SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 3. (NEW SERIES.) | NEW YORK, JULY 17, 1875. | $3.20 per Annum, (POSTAGE PREPAID.)

IMPROVED METHOD OF TRANSPORTING BRICKS DURING MANUFACTURE.

In the accompanying engraving, we illustrate a new method of transporting bricks about the yard, from the machine in which they are manufactured to the points at which the filled hacks are piled for drying and storage. The general design is to enable the work to be done more readily and rapidly, and with probably a less number of hands than is usually required. Before proceeding to describe the plan in detail, we desire to direct the reader's attention to the apparatus for manufacturing the bricks depicted in the foreground of the engraving. This machine has already been illustrated in these columns, but is here presented in a horizontal instead of an upright position. The clay is transported directly from the bed and at once dumped into the hopper, whence it passes to a pug mill, within which it becomes thoroughly ground, tempered, and reduced to a homogeneous mass of about the consistence of thick putty. Hence it passes to the molds which are formed in a mold wheel which revolves in face of the pug mill. A follower beside the wheel, traveling along an incline, forces each brick from its matrix with all the angles and faces smooth, sharp, and perfect, so that the brick as it emerges is deposited upon the endless belt, A. The various devices for conveying the bricks from this belt to their storage places will be found represented in the engraving and described in the following lines:

As the bricks are carried from the machine by the belt, they are removed from the latter by boys, who pile them six high upon the hack planks, B. The hack planks are board platforms constructed of three longitudinal boards, with suitable cross pieces and supports below, and resting on a series of fixed rollers which are inserted in socket rails, C, in the ground. After a hack plank is filled, it is easily slid over the rollers out of the way, and an empty one brought up in its place.

At right angles to the line of rollers over which the hacks are transported, and crossing said line, is an excavation which extends entirely across the yard. Running upon rails, laid in the bottom of this ditch, is a switch car, D, the platform of which is flush with the level of the ground, so that the filled hack planks are easily slid from the rollers directly upon said car. The latter is then pushed along until opposite the point where it is desired to stow the hacks. Tracks are laid from such points in sets of three, and terminate at the edge of the excavation, and upon them are trucks, E, which consist of frames wider and higher than the hacks, and provided with a hand windlass, chains, and grappling hooks. As soon as the switch car is in place, a truck is run directly upon it and over the hack, the hooks are caused to catch beneath the latter, and then, by turning the windlass, the hack is raised from the ground. The truck is readily pushed by one man along the track to the point at which the hack is to be deposited, when the latter is let down by the windlass and detached from the truck, which returns for a new load. The truck runs on either pair of the three tracks so that the latter allow of the storing between them of two rows of brick.

The saddles, as represented at F, are stowed between the sets of track during the drying of the bricks. This completed, they are placed, as shown, in the distant heaps upon the tops of the piles.

In manufacturing brick on a large scale, the matter of removing them from the press and stacking them in a convenient place, without unnecessary handling, is a very important feature; and the arrangement, patented by E. R. Gard and shown in our illustration, seems to accomplish this object admirably.

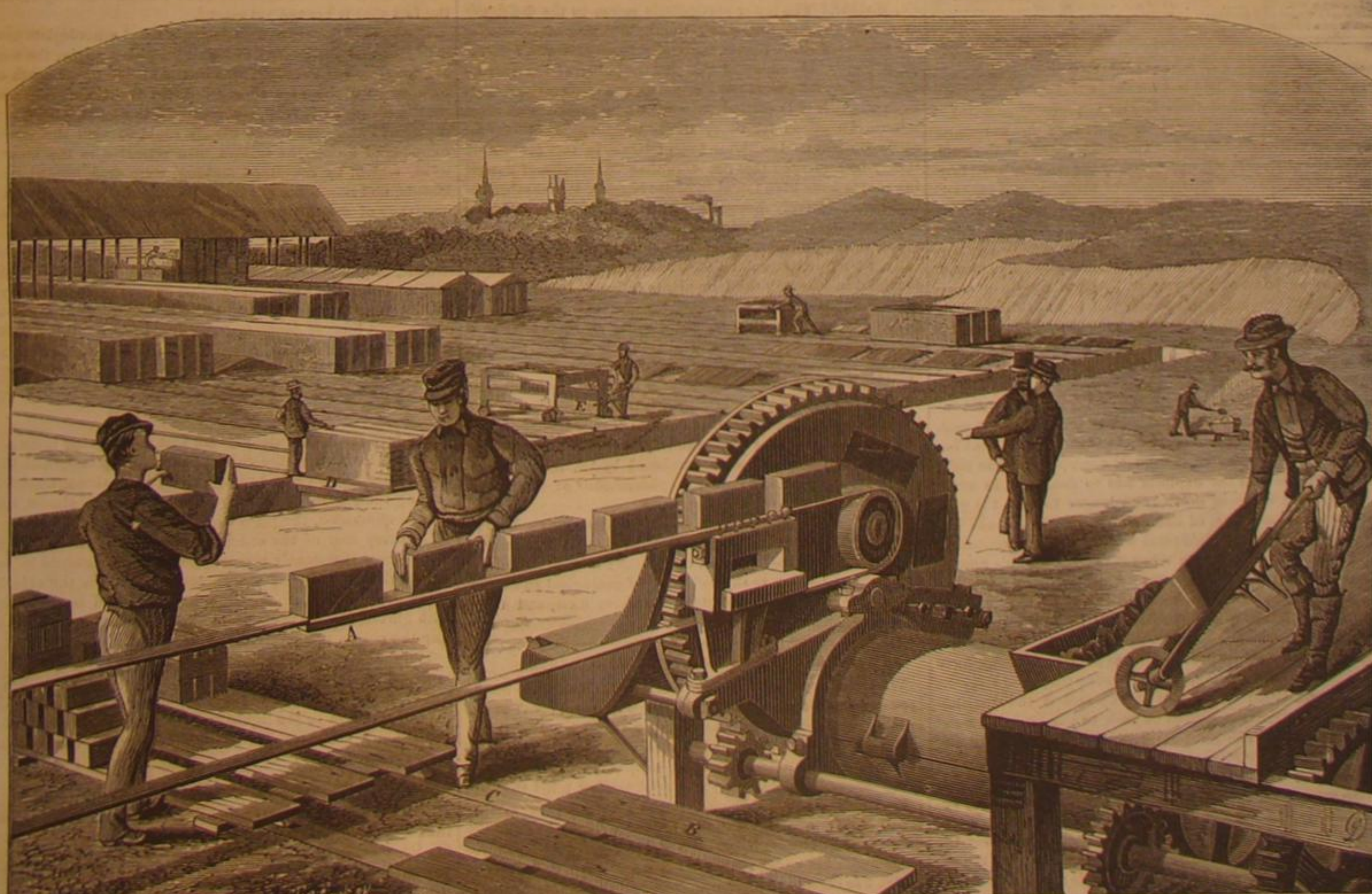
Further particulars may be obtained by addressing the Great American Brick Company, 260 Eleventh avenue, corner West 27th street, New York city.

The North Polar Region.

In an article upon the occasion of the sailing of the new British discovery expedition to the north pole, the London *Times* says:

"So what we really begin this 29th day of May, 1875, is in all probability a progressive series of operations for the discovery of this planet's most intractable and inaccessible quarter. At present there lies within a few weeks of us, and right between us and inhabited continents, a circle, 1,400 miles across, of which we know not even whether it be land or water, or in what respect it is affected by some conditions wholly different from our own. Is it anything more than a great refrigerator for the production of cold—that is, for the absorption of heat? If water preponderate there, then the cold need not be so extreme as we imagine; and just as the equator is not everywhere hotter than the tropics, just as the eastern hemisphere is warmer by 10° in north latitude than the western, and the northern hemisphere very much warmer than the southern, so even the arctic circle may have the benefit of some genial influences. It has at least half a year of continuous day. What if it be found sufficiently habitable for the establishment of stations in which the production and economy of heat will be the only serious difficulty? Science is sanguine, but it confesses itself to be hoping against hope as to the matter of its expectations. An animal or two, seeds that can stand any cold, some of the lowest forms of vegetable life, and perhaps organisms in the sea, the possible revelations of an atmosphere completely clear of aqueous disturbance, figure prominently in the catalogue of hope. If, as is suspected, there be ingredients in the earth's atmosphere too subtle for chemical analysis, the spectroscope may detect them in a region where humidity no longer embarrasses the question. Then what is the aurora? Is it of earth, or of heaven? Is it meteoric? Is it cosmic? Does it reveal a universal medium? Is it a magnetic phenomenon? At about the 70th degree of latitude the expedition will reach the other side of the magnetic pole, and will have to steer by rules the contrary of our own, and becoming more and more complex till the needle points finally to the center of the earth. At the pole not only the compass, but even the sun, moon, and stars will cease to be available for the usual purposes of observation; that is, if anything should happen to the chronometers, for all will then depend on the preservation of Greenwich time. The forlorn hope told off for the pole will have to mark its track very carefully if it would be sure of retracing its course back again. The geologists, ethnologists, and palæologists fret at their exclusion, but they must admit their chances would be small indeed. They can wait, at all events. Perhaps the one hope widest felt and deepest is that of something unknown and unconjectured. Who would have guessed a few years ago that the interior of Africa was populous and delightful, that the ocean was full of life and undergoing change, or that the elements and fabric of the sun would yield to analysis? The expedition is a lottery, in which we know too well there are blanks, but in which there are sure to be some prizes, perhaps one or two great ones."

FERMENTATION of food should be guarded against as the warm weather approaches. This action is always liable to cooked vegetables when set aside. Instead of warming up cold messes, it is better to scald them.



GARD'S BRICK MACHINE AND TRANSPORTING APPARATUS

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included........................$3 20
One copy, six months, postage included........................1 60

Club Rates:

Ten copies, one year, each $2 70, postage included........................$27 00
Over ten copies, same rate each, postage included........................2 70

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VOLUME XXXIII., No. 3. [New Series.] *Thirtieth Year.*

NEW YORK, SATURDAY, JULY 17, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

WORK FOR ARCTIC EXPLORERS.

The scientific work, laid out for the arctic exploring expedition which lately sailed from England, probably excelled in scope and variety that of any preceeding expedition as remarkably as its material outfit did. The instructions for the guidance of the observers were prepared by the most eminent Englishmen in the several departments of research, and are minute and comprehensive enough to keep the explorers from idleness, whatever else may befall them.

Popularly the grand object of the expedition is to reach the pole; practically that is one of the least important of the many purposes of the voyage. And a couple of years spent in arctic regions can scarcely fail to be fruitful scientifically, even if the pole still remains unwon. There is much to be learned of the natural history of those frigid regions, and many physical phenomena await solution there. Chief of the latter may be regarded the magnetic condition of that portion of our globe.

Accustomed to the near coincidence of compass north with astronomical north in this part of the world, it is all but impossible for us to form any adequate conception of the magnetic confusion that the explorer has to deal with in arctic regions, when compass north is no longer toward the pole but toward an area west of Baffin's Bay, in north latitude 70°, —the magnetic pole. This point will lie to the astronomical southwest of the expedition when it reaches Smith's Sound, where the Alert hopes to go into winter quarters; in other words, astronomical southwest will there be identical with compass north, and the north pole will lie to the southeast by compass.

As a guide to the expedition, three provisional maps have been constructed, showing, for the whole unexplored area, the magnetic condition which may be expected if the distribution of terrestrial magnetism be such as our present knowledge indicates. The most important of these maps of the magnetic elements shows the assumed lines of compass direction over the whole circumpolar area, and the region of Greenland, Baffin's Bay, and Davis' Strait, and also, approximately, the lines of equal declination between the north pole of the earth and the northern magnetic pole over the same areas. The importance of such information to the explorers is shown by the following example:

Suppose the expedition to have arrived at the parallel of 85° in longitude 60° W. of Greenwich, at which point the pole will be due east by compass. They start in an astronomically easterly direction for a sledge journey along the parallel of 85°. In longitude 20° W. of Greenwich the north pole will bear northeast. When longitude 40° E. of Greenwich is reached, the astronomical and magnetic meridian will correspond; the north pole will lie between the explorers and the magnetic pole, and the compass will therefore point to the true north. In longitude 180° the pole will bear due west; and in longitude 112° W. of Greenwich, the explorers will have arrived between the north pole and the magnetic pole, and consequently the north pole will bear due south.

Should the expedition be so lucky as to reach the pole, all the points of the compass will be south; latitude and longitude will vanish; the north star will lie directly over head, and all the other stars will revolve around it, neither rising nor setting. The moon will remain for days above the horizon, and the sun, in summer time, will make an unbroken circuit of the heavens, yet always in the south. Time in its ordinary sense will cease; morning, noon, and night will be one; the dial of the heavens will be a blank.

The astronomical instructions prepared by Mr. Hind, superintendent of the "Nautical Almanac," give data for two eclipses of the sun in the polar area in 1876 and 1877; also a list of occultations of stars by the moon visible in or near the probable winter quarters of the expedition, 82° N. latitude and 60° W. longitude, between September 1875 and March 1877, which will enable the observers to employ the best means of determining their longitude.

Special arrangements have been made for the spectroscopic study of the aurora, the instructions for which were prepared by Professor Stokes.

Professor Tyndall furnishes hints for the observation of glacial phenomena; the rapidity of the conduction of heat through ice; the rate at which the ends of glaciers advance into the sea; whether icebergs are formed by the buoyancy of the masses of ice thrust under the water, or by the weight of overhanging ice cliffs whose bases have been worn away by the waves; what kinds of matter are brought down from the interior by glaciers and transported by icebergs; the condition of rocks and hills along the sides of glaciers; the color of the ice and its veining at the ends of glaciers; also the color of the sky, the presence or absence of germs in the air, the range of sounds, and so on.

The solution of many weather problems will be looked for through continuous meterological observations, especially with regard to storms which pass over the extreme northern part of Europe, many of them being connected with areas of barometrical depression which follow tracts lying within the arctic circle.

Especial attention will also be given to tidal phenomena, particularly of the tidal wave which sets southerly through the northern part of Smith's Sound, and indicates an open passage along the northern coast of Greenland. Pendulum observations will also be made, with a view to obtaining *data* toward the determination of the earth's figure in high northern latitudes.

The natural history of the region explored will be attended to with equal care. The instructions for biological and botanical observations were furnished by Professor Huxley and Dr. Hooker. The latter particularly refers to the deficiency of our knowledge respecting the hybridizing of certain of the species of arctic plants, especially those of *draba*, *saxifraga*, and *salix*. He suggests also that the pollen of the various species should be carefully examined, and observations made as to whether it is carried by wind or by insects, and gives minute directions for observations touching the power of seeds to resist cold without loss of life. In this connection it may be remarked that not more than 762 species of flowering plants have been found in arctic regions, the number belonging exclusively thereto being about fifty. Arctic Greenland furnishes 207 species, of which 195 are Scandinavian types, while only 12 are American and Asiatic types. Botanically, therefore, Greenland is much nearer to Europe than to America. Among the four plants collected by Dr. Bessell, of the Polaris, in latitude 82° N.—the extreme northern limit of phanerogamic vegetation, so far as known—was a near relative of our familiar dandelion.

With microscopic plants and animals the arctic seas are abundantly furnished, and Professor Huxley directs especial attention to them in connection with the composition of the sea bottom for the testing of certain modern palæontological theories. Instructions for the collection and preservation of such low forms of life were furnished by Dr. Allman, who also directs attention to the phosphorescence of the sea, as far as it is due to living organisms.

The explorers are also furnished with descriptive lists of the mammalia which may be seen, with directions for observation and the preservation of specimens; also with instructions with reference to the collection of geological and mineralogical specimens, meteorites, meteoric dust, and other matters of interest.

INSTABILITY OF THE EARTH'S SURFACE.

We are so accustomed to consider the solid earth to be the type of perfect stability that it requires quite an effort of the mind to elevate itself to the thought that even the rocks, which appear to be the foundation on which everything else rests, are of an unstable nature, subject to upheavals, depressions, and dislocations. Every observing mind that has seen bold mountain regions, railroad cuttings, or mining shafts must have been struck with the evidences of mighty disturbances, although perhaps a book on geology never came under his eye. It is the study of these disturbances which has created this science, one of the most interesting in the whole field of human knowledge.

It was formerly supposed that the only cause of such changes was volcanic action, and that all the metamorphoses which have taken place were sudden and violent. The observations of volcanic action and of the changes which it rapidly produces in the earth's surface necessarily led to such conclusions; but patient investigation, during long periods of time, has led to the knowledge of a mode of change, formerly unsuspected, by slow upheavals and depressions, taking place gradually, at a rate of one or more feet in a century. Such changes have been and are now constantly taking place, and necessarily must, if prolonged for a sufficiently long period of time, essentially change the earth's surface, not only as to the relative hights of continents and islands, but, in connection with the ocean, as to the whole cosmography of our globe.

We will not speak of the supposed continent Atlantis, mentioned by the ancient mytho'ogical writers, which was, they asserted, sunken in the Atlantic ocean; but we will only mention positive facts, recorded as a result of careful observation. That the coasts and bottom of the Baltic sea are rising is an old and well established fact, the ancient shores being several thousand feet from the present water's edge; while Great Britain and part of the west coast of Europe, Holland, Belgium, and France are in a sinking condition. The evidences in and around the British Channel have long since proved the probability of this, while the Astronomer Royal has announced that minute observations prove that Greenwich Observatory, with the ground upon which it stands, has been sinking ever since its establishment.

In regard to our continent, it has been proved that the whole Pacific coast, especially California, with all its mountains, is perpetually rising, and that at a comparatively rapid rate. The land containing in its bosom our great American Lakes is slowly sinking; while southern Indiana, Kentucky, and the surrounding States are rising. Geological investigations prove that our great lakes, except Ontario, had formerly a southern outlet; until, by gradual northern depressions and southern upheavals, a northern outlet was formed from Lake Erie into Ontario, about 40,000 years ago. This outlet, the Niagara river, is still wearing away its channel. The division line, of the watershed south of the lakes and the Mississippi valley, has since that time been steadily traveling southward; and when Chicago recently turned the waters of Lake Michigan, through the Chicago river, into the Mississippi valley, the old state of affairs was artificially re-established.

New Jersey is sinking, with New York city and Long Island, at the estimated rate of about 16 inches per century. The coast of Texas is ascending at a comparatively very rapid rate, some observers stating that it is as much as 30 or 40 feet in the last half century.

Combining these observations with the results of the recent deep soundings of the United States steamer Tuscarora in the Pacific Ocean, we find that the bed is evidently a sunken continent, abounding in volcanic mountains some 12,000 feet high, many of them not reaching the surface of the ocean, and others which do so forming the numberless islands of the Pacific. The study of the coral rocks proves that this sinking has continually been taking place during several centuries, and observations of the coast will undoubtedly reveal the fact that it has not yet ceased.

