strong projecting bar of lignum vitæ, inserts a similar bar and twists the thread, turning it until all parts have been subjected to the strain.

After picking out the loose bits it is wound on large spools, and is now ready for the spooling room. The spool, already labeled by a method which will be described hereafter, is placed on a spindle, the thread wound on a few turns, and it is then set in rapid revolution. As the silk runs on the spool it passes through a guide in the end of a sliding arm, which is moved regularly back and forth by a revolving screw; this screw has the same pitch as the tightly wound thread upon the spool, due allowance being made for the difference in speeds, and the silk is consequently run on with unfailing accuracy and smoothness. When filled the spool is stopped and the thread cut and fastened. The entire operation takes but a few seconds. The spools are now weighed separately, and also in lots of one dozen, in order to correct any inaccuracy in amount. All that remains is to place them in neat paper boxes, and they are ready for shipping.

The larger part of the spools used are labeled by stamping directly on their ends, in one or more colors. This, besides causing a large saving in expense over the paper label, insures the preservation of the label. The spools are fed between a pair of inked metal rolls with reversed dies upon them, which print the design a sixty-fourth of an inch below the surface. When two colors are used a second pair of rolls become necessary.

Galileo's Museum, Florence.

In the January number of the *Pharmacist and Chemist*, published by the Chicago College of Pharmacy, we find an interesting letter from H. D. Garrison, Florence, Italy, describing incidents in the life of Galileo, which we are sure will be read with interest by many, and by those especially who have visited Florence and Pisa, which are the central cities of the physical sciences of Europe, and have seen the trophies of Galileo so carefully preserved there, and which the writer describes in connection with incidents in the life of their author. The extracts we give cannot help but revive pleasant memories. It will be remembered that not only Galileo, but Leonardo da Vinci, the philosopher, artist, and statesman, the renowned Torricelli, Michael Angelo, the painter, sculptor, architect, civil and military engineer, and diplomatist, and the powerful Medici family, honored Florence by making it the arena of their most memorable exploits in scientific research. Truly, says the writer, this is classic ground. Having been the home of Galileo during the principal part of his eventful life, this city is possessed of surpassing interest to those scientifically inclined. This great philosopher was born in a very humble, not to say hard looking, two story stone house, situated on a little crooked street in the old city of Pisa, located about sixty-five miles west of here, near the mouth of the Arno.

When young Galileo attended church, instead of looking at the saints and crucifixes, or even at the pretty girls, he watched the swinging chandelier and reinvented the pendulum clock. No wonder he watched this chandelier, for it is a remarkable one, from the fact that the rope by which it is suspended is about one hundred feet long. I gave the chandelier a push, as any rather tall person may do, and during my stay in the cathedral it continued to vibrate without apparent retardation. He observed, what few will now admit without the demonstration, that the vibrations of a pendulum, whether large or small, are performed in equal times. While quite young, Galileo arrived at the conclusion that large and small bodies fall with equal velocity. To the learned men of Pisa, chiefly priests, this doctrine appeared extremely absurd. To test it, an experiment was performed by dropping bodies of different sizes from the famous leaning tower, 180 feet high. To the utter astonishment and discomfiture of Galileo's opponents, the bodies, large and small, projected simultaneously, kept close company until at the same instant all reached the earth. On account of these experiments Galileo was compelled to leave Pisa, and took refuge in the rival city, Florence.

At the latter city, called throughout Italy "Firenze," Galileo, quite unmolested, busied himself in the study of mathematics, physics, and chemistry until the year 1610, when, having heard that a Dutchman, Lippershey, had constructed a telescope, he, without having seen it, contrived and manufactured one for himself of such power that he was enabled to count forty stars in the constellation of Pleiades, where before but seven had been seen. The mountains of the moon were discerned, the phases of Venus recognized, and the satellites of Jupiter discovered in quick succession. Thus, in a few months, the doctrine of Copernicus, then regarded as heretical in the highest degree, was completely confirmed. But the Church, then unused to reverses, and unskilled in explaining away scientific contradictions, saw no way to meet the issue successfully but by physical force. The priests were directed to oppose the doctrine, and did so at once from every pulpit in Florence. The arguments used by them generally ran about as follows:

All things were made for man, and nothing was made in vain. But the satellites of Jupiter, not being visible, are useless, and therefore do not exist. Galileo was promptly arrested on the charge, then a fearful indictment, of heresy. In vain did the old philosopher explain and beg them to look for themselves. His adversaries, well illustrating the adage that "none are so blind as those who will not see," would listen to nothing but renunciation and denial of the alleged discoveries, presenting at the same time the alternative of indefinite imprisonment, probably ending in death.

