect in every detail and as highly finished as the finest watch.

The diameter of the pillar plate is 17 inches, and the movement is 2½ inches thick. The balance wheel is 6½ inches in diameter, and the Breguet spring which controls its action is 8 feet long, 0.08 centimeter thick and 0.25 centimeter wide. When running the balance makes a vibration in 0.7 second. The pallet stones are of sapphire and exquisitely polished. The actuating, or mainspring, is 23 feet long, 0.17 centimeters thick and 2.9 centimeters wide.

The mammoth model is as completely jeweled as a watch of the finest grade. The plate jewels, which are as large as the smallest movement made, or about the size of a nickel five-cent piece, are fine rubies, about ten lines in diameter, but bushed with sapphires. The polish of the wheels, pinions and other steel work is perfect, and the damaskeening on the plates is most beautiful. The pendant and winding crown are of fine bronze, brilliantly polished. Every portion is made on the exact scale of the watch it represents. No dial has been made for this movement, as it is designed to show not only the action of the train, but the stem-winding and stem-setting mechanism as well.

The movement stands on a bronze pedestal and from its base to the tip of the winding crown is twenty-six inches.

Precautions Against Electrolysis of Gas Pipes.

How important it is for a city to adopt some measure for the prevention of the destruction of its gas and water pipes by electrolysis is shown in the recent suit of the city of Dayton, O., against a local trolley company. With the example of Dayton before it, the city of Baltimore has decided to take the necessary steps to forestall a destruction of its pipes. An agreement made with the trolley company of that city provides that the city is to receive $500 annually from the railway company for the privilege of running a copper wire nearly two inches thick through the municipal subways. It is expected that this wire will take up the surplus current which has been escaping into the ground and eating up the pipes, and send it back to the power house, thereby giving the company more power and giving relief to the water and gas companies. It will cost the railway company about $20,000 to lay and bury the wire, and if the calculations are correct the gain will be enormous, as it is expected to save a large amount of electricity. Whether it will work well in practice and overcome the great damage done by electrolysis remains to be seen. Those interested in the plan, however, profess to have great confidence in it.

The Current Supplement.

The deplorable artistic disaster which Italy has sustained in the fall of the historic Campanile of St. Mark's is made the subject of the opening article of the current Supplement. The famous old tower is pictured, as well as the celebrated Loggetta of Sansovino, with its splendid gates. Of technological interest are a discussion of mechanical standardization in Great Britain; an article on the manufacture of india rubber; and a review of alloys. From the scientific standpoint perhaps the most important feature of the current Supplement is the paper which Mr. Marconi recently read before the Royal Institution on the "Progress of Electric Space Telegraphy." The noteworthy Pittsburg meeting of the American Association for the Advancement of Science is fittingly commemorated by the publication of a résumé of some of the more important papers read. In addition to this résumé Mr. B. T. Galloway's vice-presidential address on "Applied Botany, Retrospective and Prospective," is published in full. Among the minor articles of interest that deserve mention are those on the Porro Prism Field Glass; the Virtue of the Pineapple; French Mortars; and the Gannets of the Bass. It may not be known to many that the man who invented the gelatine dry-plate died a few weeks ago in England. In memory of the services which Dr. Leach Maddox performed for photography an article has been published on the man and on his invention, which is appropriately a picture illustrating early negatives.

Builders' Trial of the Battleship "Maine."

The speed record for American battleships was made by the "Maine," recently completed at the Cramps' shipyard. For thirty minutes she ran at a speed of 18.95 knots per hour, while her average speed for an hour was 18.29 knots. For a run of 30 knots an average of 18.08 knots per hour was made.