The most eminent German geologists and ethnologists now maintain that the locality of man's primitive origin, the seat of the so-called Paradise, was in the Pacific Ocean south of Asia, whence the race slowly diffused itself northward to Asia, westward to Africa, and eastward to Australia. When the great Pacific continent slowly sank, so that the ocean commenced filling the valleys, man retreated to the mountains, which, by continued sinking, were transformed into islands, and now form the many groups of Polynesia. The insularity of the thus preserved races was not productive of civilization, which requires conflict, in which the superiors in the end gain the victory over the inferiors. In those islands, the inferior races were preserved for want of this conflict, hence their savage condition even at the present day; while primitively the greatest advance took place at the spot of the most intense conflict, the continent of Southern Asia. Even at the present day, it has been said that gunpowder is the greatest civilizer.

THE COLORADO POTATO BUG.

The farmers in our vicinity are just now having their potato fields invaded by the celebrated Colorado bug, and the demand for Paris green has become so great throughout the country that, were it not an article obtainable in almost unlimited quantities, the price would be greatly enhanced.

Let every user of the article keep constantly in mind that Paris green is a deadly poison, and great care should be taken in the handling of it. Hands from which the skin is abraded, or on which any sore exists, should be protected with gloves, and all precautions should be used against inhaling the poison while mixing it.

The following, from the *Maryland Farmer*, seems to be a practical mode of applying the poison to the vines. We would, however, suggest, that, on small patches, the dipping of a broom in the liquid and shaking it over the vines be used as a substitute for the appliance which our contemporary suggests:

THE COLORADO BEETLE—THE BEST EXTERMINATOR.

Sweeten a barrel of water with 1 gallon of cheap molasses; then add and well incorporate 1 lb. good Paris green, and apply the same in one application to 1 acre of potatoes. The best mode of applying the liquid to the potato vines is in the use of a can that will contain 4 or 5 gallons, which may be lashed on the back of a man, who may apply the liquid, very uniformly and rapidly, by having two short pieces of ½ inch India rubber hose attached to the bottom of the can, the other end of the hose terminating in a tin rose, similar to that on watering pots. The liquid should be well stirred at each filling of the can, and it should be frequently and violently shaken during the time of applying it. An active man can apply the poison to four acres of potatoes in a day with ease, and two applications, at proper intervals, will save the crop.

The cost is estimated as follows: Hauling water, mixing, and applying the liquid, 30 cents per lb., two applications, 60 cents; 2 gallons molasses, 60 cents; 2 lbs. Paris green, $1.40; total, $2.60.

THE POWER OF SMALL ENGINES.

One of the most frequently recurring questions, asked by our correspondents, relates to the power that can be obtained from an engine of given dimensions, with a specified steam pressure and number of revolutions per minute. As we have frequently explained, questions of this sort can only be determined definitely by means of tests. The rules, ordinarily found in works on the steam engine, for calculating the horse power of an engine, give results that rarely accord with those obtained in practice. Indeed, it is impossible to lay down rules that will apply to all cases, the construction and performance of different engines being so varied. We feel, however, that we must do something to satisfy the many readers who want information about the small engines which they are building or using. We have therefore compiled a table, from the best data at our own command, by which the performance of small engines of good design can be approximately estimated. We have also added some examples to illustrate the use of the table. It is designed for engines with cylinders up to 6 inches in diameter, and for piston speeds up to 400 feet a minute: the connection of the engine with the boiler being supposed to be tolerably direct, the ports and pipes being of sufficient size, and the steam valve closing when the piston has made ⅞ of the stroke. Even with all these suppositions, which probably represent the average conditions of small engines, the table will give results that are too large in some cases and too small in others, for the very reason that it does represent average conditions. With these explanations, we will proceed to illustrate its use.

1. To find the area of a piston, knowing its diameter: Multiply the square of the diameter by 0·7854. Example: The diameter of a piston is 3 inches. What is its area? The square of 3 is 9. Multiplying 9 by 0·7854, we obtain 7·0686, as the area of the piston in square inches. It may be well to observe that, whether the piston has either a flat, rounded, or raised end, its effective area is to be calculated from the diameter, as explained above.

2. To find the speed of a piston in feet per minute, when the length of stroke and the number of revolutions per minute are known: Multiply twice the length of stroke, in inches, by the number of revolutions per minute, and divide by 12. Example: An engine has a stroke of 3 inches, and makes 300 revolutions a minute. What is the piston speed? Twice the length of stroke is 6 inches. Multiplying by 300, and dividing by 12, we obtain 150, as the piston speed in feet per minute.

3. To find the horse power of an engine, when the diameter of the cylinder, the length of stroke, the number of revolutions per minute, and the pressure of steam in the boiler are known: Find the area of the piston, in square inches, and the piston speed, in feet per minute. Find the number in the table, the nearest to the given steam pressure and calculated piston speed, and multiply it by the area of the piston. Example: An engine has a cylinder 2 inches in diameter and with a length of stroke of 2 inches. It makes 400 revolutions a minute, with a boiler pressure of 50 lbs. per square inch. What is the horse power? Square of diameter of piston 4 × 0·7854 = 3·1416, area of piston, in square inches. Twice the length of stroke 4 × 400 = 1600 ÷ 12 = 133⅓, speed of piston in feet per minute. Nearest piston speed in table is 130, and the number in table corresponding to piston speed of 100 feet per minute and boiler pressure of 50 lbs. is 0·074; add the number corresponding to piston speed of 30 feet per minute, 0·022; this will give the number corresponding to piston speed of 130 feet per minute, 0·096. Multiplying this by area of piston, 3·1416, we obtain, horse power, 0·3 +.

The power so calculated is that available for useful work, such as would be developed on a friction brake, in an experiment made by the method explained on page 273 of our volume XXXI.

If any of our readers test their engines in this manner, we would be glad to receive the results of their experiments, which will be useful in enabling us to correct the table, if necessary.

4. To find the diameter of cylinder for an engine to develope a given horse power, when the piston speed, in feet per minute, and the pressure of steam in the boiler are known: Find, in the table, the number nearest to the given piston speed and pressure of steam. Divide the required horse power by 0·7854 times this number, and take the square root of the quotient. Example: An engine is to develope 2 horse power, with a piston speed of 150 feet a minute, and a boiler pressure of 100 lbs. per square inch. What should be the diameter of the cylinder? The number in table, for piston speed of 100 feet, is 0·161, and for 50 feet is 0·081, giving a total of 150 feet = 0·242. Multiply this by 0·7854, and we have a result of 0·1900668. Divide the horse power by the figure 0·1900668, and the quotient is 10·5226 +. The square root of 10·5226 is 3·24 +, or about 3¼ inches, the required diameter of cylinder.

5. To find the length of stroke, in inches, when the piston speed, in feet per minute, and the number of revolutions per minute, are known. Multiply the piston speed by 6, and divide by the number of revolutions per minute. Example: The piston speed of an engine is 200 feet per minute, and the number of revolutions per minute is 300. What is the length of stroke? Multiplying 200 by 6, and dividing the product, 1200, by 200, we obtain 4 inches, as the length of stroke.

In this article, we have presented the subject as plainly as possible, so that it can be used by all who have queries on power developed by small engines.

EFFECTIVE HORSE POWER OF AN ENGINE WITH A PISTON ONE SQUARE INCH IN AREA, FOR DIFFERENT STEAM PRESSURES AND PISTON SPEEDS.

Pressure.*	Horse power corresponding to piston speed (in feet per minute) of												
	10	20	30	40	50	60	70	80	90	100	200	300	400
10	·0005	·0010	·0015	·0020	·0025	·0030	·0035	·0040	·0045	·0050	·0099	·0149	·0199
15	·001	·003	·004	·005	·007	·008	·010	·011	·012	·014	·027	·041	·055
20	·002	·004	·007	·009	·011	·013	·016	·018	·020	·022	·045	·067	·089
25	·003	·006	·009	·012	·015	·019	·022	·025	·028	·031	·062	·093	·124
30	·004	·008	·012	·016	·020	·024	·028	·032	·036	·040	·079	·119	·158
35	·005	·010	·015	·019	·024	·029	·034	·039	·044	·048	·097	·145	·194
40	·006	·011	·017	·023	·029	·034	·040	·046	·051	·057	·114	·171	·228
45	·007	·013	·020	·026	·033	·039	·046	·053	·059	·066	·131	·197	·263
50	·0074	·015	·022	·030	·037	·045	·052	·059	·067	·074	·148	·223	·297
55	·008	·017	·025	·033	·042	·050	·058	·067	·075	·083	·166	·250	·333
60	·009	·018	·028	·037	·046	·055	·064	·073	·083	·092	·184	·275	·367
65	·010	·020	·030	·040	·050	·060	·070	·080	·090	·100	·201	·301	·402
70	·011	·022	·033	·044	·055	·065	·076	·087	·098	·109	·218	·327	·436
75	·012	·024	·035	·047	·059	·071	·083	·094	·106	·118	·236	·354	·472
80	·013	·025	·038	·051	·063	·076	·089	·101	·114	·127	·253	·380	·506
85	·0135	·027	·041	·054	·068	·081	·095	·108	·122	·135	·270	·406	·541
90	·014	·029	·043	·058	·172	·086	·101	·115	·129	·144	·288	·432	·575
95	·015	·031	·046	·061	·076	·092	·107	·122	·137	·153	·306	·458	·611
100	·016	·032	·048	·065	·081	·098	·113	·129	·145	·161	·323	·484	·645
105	·017	·034	·051	·068	·085	·102	·119	·136	·153	·170	·340	·510	·680
110	·018	·036	·054	·071	·089	·107	·125	·143	·161	·179	·357	·536	·715
115	·019	·038	·055	·074	·093	·112	·130	·149	·168	·187	·373	·560	·746
120	·0196	·039	·059	·078	·098	·118	·137	·157	·177	·196	·392	·588	·785
125	·020	·041	·061	·082	·102	·123	·143	·164	·184	·205	·410	·614	·819
130	·021	·043	·064	·085	·107	·128	·149	·171	·192	·213	·427	·640	·854
135	·022	·044	·067	·089	·111	·133	·156	·178	·200	·222	·445	·667	·889
140	·023	·046	·069	·092	·115	·139	·162	·185	·208	·231	·462	·693	·924
145	·024	·048	·072	·096	·120	·141	·168	·192	·216	·240	·479	·719	·958
150	·025	·050	·074	·099	·124	·149	·174	·199	·223	·248	·496	·745	·993

* In boiler, by gage.

THE KEELY MOTOR DECEPTION.

We publish on another page a communication from the counsellor of the Keely Motor Company, Mr. Collier, and his colleagues, in reply to an article on the above subject given in our paper of June 26. We devote this space, first, because the parties interested, feeling personally aggrieved by our remarks, have requested, as a matter of fair play, an opportunity for reply; and second, because we have hopes that some of our readers may be led thereby to study out the probable processes by which these gentlemen have been precipitated into this delusion. Such studies may result in useful suggestions or new knowledge. It is not often that the active participants in delusions like this are willing to come forward and chronicle themselves in the broad and public manner that these persons have done. The mental or psychological phenomena will, we think, be found interesting subjects for investigation.

An example somewhat similar to this Keely motor business occurred in London, in 1871, when Dr. William Crookes, the well known scientist, published his astonishing account of the spirit motor of Home, in which the spring gage was made to move by the simple pointing at it of the operator's finger. The truth of this performance was attested by Dr. Crookes, who himself prepared the apparatus, by Dr. William Huggins, by Edward William Cox, a distinguished lawyer, and by numerous other witnesses of undoubted reliability. Dr. Crookes and others were convinced by this exhibition that a new force, which he termed psychic force, had been discovered; but Dr. Huggins, while attesting that the gage moved (in fact, the movement was made to record itself on paper), declined to express an opinion as to how the movement was produced. An account of these performances, with an engraving of the arrangement of levers and gage used, was published in the SCIENTIFIC AMERICAN, page 99, August 12, 1871.

This motor of Dr. Crookes appears to surpass the Keely device in some respects. The power is workable at a low pressure, involves but little expense for apparatus, requires no blowing of air from the lungs, uses no hydrant pressure, and its success does not depend upon "cold vapor."

No one, we believe, has ever questioned the honesty of Dr. Crookes, or supposed for a moment that he had, personally, any hand in giving motion to the gage. The more reasonable supposition is that somebody, in some manner unobserved by those present, applied the necessary force to the instrument.

The human senses are but weak instruments at best, easily played upon and deceived; and those who have most highly prided themselves upon the possession of superior perceptions, by which they were confident of their ability to detect the unreal from the real, have become lamentable examples of the ease with which the mind of man can be entrapped and led astray by mere appearances.

In matters of Science and Mechanics, especially in those branches pertaining to the correlation of forces, it is only by the application of the most careful methods, coupled with the searching tests of mathematics, that reliable knowledge can be acquired and delusive conclusions avoided.

As in the present example of the Keely motor, so in the case of the Paine electro-motor in 1871; the originator of the deception made the most solemn assertions that the machine which he then had in operation derived its sole power from the four small battery cups, which the witnesses saw standing on a shelf at the side of the apartment. The machine was tested, with brakes, as to power, by well known practical electricians of this city, whose names are now before us, who reported large gains of power and detected no fraud. Their experiments were corroborated by many other intelligent witnesses. Special exhibitions were given to capitalists, who pronounced the show wonderful.

We expressed the opinion that the whole thing was a deception, warning the public against investing means in the motor shares. We reproduced the well known mathematics of electric action, we showed the exact amount of force derivable, under the most favorable circumstances, from the consumption of a given amount of zinc and acid, as determined, after exhaustive experience, by the most eminent savans; and from these teachings, we pointed out the necessary falsity of the statements made in behalf of the new motor. Paine, in reply to our strictures, reaffirmed all that he had before claimed for his motor, which he now alleged was far below the actual truth; he said that he was then engaged in building a great and powerful engine which would be ready in ninety days, which would develop 500 horse power from a single cup, completely annihilate the figures given by us, and show to the world that people who, like the editor of the SCIENTIFIC AMERICAN, undertook to doubt or criticise the performances of a machine they had never seen and were practically unacquainted with, were jackasses, or "a fool," as our friend Mr. Collier suggests others might properly say.

"I am familiar," said Paine, "with the experiments of Grove, Carpenter, Mayer, Faraday, Liebig, and a host of others, relative to the doctrines of correlation and conservation of forces. Therefore, I am no tyro, but the peer of any authority you may quote; and as such I unqualifiedly assert that, instead of the miserably small result of 67,000 foot pounds from three grains of zinc (as stated in the SCIENTIFIC AMERICAN) we should realize 67,000,000 foot pounds. The forces developed by the action of a single Bunsen quart cell, if utilized and converted into power, would drive the largest ship afloat with a velocity only limited by the strength of the ship's frame; and you and I will live to see the day, if our lives are lengthened to the usual term, when this statement will be verified, and that, too, without involving the question of perpetual motion."

This sort of talk prevailed with the capitalists; they swallowed the bait, paid in their money, took their shares—"without being urged"—and that was the end of the five hundred horse power, no perpetual motion, one cup, engine, and motor.

The Keely motor deception in all its aspects up to this date is but a repetition of the Paine affair. The originator is very honest; all the people who assist at the deception believe in him and in his machine. They know not precisely how the thing is done, or by what laws it is governed, but they know that it *is* done; and any suggestion to the contrary they seem to consider as a reflection on their personal intelligence and honor.

The Keely performance is as follows:

Keely blows from his lungs, for a period of 30 seconds, into a nozzle upon the generator. He connects the same nozzle, by means of a small rubber tube, with the hydrant, and lets in five gallons of water under a pressure of 26½ lbs. to the inch, then shuts off the water. He opens the valve of a pipe of 1/16 of an inch bore, between the generator and a gage or pressure indicator; and lo! the gage indicates 10,000 lbs. to the square inch.

Such, in sum and substance, is the Keely motor, as set forth by the learned counsel of the company and corroborated by various mechanical experts, in the statements they have now freshly prepared for the especial benefit and enlightenment of the readers of the SCIENTIFIC AMERICAN; corroborated also by scores of other intelligent persons, so Mr. Collier assures us.

The majority of our readers will doubtless conclude with us that, on the showing of the parties themselves, the whole thing must be classed as a second rate juggle—a mechanical Katie King arrangement, too contemptible for serious consideration.

In our article of June 25, we assumed that the chief purpose of the deception was to wriggle money out of silly people. It appears, from the confession with which Mr. Collier has favored us, that the very first practical use he made of the pretended invention was to obtain money from New York capitalists; that the second use was to procure money from the same source; the third the same, and so on, until the treasury is considered full enough for the time being. We attribute to Mr. Collier no dishonourable motives or methods in financing his company; but we think he confirms our statement as to the uses of the alleged invention. In connection with the letters from the various parties, given elsewhere, some further comments will be found.

Synthesis of Therpylene.

Some time ago M. Berthelot published investigations in which he showed that the essence of turpentine, represented by the formula $C_{20}H_{16}$, resulted from the condensation of a special carburet, $C_{10}H_8$. This last, termed therpylene, no one has ever seen until the present time, when M. Bouchardat announces that he has produced it by synthesis.

MONDAY, the day following July 4 (which this year comes on Sunday), will be, as usual, observed as a holiday in this city. Pressmen, as well as men in other occupations, will suspend work on Monday; therefore if subscribers to the SCIENTIFIC AMERICAN fail to get this issue of the paper till a day or two later than usual, they will know the reason.

THE body of an American, John Blackford by name, has recently been found in a large ice block in the vicinity of Mont Blanc, after several days of thaw. The unfortunate tourist had tried three years ago to ascend Mont Blanc without a guide, and had not since been heard of. Features and clothes are perfectly preserved.

IMPROVED ENGRAVING MACHINES.