Remembering the fate of the beautiful Athenian woman, Hypatia, who was torn into shreds by the monks under St. Cyril at Alexandria, for teaching the heretical philosophy of Plato and mathematics; and remembering also the fate of poor Bruno, who but a little while before had been driven from England, Germany, and Switzerland, in succession, and who, having taken refuge in Venice, was there kept in solitary confinement six years, then removed to Rome and kept two years longer in a dungeon, and finally slowly burnt to death, so slowly that he begged for more wood, or any means to end his suffering—and all this for having simply *argued* in favor of the probability of the Copernican doctrine, Galileo, concluded, very wisely, to appease the wrath of the Inquisition by the required denial. The Vatican Council supplemented this trial by formally denouncing the Copernican theory of the universe as "false, and utterly at variance with the Holy Scriptures."

Several years later, under the reign of a new pope, whom Galileo thought more liberal and generous, he ventured again to publish his discoveries and opinions, and was again promptly arrested and tried by the Inquisition for heresy. Again a public denial was required as a condition for mitigating his sentence, and again Galileo consented to make it. This time, besides his denial before the pope and Inquisition, he was required to publicly renounce the doctrine and deny his discoveries before his friends in the Santa Croce Cathedral of Florence.

Lest his friends should not all attend and profit by his recantation, they were compelled to be present. Then on bended knee, after kissing the Bible, he solemnly pronounced himself a liar and dupe, but on departing, as tradition has it, whispered to one of his friends, "nevertheless it (the earth) moves." Not content with this the Church felt bound to inflict mild, exemplary punishment, and hence detained him as a prisoner for life. Although his prison was his own house at Arcetri, a few miles out of Florence, still he was not permitted to leave it, even to attend church or to secure medical advice at Florence, nor was he even permitted to see his friends until after he became blind, when this permission was graciously accorded him.

At his death he was refused burial in consecrated ground, and his right to make a will was disputed. Now, in the same old cathedral which witnessed his public recantation, stands an elegant marble tomb, erected to his memory by his favorite pupil, Giovanni, and ever and anon the priests declaim, in glittering generalities, of the wonderful support their doctrines received from astronomy!

In the Natural History Museum, a beautiful room called the "Tribuna de Galileo," covered by a dome elegantly frescoed with scenes illustrative of his checkered life, is devoted to the exhibition of a magnificent statue of the old philosopher, his telescope and other philosophical instruments.

The telescope is astonishingly small and simple. It consists of an ash-gray colored tube, about four feet nine inches long, by two inches in diameter. The object glass, now cracked and shown separately, mounted in brass, is about 1¼ inches in diameter. The eye-glass, apparently a simple plano-convex lens, about three quarters inch diameter, is still *in situ*, apparently mounted in a wax like cement. The whole instrument being in a locked glass case, placed in a niche about ten feet above the floor, I was unable to make more accurate measurements. By the side of the telescope is shown another instrument of similar form and size, with which he at a later period discovered the spots on the sun. He also invented several other instruments, as a goniometer, dynamometer, and various mathematical instruments. He also invented the compound microscope, the original instrument made by him being still preserved in the old stone tower situated on a hill overlooking the city of Florence and valley of the Arno river, where he made his celebrated discoveries in astronomy. This instrument consists of a wooden tube about eight inches long, having small convex lenses about one quarter inch diameter, for both object and eye glasses. These were mounted in hard wax. The eye-glass was capable of slight adjustment, by being set in a wooden cap, which was screwed upon the wooden tube. The stage was simply a slip of glass, but it was illuminated by a little mirror placed below it, precisely as may be seen in our cheap microscopes. I wanted very much to peep through the microscope, and also through the telescope, but saw no possible means of doing so. The tower used by Galileo was apparently an old castle or watch tower used by the Florentines in their perpetual wars with adjoining provinces, during the two or three preceding centuries. Near the top of the tower is a square room which Galileo used as his studio and laboratory. It is said to appear now just as when used by the great master, from which I judge that he was not very fastidious.