We illustrate herewith two specimens of a series of machines, designed and constructed by Mr. Ferdinand Lotz, of Offenbach, Germany, for the use of engravers, and having a very wide range of application, as they are intended for the production of line engraving, producing enlarged or reduced facsimile copies, and for making copies of reliefs of all kinds. Fig. 1 is a machine employed for engraving reliefs, medallions, etc., either the same size as the original, or enlarged or reduced. With it straight and curved lines in various com-

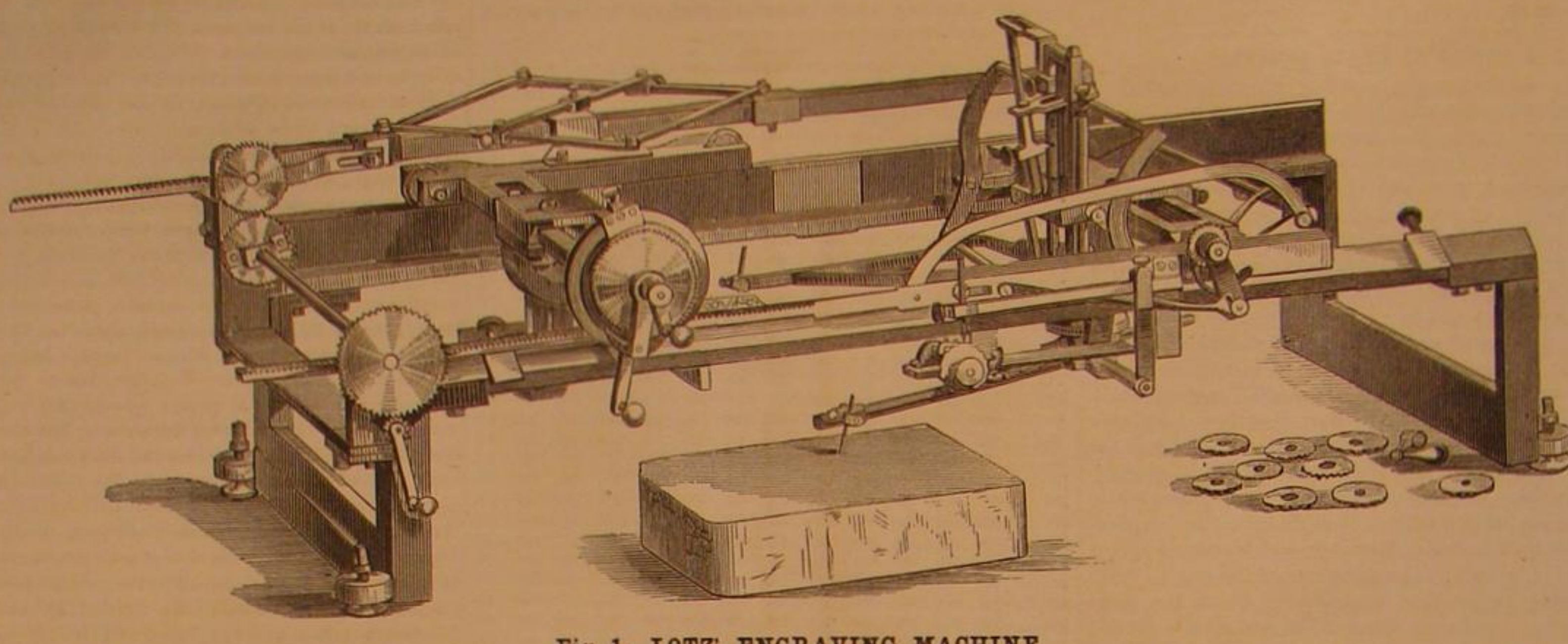


Fig. 1.—LOTZ' ENGRAVING MACHINE.

binations can be produced. The different natures of lines are formed by the use of change wheels, the forms of which vary with the design to be engraved. One of these wheels is shown mounted in place; and it will be seen that bearing upon it on the upper side is a steel point, to which motion is imparted as the wheel revolves, the motion of course varying with the form of the wheel. This movement is then transferred from the arm carrying the steel point, through a set of levers to the bar carrying the diamond point, shown resting on a lithographic stone. For ruling straight lines the upper rack, shown in the engraving, is dropped, throwing out of gear the parallelogram which transmits motion to the carriage. The latter is then moved to the left hand side of the frame. By turning the crank handle, shown in the engraving, motion is imparted through the gearing and rack and pinion, to the slide rest carrying the diamond point holder, and a line is drawn upon the stone. On turning the lever in the opposite direction, the graver is raised out of the way. The slide rest is provided with a self-acting feed, which can be graduated with the utmost nicety. Sliding blocks are placed on the frame to regulate the travel of the carriage. Thick lines may be produced by giving the screw spindle, upon which the lateral motion of the graver depends, one twenty-fourth of a turn. The lines are then so close together as to appear as one, but dark lines may also be produced by loading the cutter bar with shot, and thus increasing the pressure. In copying reliefs, it is necessary to move the carriage to about the middle of the machine, and to connect it with the pantograph shown in the engraving. The steel point actuated by the design wheel, and that part of the machine transmitting the motion thus applied to the steel point, have to be removed.

The original is fixed upon a cross plate below the carriage, in the position indicated on the engraving, and the steel point is then carefully carried over each part of the original, the motion being transferred to the diamond point.

The horizontal spindle of the carriage, to which the original is secured, carries at one end a ratchet wheel and crank, and by this combination the points are shifted through the space of one line, so as to occupy fresh ground. In reducing or enlarging originals, a suitable connection is made between the carriage and the pantograph.

In forming straight and curved or wavy lines, a design wheel of the required pattern is fixed in the position shown, and operates as already described.

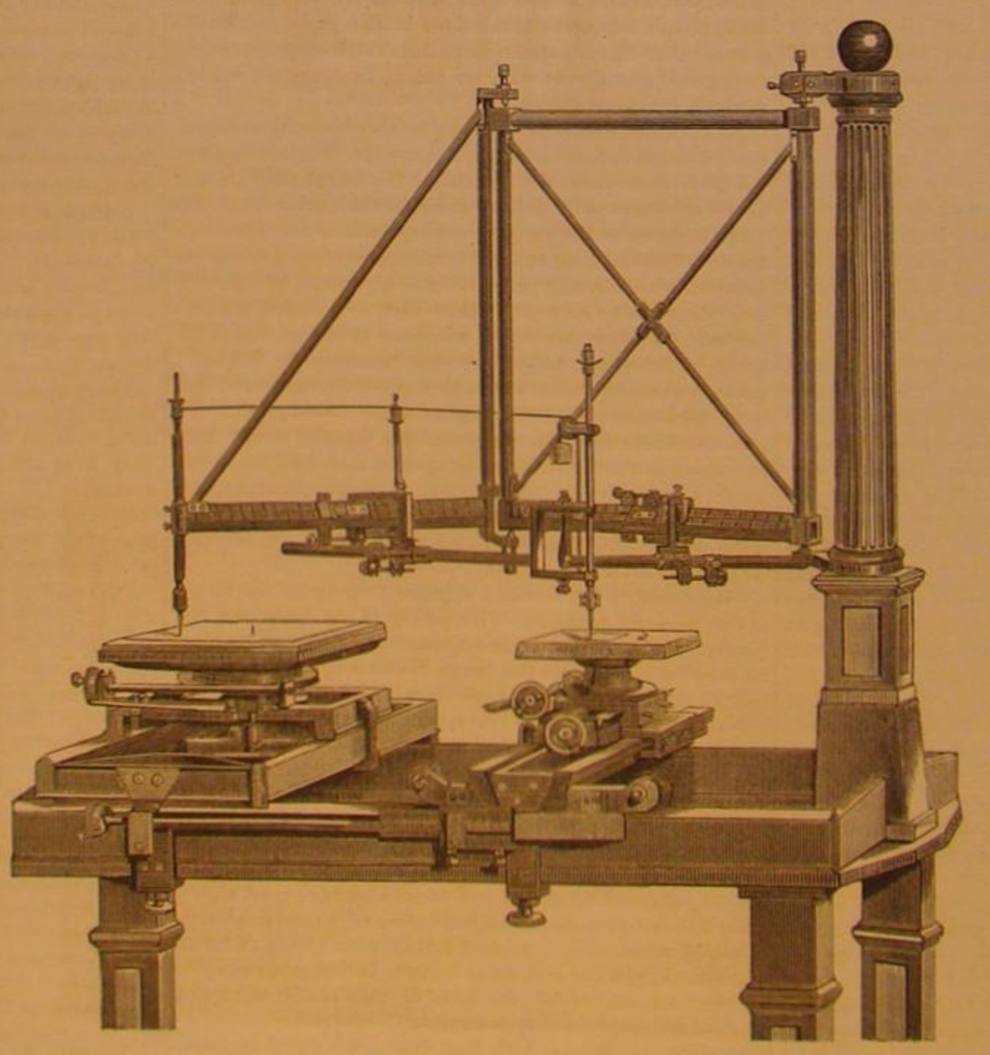


Fig. 2.—LOTZ' ENGRAVING MACHINE.

Fig. 2 represents an adaptation of the same principle, and is intended chiefly for engraving bank notes, checks, etc. With this, reductions or enlargements can be made, by the aid of the pantograph attached to the instrument.

Painting of Wrought Iron.

Mr. E. Spon, in a paper read before the Society of English Engineers, says:

In considering the painting of wrought iron, it must be noticed that, when iron is oxidized by heating in contact with the atmosphere, two or three distinct layers of scale form on the surface, and, unlike the skin upon cast iron, can be readily detached, as by the bending or by hammering the metal. The outer layer of this scale is more highly oxidized than the inner, and is slightly redder in tinge from the presence of a variable excess of ferric oxide over that contained in the inner layer. The oxide occurring in the outer scale is fusible only at a high temperature, is strongly magnetic, and slightly metallic in luster; while the inner layers are more porous, dull, and non-metallic in luster, less brittle and also less powerfully magnetic. It will be seen that the iron has a tendency to rust from the moment it leaves the hammer or rolls, and that the scale above described must come away. One of the plans to preserve the iron has been to coat it with paint when still hot at the mill; and although this answers for a while, it is a very troublesome method which iron masters cannot be persuaded to adopt, and the subsequent cutting processes to which it is submitted leave many parts of the iron bare. Besides, a good deal of the scale remains, and until this has fallen off, or has been removed, any painting over it will be of little value. The only effectual way of preparing wrought iron is to effect a thorough and chemical cleansing of the surface of the metal upon which the paint is to be applied, that is, it is to be immersed for three or four hours in water containing from 1 to 2 per cent of sulphuric acid. The metal is afterwards rinsed in cold water, and if necessary scoured with sand, put again into the acid bath or pickle, and then well rinsed. If it is desired to keep iron, already cleansed, for a short time before painting, it is necessary to preserve it in a liquor rendered alkaline by caustic lime, potash, soda, or their carbonates. Treatment with caustic lime water is, however, the cheapest and most easy method, and iron which has remained in it for some hours will not rust by a slight exposure to a damp atmosphere. Although desirable, this method of cleansing the surface is impracticable in the majority of cases, and recourse must be had to scrapers and hard brushes to remove the scale or rust. Having obtained a clean surface, the question arises what paint should be used upon iron? Bituminous paints, as well as those containing variable quantities of lead, were formerly considered as solely available, but their failure was made painfully apparent when the structures to which they were applied happened to be of magnitude, or subjected to great inclemency of weather or to constant vibration. Recourse has, therefore, been had to iron oxide itself, and with very satisfactory results. Iron oxide paints are made of two qualities. The first quality is the best adapted for iron work, and is made by purifying the oxides and placing them in retorts, when the various colors are mixed with them. They are altogether submitted to seven distinct processes in the course of manufacture. To insure large surfacing qualities, or the power of covering a large area with a small quantity of paint, the ingredients should be reduced to an impalpable powder before they are mixed with the oil; and after mixture in first quality paint, they are ground for seven or eight hours. The second quality have their colors chemically combined by mixture, and are not so carefully prepared, although they are excellent for common work. A pound of iron oxide paint, when mixed ready for use in the proportions of two thirds oxide to to one third linseed oil, with careful work, should cover twenty-one square yards of sheet iron which is more than is obtained with lead compounds. Oxide of iron paint endures a very great heat without material alteration, and keeps both its color and preservative qualities well. The author is of opinion that, when used under proper supervision, no better protection can be found for iron structures than oxide of iron paints. There is this difference to be noticed between the painting of iron and wood, that, with the former, when a painter comes to spots of rust that cannot be removed, he should endeavor to incorporate them with the paint rather than paint over them. The repainting of iron involves carefully washing down and removing all dust, dirt, and so on from the entire surface, every particle of rust being scraped and chipped off, the work receiving from two to four coats in oil, properly applied. The author would observe, in conclusion, that the real value of any paint depends upon the quality of the linseed oil, the quality and character of the pigment, and the care bestowed on the grinding and mixing; and as all this is entirely a matter of expense, cheap paints are not to be relied upon. He is convinced that the superiority of most esteemed paints is due to the above causes rather than to any unknown process or material employed in the manufacture, and their comparatively high price corroborates this opinion.

A New Six Wheel Emery Grinder.

The Lehigh Valley Emery Wheel Company, of Weissport, Pa., are now making a new six wheel grinder especially designed for the use of planing mills, sash, door, and blind factories, and for molding manufacturers. The wheels are mounted on a 1 inch steel arbor, and are located three on each end, a cone pulley by which the speed may be regulated being placed in the middle. They are as follows: One wheel of 1 inch square face, one of $\frac{1}{2}$ inch square face, another $\frac{1}{4}$ inch round face, constituting one set of three. The other set includes a wheel of $\frac{1}{2}$ inch square face, and another of $\frac{1}{2}$ inch round face, and a $\frac{1}{2}$ inch saw gummer. An adjustable rest at each end enables the operator to grind a perfectly true bevel of any degree required. The machine is already in use in several establishments, and is proving itself a convenient and useful invention.

THE ELECTRIC LIGHT.

A modification of Geissler's tubes has recently been made for the purpose of illumination. It consists of a carbon and vacuum tube, of about one sixteenth of an inch internal diameter, wound in the form of a flattened spiral. The ends of the tube, in which the platinum wires are sealed, are about two inches in length, and half an inch in diameter. They are inclosed in a wooden case, leaving only the spiral exposed. When the discharge from a Ruhmkorff coil is transmitted through the platinum wires, the spiral becomes intensely luminous, exhibiting a brilliant white light. The quantity of the light, however, is small, and it is of no practical value. It is only valuable as an experimental apparatus, or for scientific exhibitions.

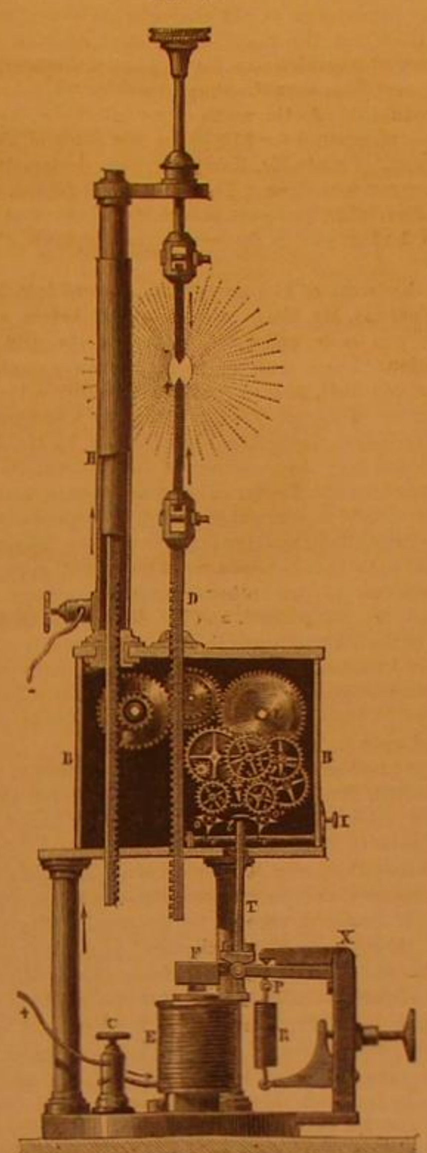
Electricity of great tension and power is required for the electric light, and the easiest and least expensive mode of getting it for these experiments is by using a large Ruhmkorff coil, but the current from a battery of 200 cells would answer the same purpose. An electric light, without mechanism at the burner, can be made by placing two carbon points in hollow brass rods which are connected by wires with a galvanic battery. The rods slide in the heads of two glass pillars, so fixed to a stand as to admit of the points being placed at different distances. The wires from the battery poles being properly connected, the points are made to touch, and are then just separated, when the most dazzling light appears, rivaling the light of the sun in purity and splendor. The light is due chiefly to the intense whiteness of the tips of the carbon rods, and partly from an arch of flame extending from the one to the other. The positive pole is the brighter and the hotter, a fact which may be proved by intercepting the current, when the positive pole continues to appear red for some time after the negative pole has become dark. Any kind of carbon is well suited for the points. The more compact forms of charcoal answer very well, but baked carbon answers better. This is made as follows: The fine dust of coke and caking coal is put into a close iron mold, of the shape required for the carbon pencils, and exposed to the heat of a furnace. When taken out, the burnt mass is porous and unfit for use: but by repeatedly soaking it in thick sirup or gas tar, and reheating it, it acquires the necessary solidity and conducting power. The best carbon points, both for brilliancy and durability, are made, however, from the coke that is sublimed inside the retorts in the distillation of coal in gas works. During the maintenance of the light, a visible change takes place in the condition of the poles. The positive pole experiences a loss of matter; particles of carbon pass from it to the negative pole, some of them reaching it, and some being burnt by the oxygen of the air on the way. The same occurs, though to a much less extent, with the negative pole; so that, while the positive pole becomes hollowed out or blunt by its losses, the negative pole is kept pointed by the additional particles.

The wasting away, particularly of the positive pole, in a short time renders the distance between the poles too great for the passage of the current, and the light is suddenly extinguished, until again renewed by contact between the carbon points and their separation. If a powerful battery is used, the points may be removed one sixth or even one fifth of an inch before the circuit is broken. The transfer of matter between the poles is considered to account for the existence of the arch of flame, and the passage of the current through the air, as thereby a conducting medium extends between the poles. The light is not caused by the combustion of the carbon, but by its being brought into a state of incandescence. With a battery of fifty Grove or Bunsen cells, a light of very great brilliancy is produced; but when very great power is to be obtained, as well as brilliancy, twice or thrice that number must be employed. Fifty cells give electricity of sufficient tension to produce the light; and if more are used, they should be so arranged as to add to its strength and not its tension. Thus, if 150 cells be used, they should be arranged in three series, the positive poles of all three being joined to form one positive pole, and similarly with the negative poles. With a battery of 50 cells it is not necessary to point the rods, as the action of the electricity will do it. A battery of 50 large-sized Grove or Bunsen cells will produce a light 34 times the power of the lime ball light, or one fifth as great as that of the sun.

Various arrangements have been invented for maintaining the steadiness of the electric light. The aim in all such is to keep the carbon points by some mechanical contrivance within such a distance of each other that the current can pass between them. Duboscq constructed an electric lamp of this description. In it, by aid partly of clockwork, the two points are made to travel towards each other at rates corresponding to those of their consumption, the positive pole in this way traveling faster than the negative.

Foucault's form of regulator, Fig. 1, has two systems of wheel work, one for bringing the carbons nearer together, and the other for moving them further apart. Fig. 1 represents the apparatus, with the omission of a few intermediate wheels. L′ is a barrel driven by a spring inclosed within it, and driving several intermediate wheels which transmit its motion to the fly, *o*. L is the second barrel, driven by a stronger spring, and driving in like manner the fly, *o′*. The racks which carry the carbons work with toothed wheels attached to the barrel, L′, the wheel for the positive carbon having double the diameter of the other. The current enters at the binding screw, C, traverses the coil of the electro-magnet, E, and passes through the wheel work to the rack, D, which carries the positive carbon. From the positive carbon, it passes through the voltaic arc to the negative carbon, and thence, through the support, H, to the binding screw connected with the negative pole of the battery. When the armature, F, descends towards the magnet, the other arm of the lever, F P, is raised, and this movement is resisted by the spring, R, which, however, is not attached to the lever in question, but to the end of any other lever, pressing on its upper side, and movable about the point, X. The lower side of this

Fig. 1.



lever is curved, so that its point of contact with the first lever changes, giving the spring greater or less leverage according to the strength of the current. In virtue of this arrangement, which is due to Robert Houdin, the armature, instead of being placed in one or the other of two positions, as in the ordinary forms of apparatus, has its position accurately regulated according to the strength of the current. The anchor, T *t*, is rigidly connected with the lever, F P, and follows its oscillations. If the current becomes too weak, the head, *t*, moves to the right, stops the fly, *o′*, and releases *o*, which, accordingly, revolves, and the carbons are moved forward. If the current becomes too strong, *o* is stopped, *o′* is released, and the carbons are drawn back. When the anchor, T *t*, is exactly vertical, both flies are arrested, and the carbons remain stationary. The curvature of the lever on which the spring acts being very slight, the oscillations of the armature and anchor are small, and very slight changes in the strength of the current and brilliancy of the light are immediately corrected.

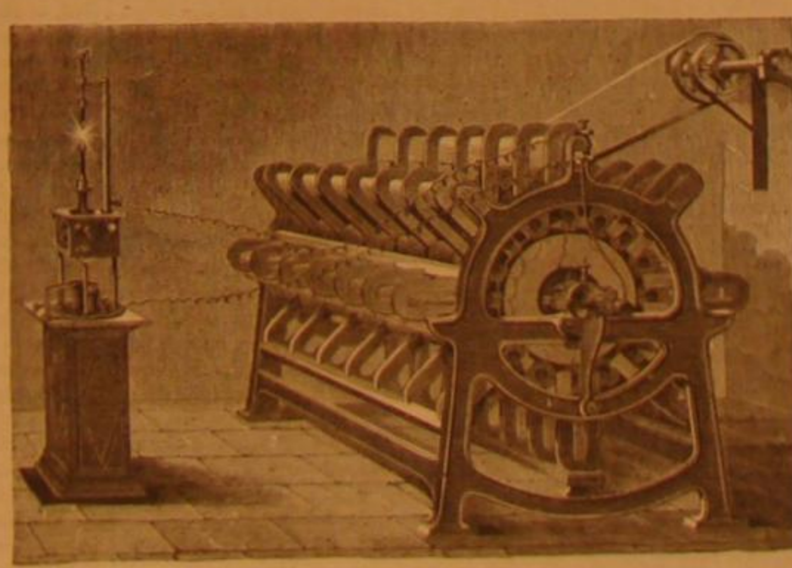


Fig. 2.—MAGNETO-ELECTRIC LIGHT MACHINE.

Mr. Hart, of Edinburgh, Scotland, has invented a simple lamp, in which the weight of the rod, in which the carbon is fixed, supplies the place of the clockwork in the above described lamp of Foucault, and an electro-magnet lets it descend, or locks it, as the carbons are consumed.

The attempts which have been made to substitute the electric light for coal gas, in lighting up streets and public places, have hitherto proved unsuccessful. One element of imperfect success, in the practical use of the electric light, is due to the uncertainty of the light and the care attending its use. By contrivances like those we have described, the light may be continued for hours; but even then it is by no means steady, and the apparatus cannot be safely left without an attendant. It has, however, been used with excellent effect where a limited space had to be lit up for a few nights, as well as for lighthouse illumination. Its power to penetrate fogs is immensely superior to that of the usual oil light. Lighthouses at Dungeness and elsewhere have been lit with electric lights since 1863, the current being obtained from magneto-electric machines driven by steam engines. Fig. 2 represents the machine. It has eight rows of compound horseshoe magnets fixed symmetrically round a cast iron frame. They are so arranged that opposite poles always succeed each other, both in each row and in each circular set. There are seven of these circular sets, with six intervening spaces. Six bronze wheels, mounted on one central axis, revolve in these intervals, the axis being driven by steam power transmitted by a pulley and belt. The speed of rotation is usually about 350 revolutions of the axis per minute. Each of the six bronze wheels carries, at its circumference, sixteen coils, corresponding to the number of poles in each circular set. The core of each coil is a cleft tube of soft iron, this form having been found peculiarly favorable to rapid demagnetization. Each core has its magnetism reversed sixteen times in each revolution, by the influence of the sixteen successive pairs of poles between which it passes; and the same number of currents, in alternately opposite directions, are generated in the coils. The coils can be connected in different ways, according as great electro-motive force or small resistance is required. The positive ends are connected with the axis of the machine, which thus serves as the positive electrode; and a concentric cylinder, well insulated from it, is employed at the negative electrode. Two of these machines are provided for each light, though only one is used, except in very foggy weather. These are driven by a six horse power steam engine, and all parts of the machinery, including boilers, are kept in duplicate. Coke is used for fuel, and about 56 lbs. are consumed each night. The machines are connected with the lamp by means of underground cables. Each lamp contains two pieces of carbon, about ten inches long by three eighths of an inch square. They are made from coke dust, and are consumed at the rate of thirty four inches per night for each light, at a cost of two cents per inch, exclusive of waste and breakage. They are moved toward each other by means of automatic apparatus; and the only danger of irregularity of the lights arises from the presence of foreign matter in the carbons. This, however, is instantly corrected. The annual cost of the electric light at Dungeness is about $4,000.

The most powerful light which has yet been constructed is that of the flashing electric light at Soutter Point, England, three miles below the mouth of the Tyne, the condensed beam of which is equal to 800,000 candles.

There are two electric lights situated on the South Foreland, three miles from Dover. These are 1,000 feet apart, one being 372 and the other 275 feet above sea level. The rear light is utilized, by means of totally reflecting prisms, to reinforce the front light, which is required over a range of 180° only. Both lights are fixed. The power of each beam is estimated as equal to 180,000 candles; and when observed from Dover, a distance of three miles, they throw a very distinct shadow from objects on the pier.

In addition to the above mentioned electric lights, there are in France two fixed lights at La Hève, and a revolving light at Cape Grisnez; in Egypt, a revolving light, at Port Said; and in Russia, a fixed light, at Odessa. The plan in operation at La Hève is very similar to that of the South Foreland. Six-plate magnets, of a power of 145 to 155 lbs., are used, and some three-plate magnets, with a power of 75 lbs. The carbon points are manufactured from the residue contained in gas retorts. They are 10 inches long, and from one third to one half of an inch thick. The optical apparatus is about 1 foot in diameter, and it sends the light tangentially to the surface of the sea. Many accidents, however, have occurred at La Hève; in one instance the lights were extinguished for a space of an hour. Much trouble has been experienced with the machinery, which is now placed in a more satisfactory condition. Of the cost of this light, we have no data later than 1869; but it appears that the average of that and the four previous years was $3,215.34, the total number of hours of illumination averaging 4,135 annually. The machines are started 10 minutes before the time of illumination, so that the currents may be well established, and the light is exhibited 15 minutes after sunset, and extinguished 15 minutes before sunrise. Double lights are produced whenever the fog is so dense that the keepers cannot see the beacon lights on the north pier at Havre, and this occurs about eighty hours every year.

The disadvantages attending a general use of electricity are due chiefly to the large amount of space required for the steam engines and the magneto-electric machinery, for storing coal, coke, etc., and for collecting and preserving the water for the engines. The repairs needed require also special workmen, not usually found in the vicinity of lighthouses. Consequently the electric light can at present be made available only in certain localities. It would be disadvantageous in lighthouses at sea, or that are not easily accessible, or those which are distant from centers of population But where there is plenty of space, and where cities are within easy reach, their substitution for other lights is strongly approved by mariners.

Correspondence.

The Keely Motor.

To the Editor of the Scientific American:

In your paper of June 26 there is an elaborate editorial article entitled "The Keely Motor Deception," in which article you treat the alleged invention of Mr. Keely contemptuously, and speak of him and his "confederates," myself included, as juggling tricksters "whose chief purpose appears to be the wriggling of money out of silly people." I am not willing to believe that journalists professing to conduct a publication devoted to inventions, and advocating, professedly, the rights of inventors, will persist in denouncing an alleged discovery with which personally you are wholly unacquainted, especially when your denunciation involves, necessarily, an assault upon the integrity of reputable gentlemen. I have practised my profession in Cincinnati, O., and in this city uninterruptedly for a period of about eighteen years, for about eight years of which time I have devoted myself exclusively to patent litigation, with probably the average success of professional men: not altogether unknown in my profession, I would be entirely willing now and at all times to leave the vindication of my professional character, when assailed, in the hands of my professional brethren, and to the judges of the courts before whom I have practised. Therefore, if I alone were involved in your article referred to, I should remain silent; but inasmuch as others than myself are also impugned, and inasmuch, further, as the alleged invention of Mr. Keely, for which interest I have been and am counsel, is derided, it is proper that I should publicly notice your article.

The invention of Mr. Keely is controlled by a company organized under the laws of the State of Pennsylvania; and probably I can best vindicate the invention, the inventor, and those connected with him, whom you call his "confederates," by stating in outline my connection with the enterprise up to the present time.

A year ago, several gentlemen of this city, one of New Jersey, and another of New York, held contracts with Mr. Keely whereby they were entitled to certain rights in his invention thereafter to be patented. By mutual consent of the contracting parties, it was agreed to merge their respective rights into a corporate company, thereafter to be organized and now known as the "Keely Motor Company." The writer was asked to act as their counsel. The initial step desired to be attained was the procurement of the requisite amount of money necessary, first, to discharge some indebtedness theretofore contracted by Mr. Keely for materials supplied to him; secondly, to complete his structures then being constructed; and thirdly, to defray the expenses incident to the procuration of letters patent in our own and in foreign countries. At this time, personally I knew but little of Mr. Keely's invention. I had seen in his workshop, a room say ten feet square, a "receiver" charged with a vapor or gas having an elastic energy of 8,000 lbs. to the square inch. I interrogated Mr. Keely critically as to how he had produced this substance; pointing to an inoffensive-looking machine, which stood in close proximity to the receiver, he said to me that he introduced a certain quantity of air into that machine under no greater pressure than was the capacity of his lungs, a certain quantity of water under no greater pressure than was the ordinary hydrant pressure at his residence, and then, by a simple manipulation of the machine, unaided by any chemical substances, heat, electricity, etc., he converted a small portion of the introduced water and air into the cold vapor then contained in his receiver. My credulity, as may be supposed, was taxed to its utmost limit. Before undertaking to enlist a dollar of capital in the enterprise, I instituted the most careful inquiry as to the character of Mr. Keely. Those of whom I inquired endorsed his integrity in unqualified terms; and one gentleman, Mr. Boeckel, for whose mechanical ability and moral integrity I had great respect, and who knew much of the invention, and who spoke without having a fragment of interest in the invention, impressed me greatly by what he communicated to me. So also did Mr. Rutherford, Chief Engineer, U. S. Navy. Thereupon, I had a conversation with Mr. Keely, in effect as follows. I said to him: "Mr. Keely, you profess to be grateful to me for kindnesses received at my hands, the importance of which, indeed, you greatly exaggerate. I am asked to become the exponent of your invention, and to enlist capital for its development. While I may with propriety expend my own money as I please, I cannot, except with greatest caution, enlist the money of others. You, Mr. Keely, know absolutely whether you produce the results which I have seen as you state to have produced them. This, with you, is not matter of opinion, but of absolute knowledge. If, therefore, you do not so produce these results, and I, upon the supposed truth of your statement, am the means of procuring the capital of others to be invested in your enterprise, I will have suffered at your hands as great a wrong as one man can inflict upon another." He reasserted that which he had before said in the most solemn language. I reduced his declaration to writing, and he signed it, I at the same time telling him, in the presence of his wife, that, if I procured a dollar for the enterprise, it would be based upon the truth of his written declaration, which, if false, made him a criminal, and that for my own vindication I would see that he was appropriately punished. With such precautions I visited your city, called together some of your best known and influential citizens—among whom was Charles H. Haswell, Esq., who himself, prior to this time, had visited Mr. Keely's place, seen his receiver when charged with this enormous vaporic pressure, and had reported upon it. I said to these gentlemen that I had not seen Mr. Keely make the power, and therefore had no personal knowledge of how it was done; stating, at the same time, however, the result of my inquiries as to his character as above, and, further, that there was the negative evidence, afforded by the total absence of anything (so far as I could discover) to produce the power other than the simple machine whereby he claimed to produce it. As the result of my interview, the gentlemen present subscribed for $10,00C of the stock of the proposed company. I made Mr. Keely's written declaration a part of my contract with them. They paid to me $3,000. I returned to Philadelphia, and gave this to Mr. Keely; and within two hours, he had paid to the constructors of his machine $2,850 of it.

By the terms of the agreement, entered into by me with these parties, Mr. Keely was obligated, before any further money was to be called for, to explain the principle of his invention. I took with me to his place my engineering assistant, Mr. Bell, and we entered upon the subject, but neither of us—although having before us a sectional drawing of the machine, made from the machine, by Mr. Bell—could understand why the result would follow from its operation, as claimed by Mr. Keely. I so stated to him, and requested that he should repair, put together, and operate the machine (then dismantled), and produce for me the result which he claimed to be able to produce. This he did, giving to me (in the presence of ten other gentlemen, among them Mr. Boeckel, Mr. Rutherford, and Mr. Bell) an exhibition on the night of the 10th of November, 1874, the result of which exhibition I reduced to writing and subsequently to print, for the information of those only who were interested in the enterprise. This report you evidently have seen, as it is commented upon in your article.

After I had written this report, I submitted it to Messrs. Rutherford, Boekel and Bell, for their careful examination, and for their endorsement of it, if they found it correct. They gave it their unqualified endorsement Next, I submitted it to Professor B. Howard Rand, of this city, an eminent scientist, as a precautionary measure, in order that he might, if he could, account for the results alleged to be produced, through any known chemical agencies or laws of physical forces. He said that, assuming the truth of my statements of facts—for he had not seen the machine, and of his own knowledge knew nothing of it—he could not account for the results alleged to have been produced upon any known chemical or philosophical principles; and at my request, he reduced this statement to writing. He was not asked, and did not assume, to endorse the Keely motor, and your assertion that he did so is purely gratuitous, and places him in a false position before the public. With this report thus prepared, I proceeded again to New York, submitted it to the parties with whom I had contracted, stated to them that, while I did not understand the ultimate philosophical principle involved in the production of this vapor, I was convinced that it was produced precisely as asserted by the inventor; that I stood ready to return to them their money previously advanced, if they desired to withdraw from the enterprise. They did not so desire, but on the contrary paid to me the balance ($7,000) of the $10,000 subscribed, which money was subsequently from time to time disbursed for the construction of apparatus connected with the invention. (1) My original contract with these parties gave to them an option of $40,000 more of the stock of the company at its par value. Prior to the agreement out of which this company had its origin, the individuals then holding contracts under Mr. Keely had themselves entered into a contract with some parties looking to the disposal of rights in the New England States, which contract became obligatory upon this, the Keely Motor Company. Under and by virtue of the several contracts, the contracting parties were entitled to an exhibition of the production and practical application of this power. This has been given to them, and was witnessed by about 30 gentlemen, among whom were many men of long and extensive experience in the construction and operation of machinery, such as steam engines, air-compressing machinery, electrical apparatus, etc. As the result of such exhibition, the parties respectfully have, unurged, paid to the treasurer of this company an aggregate, with the ten thousand dollars referred to, of one hundred thousand dollars. This company, with the single exception above referred to, has not sold or offered for sale a dollar of its stock; neither has it desired to give any publicity to its business, until it shall be ready to introduce to the public its machine.

Of the money which has thus been paid into its treasury, Mr. Keely was entitled, in his individual right, to the sum of fifty thousand dollars. This, however, he yielded to the company, stating that he did not desire to make a dollar of profit out of his invention until patents had been obtained, and he had established, to the satisfaction of the world, the validity of his assertions. After having long been living in most humble circumstances and working under great disadvantages, a comfortable house and a convenient workshop have, without his solicitation, been purchased for him, and he is now giving his undivided time to the completion of his structures. That he is endeavoring to "wriggle money out of silly people" or out of any one, I believe to be a monstrous calumny. The money which has been paid into the treasury of the company, it is the declared policy of the company to retain intact for the completion of its various structures now in progress, and for the procuration of letters patent throughout the world. As for myself, I have given to the development of this invention and to the affairs of this company my almost undivided time for a period of several months, having the meanwhile to beg the indulgence of clients for whom I have the charge of important causes, and have not been compensated to the extent of a dollar: my declared policy having been to attest by my actions the confidence that I have professed, in the genuineness and value of Mr. Keely's inventions, resting content to await that moderate degree of fame and of fortune which shall probably be mine, if the correctness of my judgment shall be vindicated in the future. So much, personally, as to Mr. Keely and his "confederates." (2) Now what about the invention?

In my report of November 10, I undertook to narrate as precisely as I could facts which I had observed. I state therein substance, and I now reiterate that I saw:

First: The apparatus, of which I at the time had an accurate sectional drawing made from the machine, subjected to such tests as I believe would have satisfied any intelligent mind, as the tests did satisfy the minds of the eleven persons present, that there was nothing in the apparatus but air at atmospheric pressure.

Second: I saw the inventor blow from his lungs, for the period of, say, 30 seconds, into a nozzle upon the "generator;" then I saw him connect this nozzle by a small rubber tube with the nozzle of his hydrant, and introduce water direct from the hydrant through this rubber tube into the "generator" until say five gallons of water had been thus introduced under a pressure, as indicated by a gage applied to the hydrant, of 26¼ pounds, the communication with the hydrant being then cut off.

Third: A connection being then made between the generator and a register of force, by a tube of one tenth inch bore (the register of force consisting of a piston of one square inch area, pressed down in a cylinder by a lever of the third order, and weighted so as, according to the calculations of Mr. Rutherford and Mr. Bell, to require upwards of 1,430 lbs. to the square inch to raise the lever.) I saw Mr. Keely, by a very simple manipulation of his generator, requiring no more force than a child could exert, make an "expulsion," as he terms it, of his vapor, and with it raise this weighted lever; and this he repeatedly did.

Fourth: I saw him, in the same manner, make expulsions *filling a chamber of 3½ gallons capacity*, with his vapor, at a pressure proved to be a fraction less than 2,000 *lbs. to the square inch*. This operation I saw repeated several times, and saw the produced vapor conducted through a tube of the dimensions aforesaid upon, *not* "a dollar toy engine," but one which did not cost less than two hundred and fifty dollars to construct, which was run at a speed of several hundred revolutions a minute, developing no inconsiderable power. (3) These expulsions were made in an inappreciable period of time, unaccompanied by noise or the use of heat, and without appreciable production of heat.