PATENTS are now printed and prepared for issue so that they may be mailed on the day of issue, thereby bringing the patentee into possession of his patent some two weeks earlier than under the old rule. Owing to this change, there will be no patent lists bearing date Dec. 24 and Dec. 31, 1878; the list following that of December 17th is that of Jan. 7, 1879, which appears in the present number of this journal.

WE are indebted to Mr. Lewis J. Miller, Clerk of the Albany, N. Y., Fire Department, for a copy of the annual report.

Correspondence.

Isolation by Gutta Percha.

To the Editor of the Scientific American:

With reference to the artice "Isolation by Gutta Percha," in No. 25 (December 21, 1878), a few words may not be out of place, though they come from a different quarter.

The writer of the article mentioned breaks a lance for the late lamented Paymaster U.S.A., Mr. Simpson, and exhibits undoubtedly great zeal for his protégé, but the facts hereafter to be stated will probably set at rest the doubts in regard to the priority of the invention, as far as Mr. Simpson is concerned.

"Gutta percha was first imported," our informant says, "from the East Indies into England in 1845." According to all available sources, the best of which shall be immediately named, the first importation of that article was effected by the assistant surgeon, Dr. Montgommerie (or Montgomery, as some have it), from Singapore, in 1843. *Vide* Moigno, "Traité de Télégraphie Electrique," 2d ed., Paris, 1852, p. 294; Du Moncel, "Exposé," 3d ed., 2, 456; *Dingler's Journal*, 97, 237; "The Atlantic Telegraph," London, 1866, p. 108; Poggendorff, *Annalen*, 74, 157. The *Mechanics' Magazine*, 1847, 46, 474, gives the name of the first importer of gutta percha as Joze d'Almerida, but agrees about the year with the rest of the authorities enumerated above.

Our informant further says "that the first publication in England regarding the isolating qualities of gutta percha was made in March, 1848, by Professor Faraday."

Now there is but a slight mistake in this, but a mistake it certainly is. In citing dates one should be scrupulously exact. That first publication took place on the 9th of February, 1848, full one year and a half after the discovery of the isolating qualities of gutta percha was made by a Prussian officer, who since is ranked among the first telegraph engineers of the age. Werner Siemens, then lieutenant of Prussian artillery, had been trying since the fall of 1846 to isolate subterranean wires by gutta percha. In the spring of 1847 he had succeeded so far as to be able to lay before the Board of Commissioners, convened for the purpose of establishing telegraph lines in Prussia, the project of isolating subterranean wires by gutta percha. The Commissioners, well aware of the advantages which subterranean lines presented over those of any other kind, did not hesitate to have two such lines laid, both of which were executed by Siemens in the summer of 1847.

The correctness of this statement may be ascertained by the perusal of the *Philosophical Magazine*, 3d series, 32, 165; of the *Journal of the Society of Telegraph Engineers*, vol. 5, London, 1876, p. 82; and of the *Telegraphic Journal*, 4, 106.

It appears from all this that when Mr. Simpson, in his application to the Patent Office, November 22d, 1847, claimed the isolation of telegraph wires by gutta percha as his invention, he was rather behindhand, and Mr. Siemens had had considerably the start of him.

It may as well be added that Mr. Siemens, together with his partner and co-operator, Mr. Halske, constructed, as early as 1847, the first press by the means of which the telegraph wires were enveloped by the gutta percha, the envelope not showing any longitudinal seam.

It is indeed surprising that Mr. Simpson's name is nowhere mentioned as having had anything to do with the isolation of wires by gutta percha, as it is a well known fact, even on this side of the Atlantic, that Samuel T. Armstrong established at Brooklyn, in the year 1847, a manufactory "of gutta percha for the isolation of telegraph wires," and that the experiment made in 1848 to lay a wire isolated by gutta percha through the Hudson river met with such a signal success that Armstrong, elated by that event, proposed the laying of a gutta percha cable between Europe and America. (Shaffner's "Telegraph Manual," p. 254.)

Where was Mr. Simpson at that time, and why did not he step forth and assert his rights?

We, therefore, cannot accede to our informant's opinion, that Mr. Simpson's rights have been impaired through a misconception of the duties of the Patent Commissioner, but are led to believe that the Patent Commissioner concerned was rather cautious about issuing a patent, and judiciously refused what, to the best of his knowledge and belief, he could not grant.