Now, what I assert is stated not as matter of *opinion*, but of *fact*. You may deny the fact and assert that I falsify. If so, I retort that you are ruthless traducers of character, and will hold you personally responsible for defamation. Again, you may, with propriety, assert that I am mistaken. To this, I will reply that what I saw was witnessed by ten other gentlemen, who will at any time attest to my accuracy, and three of whom, at least, were of equal ability with yourself. Again, you may accept the truth of the facts and undertake to account for the results upon other hypotheses than as claimed by the inventor, and to disparage their importance. You have in your article of the 26th inst. undertaken to account therefor. While I have not space to review your attempted solution of the matter, I will simply say that, if the writer of your article had seen and examined Keely's generator, and another, not seeing it, had written what appears in your columns, your editor would have said he was a fool. I simply say he is mistaken. Again, I have repeatedly seen, in Mr. Keely's workshop, a receiver with a capacity of twenty-six gallons, containing his vapor at a pressure of 10,000 lbs. to the square inch: I have seen this vapor conducted through a tube of one-tenth inch bore to an engine which was propelled by it at a speed of about 1,500 revolutions a minute, developing a power of certainly 10 horses. This fact I can corroborate by the testimony of scores of persons: among them some of your best known and most influential citizens. You think that we confound "pressure with power." We do not. We understand, probably as well as you do, the distinction between "pressure" and *vis viva*. You may say, accepting the fact, that it is condensed air. If so, please enlighten us as to the means whereby it could be so condensed. You may say that it is a gaseous product from chemical action; remarking that this vapor is totally negative in its properties and pure as mountain air, please inform us from what chemical substances it may in your opinion have been produced. I append hereto some communications addressed to me on this subject.

In conclusion, I would repeat that the Company I represent is a private corporation. It does not offer, nor has it offered, its shares in the open market, nor can it be held responsible for the action of individuals who, having acquired, may have again offered its shares, which was, however, their undoubted right. It will not, in "thirty days," though I believe it will before many months have expired, exhibit to the world that which it claims to have. In the meantime, it has not sought nor does it now seek notoriety; but the invention on which it is based having, through newspaper correspondents, been publicly discussed, we must expect, and do not shrink from, fair and legitimate criticism; and if you

Messrs. Editors, can satisfactorily explain or account for indisputable results which are astonishing in their character, and have produced profound impressions upon many excellent and able men, no one will be more grateful to you than

CHAS. B. COLLIER,
Attorney and Counsel, Keely Motor Co.
702 Chestnut street, Philadelphia, Pa. June 28, 1875.

(1) REMARKS.—It appears, from your present evidence, that Professor Rand never saw your machine, nor your cold gas or vapor, and yet you induced this eminent scientist to give you a professional certificate about nothing, which, with other statements, you submitted to the New York capitalists on behalf of the Keely Motor, and they paid you $7,000.

(2) See our remarks on page 33.

(3) In your report you affirmed that you ran a small beam engine, but did not give its size. We stated that, "judging from the Barker wheel with 2½ inch arms, this 'beam engine' was *probably* about the *size* of a dollar toy engine." You now state that the engine cost not less than $250; but you are silent as to *size*. Mr. Gloeker, however, tells us that it had a 3-inch stroke with 3-inch cylinders. You say in your report that you ran this miniature engine at the rate of 400 revolutions per minute, but you do not venture to affirm that you ran it for so long a period as one entire minute. You state, however, that you worked *the whirligig* for that space of time. "At 9:8 P. M. the reaction wheel was again rotated until 9:9 P. M." This is the only complete period of running time cited in your report for either of the little devices. It was on the strength of this contemptible exhibition, made to you by Keely, so you now tell us, coupled with your report thereof backed by Haswell's and Rand's certificates, that you got the New York parties to pay up the balance of their $10,000 subscription. We accept your confession of facts without denial.

Communication of John W. Keely.

CHAS. B. COLLIER, ESQ., Attorney Keely Motor Co.:

In view of publications in the SCIENTIFIC AMERICAN deriding me and my invention, I feel it to be my duty to depart from my intended policy of making no public declaration relative to my invention. I now publicly assert that I have produced the results which many persons have seen, in the precise manner heretofore stated, to wit, the introduction of atmospheric air into my machine, a limited quantity of natural water direct from the hydrant at no greater than the ordinary hydrant pressure, and the machine itself, which is simply a mechanical structure. With these three agents alone, unaided by any and every chemical compound, heat, electricity, or galvanic action, I have produced, in an inappreciable period of time, by a simple manipulation of the machine, a vaporic substance, at one expulsion of a volume of ten gallons, having an elastic energy of ten thousand pounds to the square inch (4). This I solemnly assert, and am ready to verify by my oath. I only ask of the public their indulgence until a new and perfect machine, now rapidly approaching completion, is finished when I will publicly demonstrate that which I now publicly assert.

Philadelphia, June 25, 1875. JOHN W. KEELY.

(4) Counsellor Collier gives, on the preceding page, a more detailed statement of the way you produce your "cold vapor," as ascertained by himself and "scores" of intelligent witnesses. He does not agree with you that it is done "in an inappreciable period of time." He affirms that you blow into the "generator" for half a minute, that you then turn in five gallons of water, and then proceed to manipulate the machine, when the "vapor" appears. Juggles more marvelous than yours have been executed by skilled practitioners in less time than you require.

Communication of G. F. Gloeker.

CHAS. B. COLLIER, ESQ., Attorney Keely Motor Co:

DEAR SIR:—Having constructed for John W. Keely, Esq., the multiplicator with which he operated on the 10th of November, 1874, referred to in your report, I desire to state that said multiplicator is correctly represented in the sectional drawing made by Mr. J. Snowden Bell, and now in your possession. I further state that, in said multiplicator, there are no secret chambers or recesses in which chemicals or compressed air could be contained, and no spaces not fully accessible to a stream of water passed through the apparatus; further that, in said apparatus, there are no pistons or moving parts other than valves.

I have also constructed for Mr. Keely a vertical direct-acting double cylinder engine, having cylinders of 3 inches bore and 3 inches stroke, and a fly wheel 24 inches in diameter and 4 inches face, weighing 200 pounds, which engine I have seen rotated at a speed of not less than 300 revolutions per minute with vapor generated in said multiplicator.

A small wrought iron chamber, of a capacity of 1¾ gallons, which I made for Mr. Keely, was delivered to him by me on May 13, 1875, about 8 A. M., the chamber being at that time open at one end; and upon the evening of the same day, said chamber, to my knowledge, contained vapor at a pressure of 10,000 lbs. per square inch and upwards, as evidenced by both a gage and a weighted lever.

I am 51 years of age, and have been employed at the Port Richmond Iron Works of Messrs. I. P. Morris & Co., Richmond and York streets, Philadelphia for nearly 26 years last past. I have for a long time been in charge of their tool room, and in the course of my experience at their works have had knowledge and observation of machinery of various descriptions constructed by them. In view of recent publications respecting the Keely motor, I submit the above statement as an evidence that my experience has been such as to enable me, at least, to form a correct judgment as to the the operation of apparatus of my own construction.

Respectfully yours, G. F. GLOEKER.
Philadelphia, June 25, 1875.

Communication of Wm. Boekel.

PHILADELPHIA, PA., June 25, 1875.

CHAS. B. COLLIER, ESQ., Attorney Keely Motor Co.

SIR:—In answer to the accusation published in the SCIENTIFIC AMERICAN newspaper, that I have, with others, been engaged in a fraud upon the public, through my connection with the invention of Mr. Keely, I desire to state as follows:

I am now 50 years of age, have lived in Philadelphia since 1848, and have devoted my lifetime to mechanical pursuits, in the practice of which I gain my livelihood. I refer to all who know and deal with me as to my honor and integrity. Had the editor of the SCIENTIFIC AMERICAN instituted inquiry as to my private character and business standing, he might have been fully impressed with the responsibility he incurs in denouncing me as a confederate in fraud of any description, more especially in reference to my connection with a matter of which he knows absolutely nothing.

I have read the communication of John W. Keely, of this date, addressed to you. I have for several years been intimately acquainted with him, and with his inventions. I have seen him produce many "expulsions" from his generator, whereby, to my own personal knowledge, he evolved a cold elastic vapor, in volume of 3½ gallons, at a pressure of about 2,000 pounds to the square inch. I believe that it was impossible for him, if he had so desired, to practise any deception in the matter; and from what I have seen, together with my intimate knowledge of the construction of the machine and its operation, I have no doubt whatever that he produces the results just as he claims to do, and as stated in his said communication. Respectfully yours, WM. BOEKEL.

Communication of H. C. Sergeant.

CHAS. B. COLLIER, ESQ., Attorney Keely Motor Co:

DEAR SIR:—My acquaintance with Mr. John W. Keely began about one year ago, and I have been permitted, from time to time, to witness certain exhibitions made by him with his vaporizer or generator, producing a vapor, transmitting it to, and running his engines. I have been permitted to examine the internal construction of his generator, and I am fully satisfied that Mr Keely has discovered that there exists a power in air and water which, by purely mechanical manipulation, will evolve a cold vapor; and, by peculiar graduations of his machine, he is capable of producing a pressure of 10,000 to 15,000 lbs. per square inch in a receiver of greater volume than that contained in his generator, with great rapidity and certainty. Yours very respectfully,

HENRY C. SERGEANT.
382 Second Avenue, New York, June 26, 1875.

This gentleman, in another confession of faith in the Keely motor, published in the New York *Times* of July 3, 1875, says:

"One of the remarkable things about the Keely motor is that it (the new vapor) cannot be transmitted at a lower pressure than 1,000 lbs. (per square inch). It can be used, of course, at a lower pressure, after it is put in action. It can be regulated like steam, but its transmission at less than 1,000 lbs. pressure causes its condensation."

This is a curious statement for an intelligent steam engineer to make. If its transmission at a less pressure than 1,000 lbs. causes its condensation, then it must necessarily condense when moved under any circumstances below that pressure. It cannot be used unless it is "transmitted."

Communication of Chas. H. Haswell.

NEW YORK, June 26, 1875.

CHAS. B. COLLIER, ESQ., Philadelphia, Pa.:

DEAR SIR:—Your letters of the 23d and 24th instants, in relation to a brief communication of mine, in reply to an unfounded assertion in one of our city papers, are this day received; and although I am indisposed to make any communication regarding the Keely motor until its elements of operation are made known to me, I cannot refuse to reply to your queries as to the nature and extent of such of its operations as have come under my observation, and my deductions therefrom.

Referring, then, to your several queries, in the progressive order of the operations submitted to and observed by me, I advise:

1st. I have witnessed the development, by Mr. Keely, of a cold vapor, void of pungency or of temperature in excess of the surrounding atmosphere, having an expansive energy of fully 7,800 lbs. per square inch, as tested by my measurements and computations thereon.

2d. I have been present when Mr. Keely has applied a like vapor to an Ashcroft gage, and the index pointed to a pressure of 10,000 lbs. per square inch; and upon writing to Mr. Ashcroft, to advise myself of his capacity to make such a gage, he replied that he had made gages that would indicate such pressure, and that he had delivered some of them at Philadelphia.

3d. I have satisfied myself fully and conclusively that the instrument of Mr. Keely was operated wholly independent of any external attachment, other than that of a chain suspension and a flexible connection with a water service pipe.

4th. I have seen a double cylinder engine, 3 by 3 inches, operated by a like vapor from a reservoir, through a conducting pipe eight feet in length, and having a bore of but one tenth of an inch diameter, although it was resisted by a friction load equal to 2,250 lbs. per square inch, and which engine I individually operated for a period of 15 minutes without any visible reduction in its speed, or indication of the exhaustion of the intensity of the vapor in the reservoir from which the supply was drawn.

5th. I have seen reservoirs which were said to contain vapor at pressures of 5,000 and 10,000 lbs. per square inch, and in volume of 2 and 26 gallons, but my only means of verifying such pressures were in the operation of the engine and the indication of the steam gage referred to.

6th. I am of the conviction that the vapor is not generated by any chemical decompositions or heat, or that it is atmospheric air compressed by an external connection.

7th. I was present upon one occasion only when Mr. Keely essayed an "expulsion," as he terms it, that is, the operation of generating the vapor, and the result was not sufficiently conclusive whereon to base a conviction of its integrity, although the imperfection of the development was very reasonably attributed to the imperfections of the original and rude instrument of generation.

In conclusion, my assertion, in the communication referred to, was that I have never endorsed the integrity of the Keely motor; and my declaration is, I do not now do it, and for the manifest reason that I am wholly ignorant of the manner in which the vapor is generated; and in the consideration of a physical operation, I could not, in the absence of a knowledge of its elements, endorse the declaration of any one.

My position has been confined to reporting that which I have seen. I have said, however, and I now write, that Mr. Keely has submitted to me a cold vapor of an expansive energy of fully 10,000 lbs. per square inch, that in its character and in the instruments of its generation it is wholly novel, and that, if he can generate it with the facility, economy, density, and continuity that he declares, he has arrived at a result hitherto unattained, and one that is as valuable as it is novel; but until I am in the possession of the elements of generation of this vapor, I cannot arrive at any satisfactory conclusions as to its merits.

I am, very respectfully, yours, etc.,
CHAS. H. HASWELL.

Mr. Haswell, it will be observed, strongly asseverates that he does not now and never did endorse the Keely motor, being wholly ignorant of the manner in which "the vapor" is made, or the physical operation, by which it is produced. He further intimates that the attempt to manufacture the vapor in his presence was a failure. At the same time, he affixes his name to a certificate which more strongly supports the deception than any document which the parties immediately connected with the "generator," and who know all about its "physical operation," have ventured to sign. It appears, from Collier's statement, to have been mainly on Mr. Haswell's report that the New York people were induced to pay their money.

In the fourth paragraph of the above, Mr. Haswell fails to state the speed of the engine or the capacity of the reservoir. But according to the Keely Company's account of the apparatus used during the exhibition at which Mr. Haswell officiated (see SCIENTIFIC AMERICAN, May 2, 1874), the "generator" was of globular form, 3 inches thick and about 15 inches in exterior diameter, connected with an iron cylinder 40 inches long, 4½ inches interior diameter, capacity 3¼ gallons.

Mr. Collier has rated the speed of the engine at 400 revolutions per minute. Mr. Haswell's statement in the fourth paragraph, therefore, purports that, from a generator containing about 3¼ gallons of the vapor, he personally operated a double cylinder engine, having cylinders of 3 inches bore and 3 inches stroke, for a period of 15 minutes, without the least indicated reduction of the pressure contained within the generator. If we are wrong in this estimate, Mr. Haswell will correct us.

Communication of J. Snowden Bell.

CHAS. B. COLLIER, ESQ., Attorney Keely Motor Co.:

DEAR SIR:—Having been cited in an issue of the SCIENTIFIC AMERICAN, dated the 26th inst., as one of the "confederates" of Mr. John W. Keely in a "juggling exhibition," etc., I desire to state:

1. My connection with the operation of the invention of Mr. Keely, which is designated as above, consisted in my attendance upon an exhibition thereof, given by him November 10, 1874, and in my attestation, over my signature, of the correctness of a report, made by yourself, of said exhibition.

2. Such attestation was given after a thorough and critical examination of the working of the apparatus of Mr. Keely, and related solely to matters of fact entirely within my own knowledge. I now publicly and emphatically reiterate and reaffirm my endorsement of said report, and declare further that, if I desired confirmation of the evidence of my own senses, I should find it in the utter inability of the most determined opponents of the invention to furnish any "deception" theory, accounting for the results produced, which is compatible with the conditions of the operation, as witnessed by me.

3. I have examined the patents mentioned in the SCIENTIFIC AMERICAN article above referred to, and find that there is no manner of analogy between them and the invention of Mr. Keely. As to the suggestion of an experiment to be made with "ten communicating water tubes," I have to say that, while I am prepared to admit that the exertion of 620 pounds initial pressure upon air in a close vessel would evolve a corresponding resultant, I am unable to perceive what relation exists between such familiar fact and the evolution of vapor of 2,000 pounds pressure to the square inch from water and air at an initial pressure not greater than 26 pounds to the square inch. I further admit that, if a weight of 1 pound be hung upon the long arm of a lever, the arms of which are to each other as 10,000 to 1, it will balance a weight of 10,000 pounds upon the short arm; but as no such lever was used in the exhibition of November 10, 1874, this *explanation* must likewise be dismissed as *insufficient*.

Respectfully yours, J. SNOWDEN BELL,
Mechanical Engineer.

Communication of Wm. H. Rutherford.

PHILADELPHIA, June 26, 1875.

CHAS. B. COLLIER, ESQ., Attorney Keely Motor Co.:

DEAR SIR:—I have read the editorial article which appeared in the SCIENTIFIC AMERICAN advanced issue, dated 26th inst., entitled "The Keely Motor Deception," and presume I am included as one of the "confederates" of Mr. Keely, with yourself and others.

I was present at the exhibition given by Mr. Keely on the night of November 10, 1874, of which you made a report dated November 13, 1874. This report being submitted to me, I carefully examined it, and gave to it, and to the conclusions therein stated, my unqualified endorsement, and I now re-affirm the same.

I have read the communication of Mr. John W. Keely addressed to yourself dated the 25th inst., and of my own knowledge can and do attest to the truth of that which he therein asserts. Respectfully yours, W. H. RUTHERFORD,
Chief Engineer, U. S. Navy.

(6) The following is, substantially, the report of the Keely exhibition of November 10, 1874, which Mr. J. Snowden Bell, M. E., desires now to "publicly and emphatically reiterate;" and to which W. H. Rutherford, Chief Engineer U. S. N., now re-affirms and gives his unqualified endorsement:

"Mr. Keely then proceeded to make an "expulsion," that is to say, to develop a force or pressure from the multiplicator sufficient to exert a pressure of 1,430·36 lbs. This he did by blowing from his lungs, for, say, thirty seconds, into the nozzle upon the multiplicator. He then shut the cock and turned on the water from the hydrant. The operation was completed in about two minutes after the attachment to the hydrant was made, by simultaneously opening two cocks upon tubes connected with the first and second drums, when the lever and weight of the force register were raised." The operation of the engines now took place as follows

"A short tube, carrying upon its end a reaction wheel or 'Barker's mill,' having two arms of about two and a half inches long each, was screwed upon the reservoir, and, at 9:03 P.M., was put into rotation at a very high velocity, by the manipulation of two cocks. At 9:05 P.M., the reaction wheel was removed, and connection applied to a small beam engine, which was rotated at 400 revolutions. At 9:08 P. M., the reaction wheel was again rotated until 9:09 P. M." The machinery was then stopped, and the gaseous fluid allowed to escape against a candle flame and blow it out. At 9:15, the engine was run again for a few turns. "At 9:17 P.M., the reaction wheel was run again, and at 9:20, the experiments being concluded, the multiplicator was taken apart and inspected by those present. There was no heat perceptible in any part of the apparatus." These remarkable pieces of machinery were, according to this report, run for a minute or two at a time, at various intervals, extending over an entire period of 15 minutes. There was no heat and no noise save that of running water when the ear was placed against the multiplicator.

"The report, after giving the foregoing facts in regard to actual performances, summarizes the results, which we condense as follows: 1. The invention produced a series of gaseous expulsions of 2,000 lbs. per square inch. 2. The force was almost instantly produced. 3. It moved instantly through a distance of 12 feet. 4. It was attended with no noise. 5, 6. Nothing was or could have been introduced into the apparatus to produce the force. 7. No heat, electricity, or galvanic action was discernible, except that electric sparks were observed in the spur gearing of the engine, caused by friction. 8. Hydrant water, 26 lbs. to the inch, was admitted. 9. The water was drawn off unchanged after the performance. 10. The vapor had no smell or taste, and did not burn. 11. The interior of the apparatus was found to contain no residuum or substance other than air and water. 12, 13. The operations were conducted by gas light. Every facility for the closest investigation was offered to the persons present."

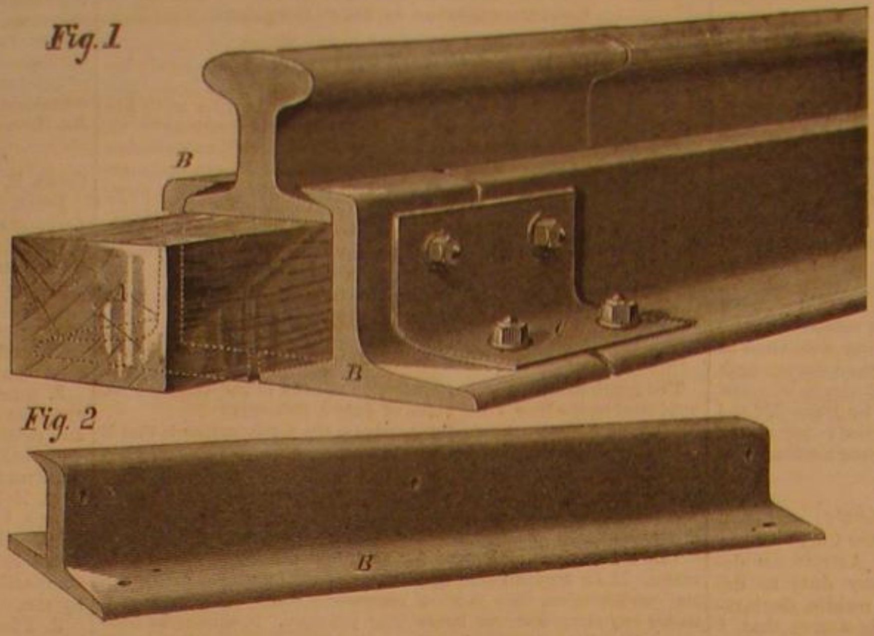
IMPROVED RAILWAY TRACK.

The invention illustrated herewith consists in securing the rail upon an elastic continuous bed, by a simple method of fastening which dispenses with the nuts, bolts, and other means usually employed for that purpose. The principal advantages claimed are that the wear of rail and rolling stock will be lessened, and that there will be less probability of breaking rails owing to the elasticity of the bed.

A, Fig. 1, is a wooden beam which forms the bed upon which the rail rests. The base of the rail and all of the beam are inclosed in the space formed by the inverted T-shaped metal bars, B, one of which is shown detached in Fig. 2. These have inner base flanges which meet beneath the beam. The bars are tied together by metal plates, C, and screw bolts, the nuts of the latter being prevented from working loose by the elasticity of the wooden bar. The vertical part of each of the bars, B, is curved inward at the top, forming ribs which bear on the base of the rail.

The inventor states that the cost of altering the tracks of a road, to conform to the above described plan, will involve only the extra expense of a light steel or iron rail, as the old rails will make the flanged pieces, and the saving of ties, the sleepers. The flanged pieces are put together with alternate splices, and their hold on the rail increases proportionally with the load. They are easily loosened by inserting a bar under the bases and prying upward, this causing their upper portions to spread apart, when the rail and bed may be readily removed.

Patented March 3, 1874. For further particulars address the inventor, Mr. Geo. Potts, Unionport, Jefferson county, Ohio.



POTTS' RAILWAY TRACK.

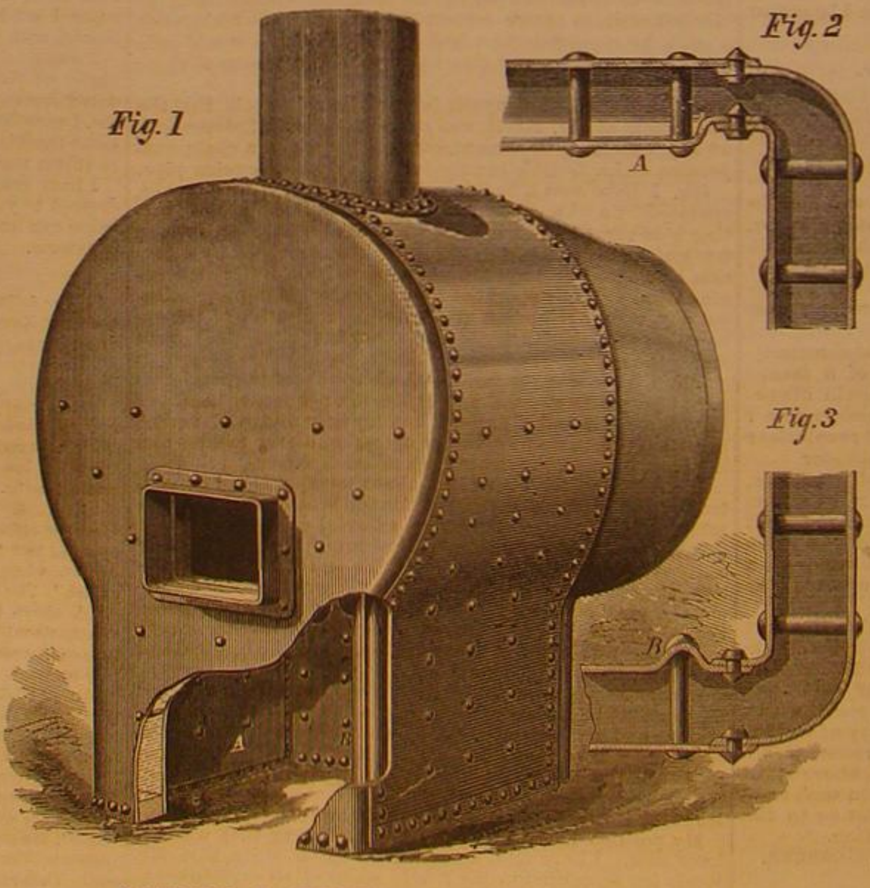
Uninflammable Products.

It is well known that certain substances, notably phosphate of ammonia, incorporated in the fibers of tissues render the same incombustible, or, rather, admit of their burning very slowly and carbonizing with the production of flame. M. L' Abbé Mauran, says *La Nature*, has recently discovered that a mixture of borax, sulphate of soda, and boracic acid, in suitable proportions, while rendering cloth uninflammable, will also prevent any alteration of color, flexibility, or lasting qualities through the effect of combustion.

IMPROVED FIRE BOX FOR LOCOMOTIVE FURNACES.

It is a common fault in locomotive furnaces, made in the usual way, that the flanges and rivets of the end sheets, at the points where they are connected to the side sheets, soon become burnt, and thus cracked and leaky. The result is that the end sheets have to be renewed several times before the sides are worn out, involving considerable trouble and expense. To obviate this difficulty, the invention illustrated in the annexed engraving has been devised, and it consists in forming the side sheets to bulge inward throughout the entire width, as shown in Fig. 2, at A; or where the central portion of the sheet is on the same plane as the joints, bulges, B, Fig. 3, may be made adjacent to the flanges to protect said joints. In Fig. 1 is given a view of the interior of the fire box, showing that the device causes but a slight modification of the usual form. By this means, it is claimed, the joints are protected from the intense heat of the fire, and are preserved and rendered as durable as any other portion of the furnace. The cost for the labor of making a locomotive fire box of this design is, we are informed, only three to five dollars in excess of that of constructing the box in the usual way. The iron for the side sheets is required to be from one and a half to two inches longer than when the sheets are made straight.

Patented through the Scientific American Patent Agency, April 27, 1875. For further particulars address the inventors, Messrs. W. Dawson and J. Hughes, Scranton, Pa.



DAWSON & HUGHES' LOCOMOTIVE FIRE BOX.

Spirit Photography under a Cloud.

M. Buguet, of Paris, a spirit photographer, came to London early last summer, and, after advertising in this journal for premises, he obtained them, where he received many visitors and sitters. Was not the genuineness, it was asked, of the spiritual origin of the Buguet photographs attested by Mr. W. H. Harrison, a whilom contributor to this journal, and the present editor of the *Spiritualist*? And did not a whole host of *dilettanti*, including the names of some who stand very high in Science, say it was all correct? And were not all the uncles, aunts, grandfathers, grandmothers, and other relatives of several of the sitters recognized in these spirit photographs? All this, we admit, is quite true.

Returning to Paris from this country, and laden with what were the equivalents of testimonials from men of note—fellows of the Royal Society, lecturers in University College, editors, and simple commoners—M. Buguet practised "spirit photography" with renewed zeal in that gay capital. Parisian policemen seem to have been materialistic to an unusual extent; they wished to know more about this kind of practice. One fine morning two of the "force"—one of them an inspector, the other a photographer—called upon M. Buguet to have a spirit photograph taken. Waiting till the dark slide with its sensitive plate was about to be inserted in the camera, they produced their warrant, had a developer applied to the as yet *unexposed* plate, and saw a "spirit" developed. A search was then made, the originals of this and other spirit forms were discovered, and the ingenious photographer was subsequently lodged in "durance vile," from which, after confessing that he was an impostor, he was liberated on bail. In the meantime spirit photography has still many true believers in London; and, although the editor of one of the weekly periodicals devoted to this topic denounces Buguet as a "thorough scoundrel," that of the other looks upon him as a kind of Galileo, who has made a confession he knows to be untrue in order to be released from prison, quite overlooking the fact of the seizure, by the police, of the tools and implements by which the trade in the so-called "spirit photographs" was carried on.

It is said, however, that many of the "spirits" evoked by M. Buguet have been recognized. Far be it from us to say that they have not; but we do not travel beyond our own experience in such matters when we assert that a muslin mask, fastened upon the face of a courageous medium, has been recognized, by a person of more than average intellectual powers, as a deceased relative; and that in a deposition of silver on the back of a wet collodion plate, caused by contact with our own fingers, the bearer of a name well known in spiritualistic circles has recognized a visible manifestation fraught with much interest. Surely, one might say, if spirit photography be the incontestible fact some people say it is, there ought not to be much difficulty in convincing the world of the reality of such fact, and this opinion we endorse.—*British Journal of Photography.*

Sir John Franklin's widow is hopelessly sick

Remarkable Railroading in Switzerland.

A railroad has recently been opened to the summit of Mount Uetliberg, Switzerland, which overlooks, at a hight of about 1,300 feet, Lake Zurich, and is much visited by tourists for the sake of the view. The total length of the road is about 30,000 feet, or more than 5½ miles. The lowest grade is 232 feet per mile, but 59 per cent of the whole length is of grades exceeding 264 feet per mile. The curves are of 500 and 450 feet radius, the latter coinciding with a grade of 327 feet per mile. The track is of the standard gage, and the rails, of iron, weigh 60 lbs. per yard. There are three tank locomotives of the Krauss pattern, with six drivers coupled, each 36 inches in diameter, and with a wheel base of only 6 feet 8 inches. They weigh 41,800 lbs. empty, and in service, from 52,800 to 55,000 lbs. The heating surface is about 770 square feet, the diameter of piston 12½ inches, the stroke 21½ inches.

The first ascent was made April 24 of this year. The engine pushed up three cars loaded with ballast and workmen, a total gross load of 27½ to 30 tuns. This load was moved without difficulty at a speed varying from 8 to 10½ miles per hour, maintaining a steam pressure of 170 lbs.

The descent is made with compressed air, by means of an apparatus used on the engines of the Rigi Railroad. The speed was 15½ to 18½ miles per hour.

At trials made by the professors of the Zurich Polytechnic School, the weight hauled was about 627½ tuns, the traction exerted about 7,500 lbs., and the work about 200 net horse power.

A peculiar feature in the working of this road is the use of a jet of water against the rails, in front of the wheels of the locomotive, sufficient to wash the rails completely. It was observed long ago that the influence on adhesion of a slight humidity such as that deposited by a fog, and that of a veritable layer of water deposited by rain, are entirely different. On the Swiss Central Railroad, a jet of water is used on the front wheels of certain engines to facilitate the passage around curves, and the effect on the durability of the ty es has been remarkable; but this jet of water, which was only intended to lubricate the inside part of the rail head, moistens the whole surface in contact with the tyre. No modification of the adhesion has been observed as the result of this; this jet of water does not dispense with the use of sand, while at Uetliberg absolutely no use is made of sand, but water is employed exclusively.

Another Swiss mountain railroad, the Rigi Kulm and Lake of Zug line, is about seven miles long; six miles of it are worked with a peculiar cogged wheel arrangement, or something similar in effect, by which grades of 1,056 feet per mile are surmounted, there being one section more than a mile and a half long with a grade very little less. The radii of the curves, which are uniform, is 600 feet.

Water and its Inhabitants.

The quality of water in relation to its fauna and flora has been the subject of investigation by some of the French Academicians. In substance, the results seem to prove that water in which animals and plants of higher organization will thrive is fit to drink; and on the other hand, water in which only the infusoria and lower cryptogams will grow is unhealthy. If the water become stagnant and impure, aquatic plants of the higher order will languish and disappear, and the half-suffocated fish will rise near the surface and crowd together in parts where there may still be a little of the purer element trickling in, and if driven from these places they soon die. *Physa fontinalis* will only live in very pure water; *valvata piscinalis* in clear water; *limnæa ovata* and *stagnalis* and *planorbis marginatus* in ordinary water; and finally, *cyclas cornea* and *bithynia impura* in water of middling quality; but no mollusk will live in corrupt water. Plants also exercise a reactive influence on the quality of water. The most delicate appears to be the common water cress, the presence of which indicates excellent quality. Veronicas and the floating water weeds flourish only in water of good quality. The water plantain, mints, loosestrife, sedges, rushes, water lilies, and many others grow perfectly well in water of moderately good quality. Some of the sedges and arrowheads will thrive in water of very poor quality. The most hardy or least exacting in this respect is the common reed, or *phragmites communis.*

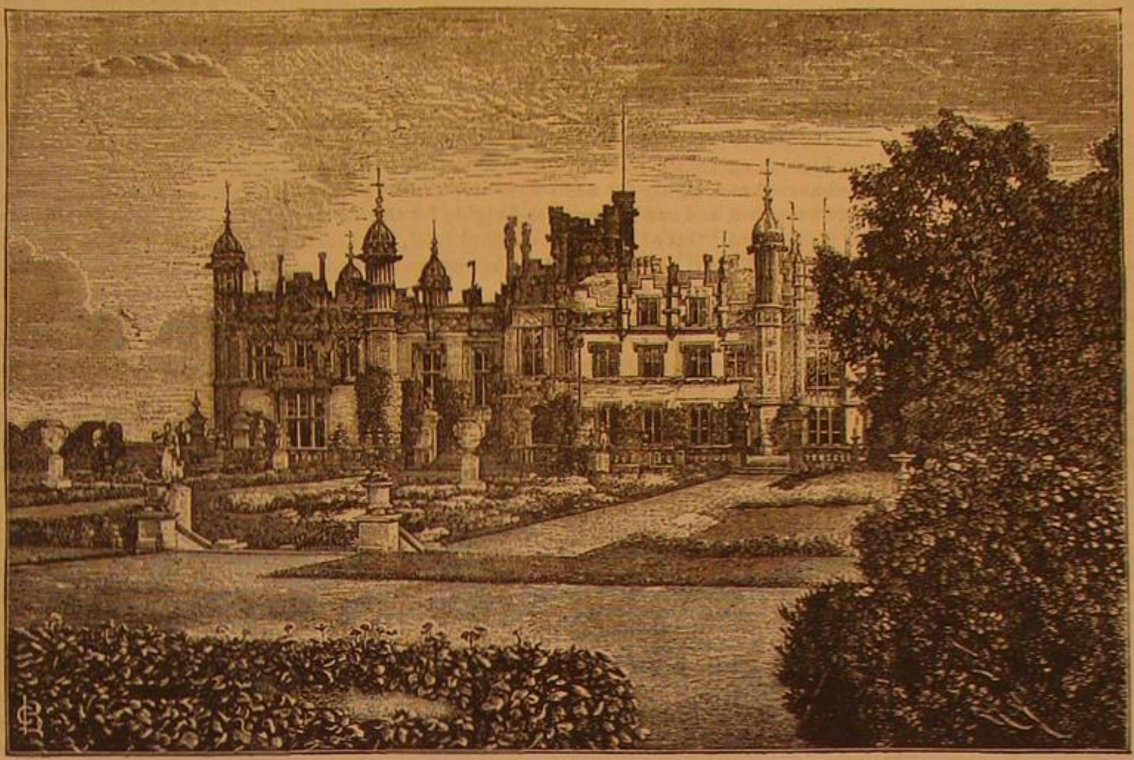
It is said that iron goods treated as below described, acquire a bright surface, having a white glance without undergoing any of the usual polishing operations. When taken from the forge or rolls, the articles are placed in dilute sulphuric acid (1 to 20) for an hour; they are then washed clean in water, dried with sawdust, dipped for a second or so in nitrous acid, washed and dried as before, and finally rubbed clean.

KNEBWORTH PARK, HERTFORDSHIRE, ENGLAND.