Even the favorable report of Congress, in 1862, "on the originality and novelty of Mr. Simpson's invention," and the patent granted him rather late in 1867, "as the originator of the first practical method to lay a telegraph line through the ocean," are couched in rather cautious terms; and as for the decision of the Circuit Court of New York, we must await what the Supreme Court will have to say about the case.

F. HENNICKE.

Reproduction of Eels.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 4th you state that "the mystery which has hitherto attended the propagation of eels has at last been cleared up by the discovery of ripe ovaries by Professor Baird."

In the "Medical Repository," of 1806, of which I have a copy, I find the following, given by Dr. Mitchill: "On the 5th of September, 1806, being on a shooting and fishing party with some friends at Flatland, on Long Island, one of the inhabitants brought from the adjoining bay a basket of uncommonly large salt water eels. He soon began to skin and gut them in our presence; the eels abounded with fat. . . . I examined about a dozen of the eels as they were displayed before me; I found there were two white organs, which, to an incautious eye, would pass for fat These on a nearer inspection. were the roes or ovaria, extending in two long leaves, or legs, from the anus on each side of the spine far toward the neck. They were plentifully supplied with blood vessels. and contained numberless ova of a very minute size." Yours very respectfully,

R. K. TELLER.

OFFICE OF THE HANCOCK INSPIRATOR CO., BOSTON.

MESSRS. MUNN & Co.—Permit us again to say that in all our advertising experience we have had no such results from any and all other sources, as from our advertisement in your valuable journal.

Yours very truly,

J. E. BLAKEMORE, Treasurer.

Poisonous Colors.

According to the *Chemical Review*, energetic steps are being taken in Switzerland against the use of poisonous colors. The Governing Council of Zurich has prohibited the use of all coloring matters prepared from the compounds of the metals lead, arsenic, copper, chrome, zinc, antimony, bismuth, and mercury, for decorating articles of consumption or of clothing, or their materials; also paper for wrapping up chocolate, coffee, tea, chiccory, tobacco, and eatables in general; toys, covers and cushions of children's carriages, carpets, curtains and window blinds, lamp screens, wafers, and table services. Poisonous organic matters, such as gamboge, picric acid, the aniline colors, especially magenta, are not to be used for coloring articles of food or drink, such as confectionery, jams, sirups, wines, etc. The same rule applies to the phenol colors. Imported articles containing such poisons may not be sold.

AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE.