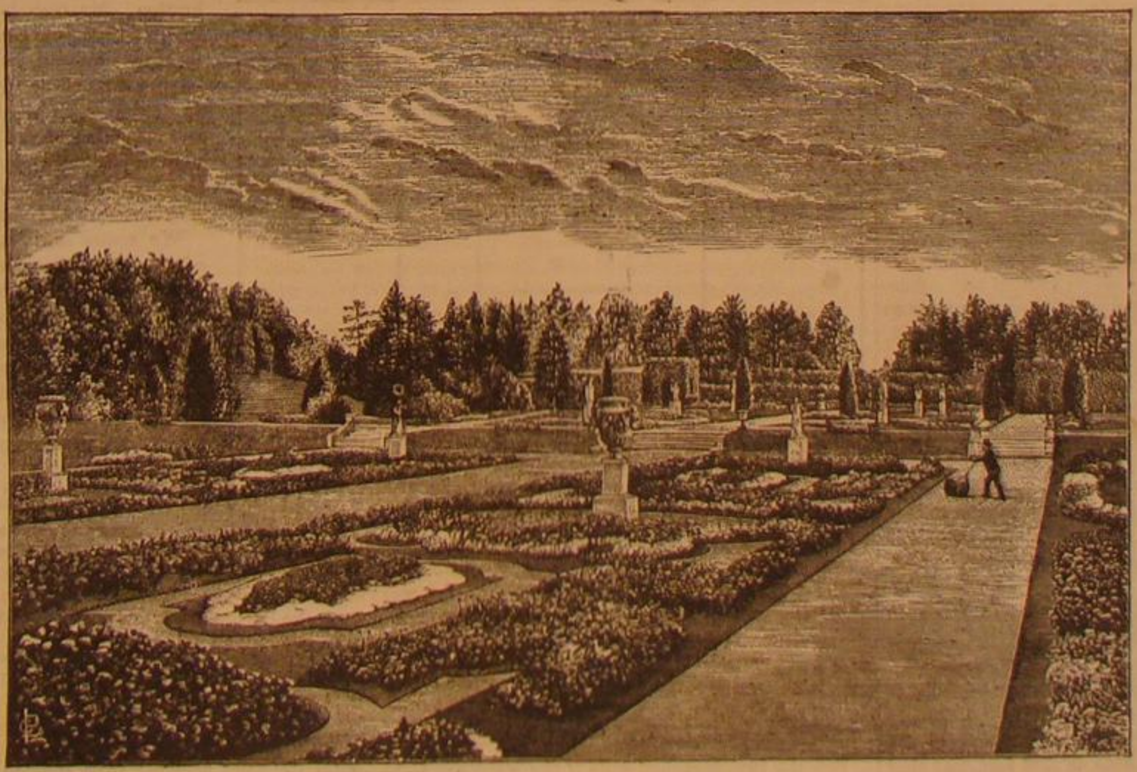
To every student of English literature, the name of the late Lord Lytton is familiar. Few there are who have not read the charming productions of his pen; and though he has passed away, he has made for himself an enduring name apart from all inherited or bestowed. But though his works have been read by myriads, yet those who have seen his residence and its gardens may be counted only by hundreds. He was a man of taste, and hence it might be expected he would by no means neglect his garden; and though in size and appliances it has no pretension to rival many of the great establishments, it is, nevertheless, one of the prettiest gardens we know.

Knebworth Park covers about three hundred acres of nearly the highest ground in the county of Hertford. The manor passed into the possession of Sir Robert Lytton in the fifteenth century, and it has continued in the possession of his descendants. The ancient manor house was pulled down in 1811, and the present mansion erected on nearly the same site. Of the west or garden front of this, our first engraving is an accurate representation, and, owing to the elevation of the site, the tower, which forms a prominent feature in the architectural design, commands the view of a wide range of the surrounding country. Extended before it is a flower garden on grass, the beds framed in gravel, plentifully embellished with vases and statuary, and covering altogether about four acres. The design is somewhat complicated, and from its character difficult to plant so as to combine harmony of color with variety, while the number of plants required, some 36,000, is large for the means of producing them. The effect, however, as will be seen from our second engraving, is excellent; and though at the time of our visit the glory of the flower beds had departed, enough of their beauty was left to show what it had been when they were in their pride. The lawn surrounding the beds is beautifully kept, and extends on both sides of the broad central walk to the high laurel hedges which form the boundary of this garden. It is dotted with some fine araucarias, wellingtonias, cryptomerias, and other conifers. Some of the araucarias, after the dry summer of 1866, appeared, to be dying, but Mr. Kipling, the gardener, gave them a good mulching of loam, leaf soil, and a little well decayed manure, and they improved wonderfully. The ivy-covered summer house on the mound on the southwest side, and which forms a conspicuous object in our second view, commands a good view of the flower garden and mansion, and, in a clear day, of the surrounding country.

An old flower garden has been turned into a rosary, in which it is contemplated to carry pillar roses on arches over the surrounding walks.—*Journal of Horticulture.*



KNEBWORTH HOUSE, ENGLAND.



GARDENS AT KNEBWORTH, ENGLAND.

Modern Blasting Agents.

In a paper on this subject, recently read by Mr. Noble before the Society of Arts, the author thus explains the reasoning which led to firing slow explosives by local detonation: "When a hammer strikes a very thin layer of nitro-glycerin on an anvil, the blow produces a strong compression of the liquid, which liberates heat and raises its temperature to the point at which it detonates. But only that part which actually receives the blow explodes. If, however, the hammer is very heavy, and the blow strong, the explosion is no longer confined to the part which receives the direct shock, and the whole goes off. A local detonation, owing to the immense tension of its gas, must be very similar in action to a strong blow, and will thus compress the explosive liquid which surrounds it, causing it to detonate at will and to propagate the explosion throughout the whole mass by the same means. Whether that theory be correct or not, it led to a result which affords considerable facilities for the utilization of modern explosives. It enables us, with or without confinement, to turn a solid or liquid substance of very harmless appearance instantaneously into gas which occupies the same or nearly the same bulk, but has an expanding tendency which, for nitro-glycerin gas, must come near a pressure of 500 tuns per square inch."

Bicycle Riding.

This is a sport confined to a select few in this country; but in England it is extensively practised, with great satisfaction by the riders. Some of them give their experience in the *English Mechanic* as follows: L. Striffler, Secretary of Zephyr Bicycle Club, Moston, says: "I have had a roadster made to order, with a 51-inch driver, and it only weighs 30 lbs., and is plenty strong enough. I have discarded the brake as a nuisance, a danger, and extra weight. The best brake is your feet on the pedals, holding back; and if the hill is so steep that it overcomes you, then you may depend it is not safe to ride down, but get off and walk. Always lean well back when descending a hill, and incline forward when ascending, or when riding against a head wind. When riding on a tolerably level road, and especially if going fast, keep upright and firm in your saddle, and you will have no fear of a spill if you happen to come against a stone. Of course, the use of the step is an absolute necessity with our present sized machines, as far as mounting is concerned. I prefer vaulting off from the treadle, as it saves feeling about with your foot for the step, and perhaps catching your toe in the front wheel spoke. If you are riding through a town, if the same be paved and wet, be very careful about turning, as the mud which accumulates in towns seems to acquire a greasy consistence, and seems to completely lubricate the road; and if you turn sharply, your wheel runs away sideways, and you find yourself on the ground. I think it is wise to walk through towns if they are paved, and especial- if wet, as you cannot get any speed, and it is no comfort to yourself, and the incessant jolting has a tendency to loosen your spokes. When going through a country town with macadamized roads, it is glorious to slip through at railway speed and astonish the natives; but whenever I come to a piece of ground which is paved with sets or rubble stones, let me get off and take pity on my good steed."

B. Travis says: "I have been a rider for six years on a wooden machine, and now on a spider-wheeled one. I am only about 5 feet 2 inches, and I ride a 45-inch wheel, with 5 inch cranks. With it I can and do ride up inclines much easier than with my old machine; yet they are each the same weight (50 lbs.) This attribute to the rider being able to apply his power because he sits over the wheel. Every rider who sits much behind his driving wheel knows that in driving up hill his arms have to counteract the push of his feet, whereas push downwards on the treadle requires very little pull on the handles to keep the wheel right. The large wheel machines are worked with the forepart of the foot on the treadle, and not with the hollow of the foot, as the small-wheeled ones were. That is also a great advantage; the leg not having to traverse so great a distance, one is enabled to ride more gracefully, and with greater ease. Some machines are without brakes, the necessity of which depends on the inclines they have to run down. I live in a hilly district, and often on a Saturday afternoon trip I have to go over hills 1,000 feet high. I consider it highly dangerous to attempt a run down some of them, unless you have a brake you can depend on, and then the run down will be splendid and swift; yet with a good brake, you can keep the machine well in hand."

"I have seen in your paper something said about a one-line railway, the running of a bicycle having inspired the remarks. Now, there is no analogy in the matter, for an engine or train would not keep erect on one line of rails only, unless it was perfectly balanced, and remained so. A man could not run a bicycle even under those conditions. It requires a continual side movement of the front wheel to restore the balance that is always being lost; for if the wheels were put in a straight line, and fastened, there is no rider could ride it, for he would quickly lose his equilibrium—he could not restore it, and down he must come.

"I have also seen remarks and suggestions about multiplying wheels, so that one turn of the crank will make two turns or more of the wheel. Now, it won't do. The same effect can be got by shortening the crank; but then, who has the strong legs required to drive them? Bicycles as made at present are very good, and very simple also; any addition of gearing will only impair them. Now, I do not expect that any rider will be able to propel himself through the air on any bicycle much over a mile in three minutes—for that is 20 miles an hour—the air itself being the great retarder. I would rather face an incline than a strong wind, it being impossible to go with any speed in the face of a stiff breeze."

A New Cement.

A French chemist is said to have succeeded in preparing a mineral compound, which is said to be superior to hydraulic lime for uniting stone and resisting the action of water. It becomes as hard as stone, is unchangeable by the air, and is proof against the action of acids. It is made by mixing together 19 lbs. sulphur and 42 lbs. pulverized stoneware and glass; this mixture is exposed to a gentle heat, which melts the sulphur, and then the mass is stirred until it becomes thoroughly homogeneous, when it is run into molds and allowed to cool. It melts at about 248° Fah., and may be re-employed without loss of any of its qualities, whenever desirable to change the form of an apparatus, by melting a gentle heat, and operating as with asphalte. At 230° Fah it becomes as hard as stone, and preserves its solidity in boiling water

THE SONG OF STEAM.

[The following fine poem, which *Blackwood's Magazine* has pronounced to be the best lyric of the century, is by George W. Cutter, of Covington, Ky.

Harness me down with your iron bands,
  Be sure of your curb and rein,
For I scorn the strength of your puny hands
  As a tempest scorns a chain.
How I laughed as I lay concealed from sight
  For many a countless hour,
At the childish boasts of human might,
  And the pride of human power:

When I saw an army upon the land,
  A navy upon the seas,
Creeping along, a snail-like band,
  Or waiting a wayward breeze:
When I saw the peasant reel
  With the toil that he faintly bore,
As he turned at the tardy wheel,
  Or toiled at the weary car!

When I measured the panting courser's speed,
  The flight of the carrier dove,
As they bore a law, a king decreed,
  Or the lines of impatient love,
I could but think how the world would feel
  As these were outstripped afar,
When I should be bound to the rushing keel,
  Or chained to the flying car.

Ha! ha! ha! they found me at last,
  They invited me forth at length,
And I rushed to my throne with a thunder blast,
  And laughed in my iron strength.
Oh! then ye saw a wondrous change
  On the earth and ocean wide,
Where now my fiery armies range,
  Nor wait for wind nor tide.

Hurrah! hurrah! the waters o'er,
  The mountains steep decline;
Time—space—have yielded to my power—
  The world! the world is mine!
The rivers the sun hath earliest blest,
  Or those where his beams decline,
The giant streams of the queenly West,
  Or the Orient floods divine.

The ocean pales wherever I sweep
  To hear my strength rejoice,
And monsters of the briny deep
  Cower trembling at my voice.
I carry the wealth and ore of earth,
  The thought of God-like mind;
The wind lags after my going forth,
  The lightning is left behind.

In the darksome depths of the fathomless mine,
  My tireless arms doth play,
Where the rocks ne'er saw the sun's decline
  Or the dawn of the glorious day;
I bring earth's glittering jewels up
  From the hidden caves below,
And I make the fountain's granite cup
  With a crystal gush o'erflow.

I blow the bellows, I forge the steel,
  In all the shops of trade;
I hammer the ore and turn the wheel
  Where my arms of strength are made;
I manage the furnace, the mill, the mint,
  I carry, I spin, I weave,
And all my doings I put in print
  On every Saturday eve.

I've no muscles to weary, no breath to decay,
  No bones to be laid on the shelf,
And soon I intend you may go and play,
  While I manage the world myself.
But harness me down with your iron bands,
  Be sure of your curb and rein,
For I scorn the strength of your puny hands
  As the tempest scorns the chain.

Great Eastern Railway Company's New Station, London.

The terminus of the Great Eastern Railway Company at Liverpool street, if not partaking altogether of the palatial, will be unmistakably a great improvement upon many of the London termini, and will be one of the largest; the area comprised within the retaining walls—this being a low level station—is more than ten acres in extent, and is some 2,000 feet in its entire length. The general character of the design is gothic, broadly treated in the several elevations.

The area occupied by the various lines of platform is covered by a roof in four spans, the two central ones being 109 feet each, and the side spans 46 feet and 44 feet. The whole width covered in is 314 feet.

The roof trusses are principally comprised of wrought iron with ornamental details of cast iron, and the effect is extremely pleasing. The columns are double in the center, and have also to act as down pipes for the conveyance of water from the roof. The covering is chiefly glass, with a small proportion of boarding and slates. The length of the roof over the main line on the east side is 730 feet, and that over the local platforms 450 feet long and 76 feet above platform level. The platforms are arranged so that the advantages of the end-on system, as at Charing Cross, as well as those of the sidelong, as at King's Cross, are retained. The main line platforms are 1,000 feet long and 32 feet in width, while the local platforms are 550 feet in length, and vary in width from 10 feet to 21 feet. Lamp rooms are provided below the platform, connected with each by a subway and hydraulic lift.

The arrangements for traversing carriages across and along the main line, and the whole of the turntables, eleven in number, are worked by hydraulic power.

Communication is also obtained with the Metropolitan system by a junction with the railways, besides subways from the platforms under Liverpool street for passengers. The whole of the signaling and multifarious working of the points is connected at Primrose street, into one box, which contains more than 100 levers for the purpose of interlocking and other arrangements.

The whole of the works have been designed by Mr. Edward Wilson, C. E., the company's engineer, and executed by the well known firm of Messrs. Lucas Brothers.—*The Engineer.*

THE IRISH-AMERICAN RIFLE CONTEST.

The international contest, between the American team o six of our best known crack shots and an equal number of skilled Irish riflemen, has resulted in a victory for the Americans, gained by 38 points. Three ranges, respectively of 800, 900, and 1,000 yards, were fired over, fifteen shots at each distance being allowed to each competitor. The targets were six feet in hight by twelve feet in breadth, and were divided off, with a center six by six feet, inside of which a bull's eye three feet square was painted. A shot, by striking the bull's eye, counted four, on the center, three, and, if hitting outside the latter, two. From this it will be seen that sixty was the highest aggregate possible for any set of fifteen shots, one hundred and eighty for any competitor's entire score of forty-five shots, and one thousand and eighty for the shots of the whole team. Out of the last mentioned total, the Americans made 967, and the Irish 929. The annexed diagrams show the best shooting at each range.

Fig. 1 was made by Mr. Pollock, of the Irish team, at 800 yards, and counted 59, every shot, with one exception, striking the bull's eye. Fig. 2 is Colonel Bodine's (American team) target, which also counted 59. Fig. 3 is Mr. James Wilson's (Irish team) target, which indicates 55.

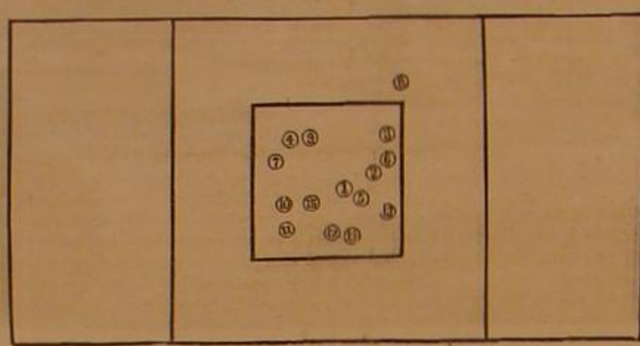


FIG. 1.—4—4—4—4—4—4—4—3—4—4—4—4—4—4—4—59.

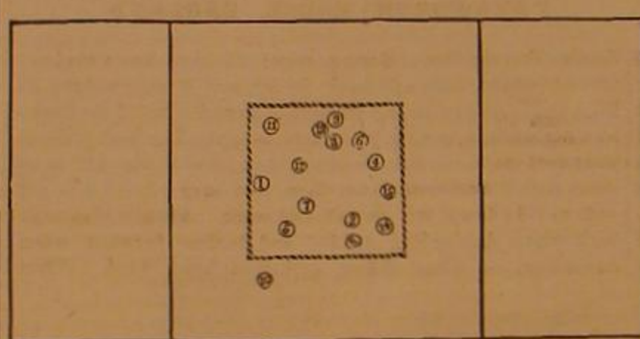


FIG. 2.—4—4—4—4—4—4—4—4—4—4—3—4—4—4—4—59.

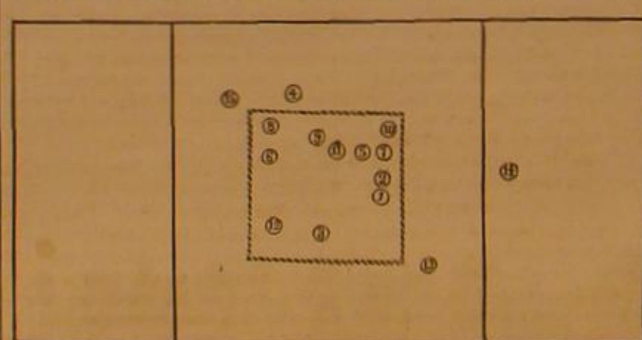


FIG. 3.—4—4—4—3—4—4—4—4—4—4—4—4—3—2—3—55.

It is difficult to appreciate fully the magnificent marksmanship which these scores prove, especially with regard to the long ranges, at which the Americans gained largely. One thousand yards is equal to about eleven avenue blocks in this city, including the widths of the streets; and hitting a three-feet square target at that distance amounts to about the same as (if the buildings were out of the way) standing at Trinity church and sending a ball into a window of the SCIENTIFIC AMERICAN office. The bull's eye would appear of about the same size as a dot half an inch square held at a distance of some three yards from the eye.

To Kalsomine a Wall.

Buy the best bleached glue if the walls are to be white or some light tint (if dark, it is immaterial, so the glue is clean), and use it in the proportion of a quarter of a pound of glue to eight pounds of whiting. Soak the glue over night; in the morning pour off the water, as the glue simply swells while soaking. Add fresh water, put it in a tin pail, and set that in a kettle of boiling water. When dissolved, stir into it the whiting, adding enough water to make it, after mixing, of the same consistence as common whitewash. It may be tinted to any color desired, and is applied with a whitewash brush. If the color is rubbed smooth in a little water first, and then mixed with the wash, it will be more even. If the walls have been previously whitewashed, scrape away all that will come off, and wash with a solution of white vitriol, two ounces in a pail of water. The vitriol will be decomposed, forming zinc white, and plaster of Paris, to which the kalsomining easily adheres. It is important to dissolve the glue in a hot water bath; for if scorched by too great heat, its tenacity is impaired or destroyed. Whiting is simply chalk freed from impurities, and reduced to a fine powder, and, is also known under the names of Paris and Spanish white, though the latter is really a white earth found in Spain.