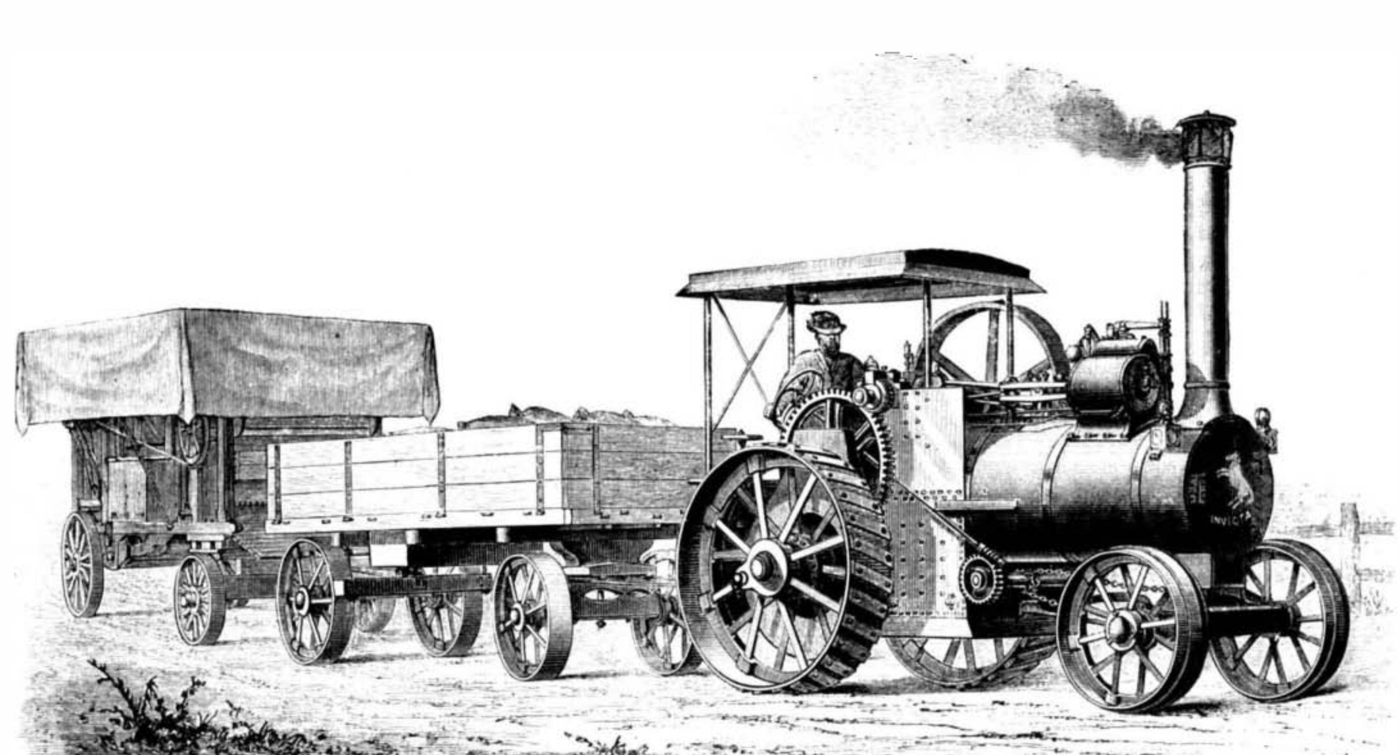
The accompanying engraving represents a road and farm locomotive and train of wagons lately built by Messrs. Aveling & Porter for the Kohala Sugar Company, of Kohala, Sandwich Islands, for hauling sugar cane, sugar, forthrashing, and for farm purposes generally. The engine is one of Messrs. Aveling & Porter's newest design. It is fitted with differential gearing and double speed gear varying from two to six miles an hour; and is provided with governors which can be used when the engine is employed in driving stationary machinery. Wrought iron side plate brackets are used for carrying the crank shaft, countershaft, and driving axle. This arrangement, which has been in use on Messrs. Aveling's engines since 1871, has proved of great value in strengthening those parts of a road locomotive most subjected to strain and wear when used on rough roads and on farm lands. The cylinder is steam-jacketed and lagged, and the boiler is made of "best best" plates, butt jointed, carried through flush from end to end; it is double riveted, and is lagged and felted and covered with plate iron and banded in locomotive style. Besides the primal use of the side plate brackets, Mr. Aveling has lately further utilized his invention as a groundwork for the better arrangement of the driving and double speed gear of his engines. The whole of the crank shaft and countershaft gearing is now arranged to work between (instead of outside) the wrought iron brackets, and the fly wheel is fixed close to the crank shaft bearings. The pinions for the two speeds are keyed fast upon the crank shaft. The intermediate shaft is fixed, and the sliding sleeve, which carries the spur wheel and the fast and low speed pinions, revolves on it. The two crank shaft pinions are of the same size, and the intermediate spur wheel gears with one or the other as required. The advantages of this improvement are that it decreases the width of the locomotive, and avoids all overhanging gear, the side plate brackets serving as sides to a wrought box in which all gearing is placed immediately over the boiler.

This arrangement strengthens the whole structure.

It is stated that this firm have built upwards of 1,600 road and farm locomotives, and number among their customers the governments of Great Britain, France, Russia, Austria, Hungary, Italy, and Mexico.

The British Government has purchased nearly one hundred of these locomotives, the Italian Government sixty-six, and the Russian Government bought them in large numbers at the beginning of the Russo Turkish war for the removal of ordnance and stores.

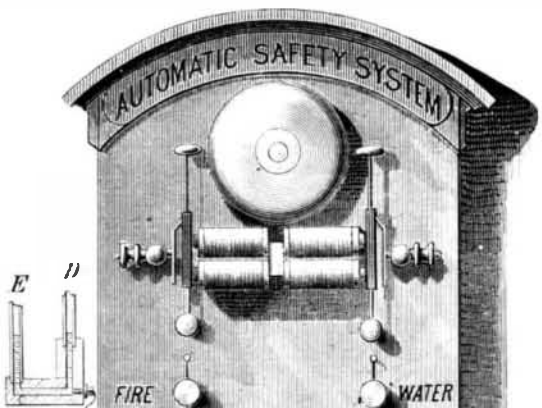
Mr. Wm. C. Oastler, 43 Exchange Place, New York city, is Messrs. Aveling & Porter's representative in the United States.



AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE AND TRAIN.

FIRE AND WATER INDICATOR.

We illustrate herewith a novel fire and water indicator and alarm, which is the invention of Col. A. Gerard. It was



AUTOMATIC SAFETY APPARATUS.

recently patented in this country, also in Canada and Europe, and is controlled by the Automatic Safety Company, of No. 40 Charles St., New Orleans, La.

The invention consists in a simple arrangement of devices, by means of which the presence of fire or undue heat or any change of temperature may be indicated or recorded at any distant point. The instrument illustrated is also designed for the detection of the presence of water in the holds of vessels.

The two vertical glass tubes shown below the alarm apparatus, and marked "Fire" and "Water," are similar in their construction. The glass tube, D, is inserted in a metallic piece, C, which extends through the support, and has a passage, E, that communicates, in the case of the fire alarm, with the receiver hollow sphere, A, and in case of the water alarm with the bell or receiver, B, which is inverted upon the floor or surface liable to the incursions of water. Needles enter the tops of the glass tubes and extend downward toward the mercury contained in the lower part of the tubes. These needles are in electrical communication with the alarm bell at the top of the apparatus, and the mercury is in communication with the battery wires, the whole being arranged so that the rising of the mercury beyond the prescribed distance in either tube will complete an electrical circuit and operate the alarm apparatus.

The hollow sphere, A, being placed in any distant apartment, a rise of temperature in the vicinity of the sphere expands the air contained by it, creating a pressure which displaces the mercury in the tubes of the apparatus and gives the alarm. Similarly, when the water rises upon the surface on which rests the bell, B, the air in the bell is displaced, and the mercury in the tube marked "water" rises and completes the electrical circuit and gives the alarm.

The necessity of an invention that will with certainty report leakages or fires on shipboard will be recognized by any one having even a cursory knowledge of shipping, and the simplicity and adaptability of the Gerard system will be apparent to our readers.

This apparatus is applicable to buildings as an indicator of high temperatures or fire, and, placed in a cellar liable to flooding, it indicates the presence of water. It is capable of many other applications, which our space will not permit us to enumerate.

Edison's Electric Light.

The Philadelphia *Bulletin* suggests that if Mr. Edison wishes public faith in that electric light of his to remain steadfast, he will have to give an early demonstration of the truth of his claim that it is a practical success. When he first announced that he had solved the problem of dividing the light and of adapting it to domestic uses, there was a very general inclination to accept the story with absolute confidence, because Mr. Edison had proved by his previous inventions that he could achieve some things which had been regarded by other men as impossible. But, after all, the proof of the pudding is in the eating, and the world, after waiting patiently for the public display of an invention which sent gas stocks down as soon as it was heralded, will be disposed, unless Mr. Edison shows his hand, to suspect that the Edison Electric Light and the Keely Motor will have to be ranked together as enterprises which contained much more of promise than of performance.

New Mechanical Inventions.

Mr. Charles F. Brem, of Charlotte, N. C., has patented an improvement in Automatic Car Couplings, and it relates to a construction, whereby the coupling pin, which is pivoted in the bumper, is prevented from being raised out of its bearings in the act of coupling or uncoupling, and is nevertheless adapted to be quickly detached from the bumper when required.

An improved Hydrometer and Liquid Meter has been patented by Mr. John M. Cayce, of Franklin, Tenn. The object of this invention is to provide an improved apparatus, chiefly for use of distillers and the government, for measuring and determining the specific gravity of spirits or alcoholic liquors. This invention cannot be properly described without engravings.

An improvement in Windmills has been patented by Mr. William Frazier, of Centralia, Ill. The object of this invention is to construct the windmill in such a way that the wind will act upon the whole or any part of the surface of the arms or sails.

Mr. C.A. Hussey, of New York city, has patented an Electro Magnetic Motor. The invention consists in providing an electric motor with two stationary and one intermediate rotary magnet, the latter arranged with regard to the other magnets and the commutator, so that the best results are secured.

Mr. Geo. W. Prescott, of Battle Creek, Mich., has patented an improved Buffer for locomotive tanks for coupling them with coaches, using Miller's or any other similar coupling. It will protect the brakeman from being crushed while coupling the cars.