There is a great difference in whitewash brushes; and the beauty of the work, as well as the ease of performing it, depends very much on a good brush, making it well worth while to pay the difference between a good one and a cheap one. For the inexperienced, it is more difficult to lay on tints evenly than pure white.

For those who have not had experience in using or dissolving glue, it is well to say that the dry glue should be spread in a broad flat basin, like a shallow milk pan, and cold water enough poured on it to fairly cover it; then let it lie over night, or for a day, when, if the water be not all absorbed in the swelling glue, the excess should be poured off, when fresh water will be added, in which you boil the glue, to be mixed with whiting.—*D. S. C., in the Maryland Farmer.*

Centennial Notes.

A definite project for a huge hotel, to accommodate five thousand of the people who will flock to Philadelphia during the Centennial, has been agreed upon. A number of citizens have taken steps to erect a gigantic wooden building, ten stories in hight and containing a thousand double-bedded rooms. It is proposed to complete the work in five months, an undertaking, the magnitude of which will be realized when it is considered that there will be thirty miles of wall to plaster. The structure will be about four times as large in capacity as the Continental Hotel in Philadelphia.

A correspondent, Mr. John L. Geissler, of West Chester, Pa., writes us that he has invented a remarkable clock, which, with a single pair of hands, indicates simultaneously, on one dial ten feet in diameter, the time not only of the place where located, but of the principal cities of the world. He has offered to place the clock on the wall of the Centennial structure for $500, this being the actual cost of its construction; and he says such a timepiece would doubtless meet with much approbation from foreign visitors, as it would enable them to learn their home time to a fraction of a minute. While it probably might be of interest for the average Briton to note the fact that 2 in the afternoon at Philadelphia corresponds to about the hour at which he would begin his daily onslaught on underdone joints and Bass' ale, we fear that the Italians, who count up to twenty-four o'clock and mark their dials accordingly, and the Chinese, the hands of whose timepieces travel backwards, would not gain much useful information from Mr. Geissler's huge clock. However, the idea is a good one, because the Centennial should certainly have a timepiece connected electrically with clocks in all the principal cities in the United States, so that, at 12 o'clock Centennial time on the momentous 4th of July, the entire country might join in unanimous celebration. Mr. Geissler offers a curious clock for a small cost, and the Centennial authorities would perhaps do well in adopting his suggestion.

It is proposed by the managers of the Centennial to appoint an electrician who shall have the supervision and direction of the electrical department. This is a very important and responsible position, and should be filled by no person save one whose talents and qua lifications are of the highest order.

We notice that the *Telegrapher* suggests the name of Mr. David Brooks, in which nomination we heartily concur. Mr. Brooks has had valuable experience in the foreign expositions, is a thorough expert in all matters electrical, and enjoys a wide acquaintance among the electricians and telegraphic engineers of Europe. We trust that the Centennial managers will see the wisdom of appointing Mr. Brooks.

Recent American and Foreign Patents.

Improved Spring Bed Bottom.

Joseph Fowler, New York city.—Springs are attached to the bedstead and to the cross bars by means of the contracted coils of springs, which allow a rivet to take hold of the coils and draw the spring downward. The head of a rivet rests on the lower contracted coil of the spring. The bed is suspended on the springs in this manner, and the bolts or rivets form a substantial connection. The devices improve another invention, patented to same inventor January 26, 1875.

Improved Shirt.

John C. Dunham, Buffalo, N. Y.—This invention consist of a shirt front detached from the body, except at the top and for a certain distance downward, sufficiently to keep it in place, by which the front is preserved smoother and neater. The invention also consists of the upper end of the front narrowed by rounding the corners to diminish the breadth of the connection with the yoke, by which wrinkling of the front is prevented when the arms are raised.

Improved Toy Gun.

William H. Martin, Mobile, Ala.—This invention consists of a longitudinal slotted barrel, with ball or arrow propelling slide piece working freely therein by means of springs attached to a cushioned collar at the muzzle of the barrel. The hook or arrow shaped rear part of the slide is locked by spring jaws, and released by a trigger and slide piece.

Improved Sliding Gate.

John P. McMurray, Oregon, Mo.—The gate rests outside of the gate post, so that it may be readily moved longitudinally about one half its length, and then it may be swung round on a bracket to open the full gateway. It also can be moved on the rolls longitudinally, and may be elevated to swing clear of snow in the winter season.

Improved Fastening for Hats.

Clinton R. Blackwood, New York city.—This spring fastener is made in one piece, and in the form of a bow, the curve of the bow being perforated and fastened to the inside of the hat with thread. leaving the ends to hang down, so as to bear upon the back part of the head.

Improved Water Wheel.

Oliver J. Bollinger, York, Pa.—Secondary guides are arranged in the outer ends of the water passages to divide them into two channels narrower than the throat, so that any objects floating in the water, too large for passing through the throats, will be arrested at the outside of the case, where they can be easily reached for removal. The gates are placed at or near the inner end and narrowest part of the chutes, by which they are subject to the least pressure on account of the smallest area being opposed to the water, so that they offer the least resistance to the moving of them in opening and closing. The gates are attached to a ring, which has radial arms and a hub surrounding the shaft, to strengthen it against lateral strains; and it is connected by the rods which incline toward the shaft with the running block on the shaft, and other mechanism for opening and closing.

Improved Combined Table and Desk.

Thomas W. Moore, Plainfield, N. J.—This invention consists of a table having a suitable inclosed space with pigeon holes, etc., under the top. The top is made of two parts, and hinged at the point where the slope of the desk begins. One side of the frame is lower than the other side, and the ends are sloped from it up to the point where the top is hinged. On this low part a piece is hinged to swing up on the top and hold the table top level when a table is required, and close the space beneath. The table top has a piece at each end, which overlaps the end of the frame, and keeps the space under the top closed when it is adjusted for a table.

Improved Bottle Stopper.

Gustave J. Crikelair, Green Bay, Wis.—There is a band around the neck of the bottle, which carries a little clevis. This clevis is pivoted to the band, so that it may work up and down, and a bent lever is attached to the jaws of the clevis by the fulcrum pin. This lever curves up over the top of the bottle, and is attached to the stopper, which last has a flange around it, which incloses a packing. A spring is fastened to the lever, the upper end of which bears with a constant pressure against a lug, which is fastened between the jaws of the clevis. When a person takes hold of the bottle, he bears with his thumb on the lower end of the lever, which action raises the stopper, and allows the contents to flow out when the bottle is tipped. A hook is attached to an eye on the under side of the lever, and hooks under the clevis to hold the stopper down.

Improved Child's Carriage.

F. Herman Jury, New York city.—The rim of the wheel is shaped so that, while it widens out at the top to the edges, the bottom will be sufficiently thick to afford the requisite thickness for firmly holding the spokes which screw into it. The hub is cast with an inner annular chamber, to dispense with unnecessary metal, and the ends, which are contracted to the size of the box, are screw-threaded, and the box is screwed in, making a tight hub. The axles are short pieces of round metal screwed into the ends of a hollow middle tubular portion, to make the middle portions stronger for a given quantity of metal by increasing the size. The body is jointed to fold together; and by a spring top for holding up the top, and the braces arranged inside, the top can be raised and lowered easily by the person inside.

Improved Car Coupling.

Benjamin S. Kearney, Franklinton, N. C.—This invention relates to an improved automatic car coupling, that may be readily used for cars of different hights; and it consists of a drawhead with tapering mouth, vertically sliding front socket or gate, and governing rear piece, that couple and control, by suitable levers, the link with ball-shaped heads.

Improved Potato and Seed Planter.

William H. Whitman, Scranton, Pa.—In the slot of a pitman are placed springs, which rest against a crank, and the effect of which is to cause the pitman to stand still for a little time at the end of each movement. The other end of the pitman is pivoted to a frame, which slides upon a block, in which is formed a hole of sufficient size to receive enough seed for a hill, and which is placed directly beneath the hopper. Plates are so arranged that as the frame moves forward one plate will uncover the upper end of the pocket to allow the seed to drop into said pocket. As the frame moves to the rearward, the plate will cover the upper end of said pocket, and another plate will uncover its lower end, allowing the seed to drop to the ground. The plate is made with a short edge, so that, when the machine is used for planting potatoes, it may cut off a piece of potato large enough for a hill. In the case of large potatoes, they will be cut more than once, and small potatoes will not be cut at all. When the machine is used for planting seeds, the upper plate serves simply as a cut-off. The hopper is made in three parts, so that the two upper parts may rock upon each other, and upon the stationary lower part to keep the seed from clogging by the advance of the machine.

Improved Cultivator.

Albert Dart, Rockville, Conn.—A rear wheel gages the cut of two front mold boards. Adjustable bars carry the two rear mold boards. These bars are spread apart by a cam operated by means of a lever. A horizontal guide bar passes through the beam and through the bars, and supports the bars and mold boards as they are spread or expanded by the cams or forced inward by the pressure of the earth thereon. The wheel is supported by the spring, which is attached to the under side of the beam.

Improved Mirror.

Allen Huber, Berlin, Can.—This consists in covering the back of the mirror with varnish or waterproof material, and with a coat of gypsum, plaster of Paris, or equivalent material. The advantages claimed are that the mirror plate and frame will be strengthened, the silver will be protected from injury, and the wooden back board or other back and the wedging of the plate will be dispensed with.

Improved Pneumatic Dispatch Apparatus.

Olney B. Dowd, New York city.—Two pipes join the local stations with the central station, with a circuit of the impelling fluid, preferably compressed hydrogen gas, passing out through one and back through the other, and worked by pressure in a reservoir at the central station. It is designed to make the apparatus useful for hotels, offices, and private houses by a special circuit to each, the outgoing pipe being connected with one of the contrivances for stopping the carrier, so as to discharge into it, and the other connected, so as to allow of the return of the fluid, and having the apparatus for introducing the carrier to be returned to the central office.

Improved Variable Exhaust.

William P. Leseur and Charles Michel, College Point, N. Y.—The invention consists in supporting a cone plug upon a vertical screw stem arranged to project up through the mouth of the exhaust pipe of a locomotive engine. The chief advantage of this arrangement is economy of space and unobstructed passage for escape of steam, it having been the practice heretofore to support and adjust the plugs of exhaust nozzles by means of rods arranged exteriorly thereof.

Improved Farm Fence.

David L. Hoffman and Parker M. Shoemate, Aullville, Mo.—This consists in making the fence in sections, so that each panel may be separated into two longitudinal parts.

Improved Row Gage for Plows.

William Edwin Stanley, Montezuma, Ga.—This is a row gage attachment to plows for marking off rows to guide the plowman straight. A socket for receiving the end of the marking rod is mounted on a support which revolves to shift it from side to side as the plow reverses. Said support has a hollow axle, through which a cord, having a weight attached to it, extends to the end of the socket next to said support, and is secured thereto to return the marker to the normal position after it escapes from obstructions, causing it to swing back on a pivot, as a means of preventing it from breaking. The revolving support for the socket is supported on standards, some of which are attached so as to form guides to keep the suspended weight from swinging about.

Improved Station for Submarine Telegraphs.

Robert F. Bradley, Moffettsville, S. C.—This invention relates to an improved system of telegraph stations in mid-ocean, by which messages can be sent from any point of the ocean, along the line of the cable, to the terminal points, and *vice versâ*, so that communication with vessels and passengers during the voyage may be established. The invention consists of a hollow sectional column with a base plate attached by ball and socket joint, which column is lowered into the water and anchored rigidly to the ground. The branch cable is coupled to the main cable, and carried along the column to the surface of the water, to be there placed in connection with the instruments on board of the vessels.

Improved Letter and Picture Block.

Daniel Birmell, Greenville, N. J.—This invention consists of a different shaped end point or projection to each letter block, so that no letter block will correspond to any other, in combination with picture blocks, having notches corresponding to the letters of the name of the picture, to aid the child in selecting the letters for naming the picture and identifying them therewith.

Improved Life Preserver.

Adolph Traub, New York city.—This life preserver is constructed of a front and rear part, connected together by straps or suspenders, supported by the shoulders, having movable wings or fins attached thereto, the whole being made double or bag-like and filled with roasted cork.

Improved Transom for Doors.

John Berndt, Denver, Col. Ter.—This invention relates to certain improvements in transoms for doors; and it consists in a transom sash that is made to slide into a casing above by means of a branched cord moving over pulleys, one of the branches of which cord is attached to the sash for the purpose of raising it, and the other attached to a suspended detent or locking bar which prevents the raising of the sash except by the cord upon the inside of the house, the cord being fastened below by a self-closing cam lever, and so arranged at its branched ends as to raise the sash and lift the locking bar at the same time.

Improved Hay and Cotton Press.

John L. De Witt, Gardner, Ill.—The invention relates to means whereby the operators on a hay or cotton press may be enabled to work more continuously and with a greater result within a given time. It consists in making the same piece, grooved on both sides, act successively as a follower and platen, and in holding the platen by a hand-operated slide so that it may be pushed out with the tied and pressed bale.

Improved Clothes Wringer.

Leander Becker, York, Pa.—This invention relates to certain improvements in wringers; and it consists in the combination with the body of a washing machine, and the adjustable bearings of one of the wringer rolls of a lever, and an adjustable vertical rod attached to said bearings, so that the weight of the washer is made to supply the pressure for the wringer rolls, the said pressure being regulated at will.

Improved Washing Machine.

Leander Becker, York, Pa.—This invention relates to certain improvements in washing machines; and it consists in two levers pivoted to the outer casing and having notched extensions and pendant segments. To the top of the levers is pivoted an arc-shaped set of rubbers, which are attached at the bottom by a connecting rod with a double crank upon the main shaft. Suspended in the notches of the lever extensions and segments is another adjustable and detachable set of rubbers which correspond to the first in construction, and between which and the first set the clothes are contained.

Improved Paper Machine.

Chas. L. Crum, Winchester, Va.—The object of this invention is to better adapt the Fourdrinier paper machine to making heavy paper or boards out of straw, wood, or other materials; and it consists in the combination with the ordinary belt of wire cloth which carries the pulp, of a second upper endless belt of wire cloth passing around rollers, and an upper suction box resting upon the upper surface of the second belt and just above the web formed from the pulp.

Improved Bale Tie.

H. K. Du Bose and E. W. Charles, Jr., Camden, S. C.—The invention has particular reference to flexible ties by which hay, cotton, and analogous substances are held in a compressed state. It consists in a tongueless buckle and a fastener having two cross slots cut obliquely toward each other.

Improved Spring Seat for Horse Rakes, etc.

Amos W. Coates, Alliance, O.—The object of this invention is to adapt the supporting spring of a chair seat in a horse rake, harvester, or other analogous implement to the different weights of different drivers, and, while preserving its elasticity, render the said spring strong enough to support a heavy driver without bearing down and removing the driver from the most convenient position for operating his hand levers. It consists in the combination with the ordinary inclined band spring, of an auxiliary spring attached to the base frame and connected with the main spring near the seat by means of a stud which is rigidly fixed to the main spring, the said auxiliary spring being slotted at its connection with the stud, so that it does not act at all until the main spring is borne down sufficiently low to cause its stud to rest in the lower part of the slot.

Improved Coffee Pot.

Sumner P. Webber, Charlotte, Mich.—This invention consists of a coffee pot with a cylindrical coarse strainer that is fitted securely into an annular finer strainer, arranged below the spout at the inside of the pot, the detachable strainer being supported at some distance at the bottom of the pot and retained by springs at the top, a ball serving to lift it out of the pot.

Improved Steering Propeller.

Wilhelm F. Zoebe, Brooklyn, N.Y.—This invention consists in the employment of a propelling screw that is driven by hand power applied to actuating lever rods, which rods are pivoted to sliding and guided pieces, transmitting the power alternately, by intermediate gear wheels, to the shaft of the screw. The screw is secured to a supporting frame sliding in vertical direction for yielding to obstructions, and is also employed for steering the boat by connecting the screw frame, by a governing arm and wheel, ropes, and pulleys, with the steering wheel of the boat.

Improved Water Wheel.

Isaac Mallery, Dryden, N. Y.—This wheel has two sets of buckets, arranged one above the other, and a chute curb, having two tiers of chutes. The revolving gate is provided with a series of openings. The water may be admitted to only the lower tier of buckets in the wheel through two or four openings; or by moving the gate farther, two or four chute openings are uncovered for the upper tier of buckets, so that water may be admitted through two, four, six, or eight openings, successively, according to the amount of power required.

Improved Farm Gate.

Wellington H. Pratt, Prattsville, Mich.—Devices are provided in connection with this gate, whereby it is supported without sagging. It may be raised from a horizontal position, and swung round over a moderate depth of snow without obstruction, and, when opened, will remain in any position in which it may be placed.

Improved Berry Cup.

Dewitt W. Kniffin, Marlborough, N. Y.—This is a berry cup made of wood veneering, having a bottom of two thicknesses fastened together with the grain of the wood at right angles, one part having tenons which pass through slots and hold the bottom to the body.

Improved Lathe Rest.

James E. F. Leland, Baltimore, Md.—This invention relates to lathes for turning irregular forms, and consists of a spring rest for supporting the article being turned. The spring is given a certain amount of tension to force the rest forward toward the article, while the rest will adjust itself to the irregularities.

Improved Motor.

Jacob G. Peterson, Morganton, N. C.—By this device, a power is applied to one shaft by two springs separately wound when the same could not be used with one spring on account of the difficulty in winding it up.

Improved Corn Sheller.

Frelinghuyson H. Hunter, Heltonville, Ind.—This corn sheller has a ribbed surface, over which the ears are drawn by hand to free them of the kernels. The invention relates to a chaff box, which is formed of a sheet metal plate applied beneath the ribs of bars of the sheller.

Improved Felly Plate.

James Y. Sitton, Due West, S. C.—The feature of this invention consists in vertical ears or flanges formed on the sides of the clip, and extending up to embrace the sides of the tyre, thus holding the same in proper position on the felly.

Improved Stone-Extracting Tool.

Nathan R. Cheadle, Delta, Ohio.—This is a method of removing stones in well-boring by first cutting under them, and then dislodging them with a drop.

Improved Fence Post.

Eugene Powell, Delaware, Ohio.—This consists of a post with braced stool seated in the ground, in connection with an additional stool attached at right angles thereto, in the direction of the fence, for increasing the base surface of the post.

Improved Fly Net.

Luther B. Lee and George W. Lee, Ridgewood, N. Y.—The object of this invention is to prevent the ends of the cross bars from untwisting, and at the same time to give to said ends a neat appearance. The cross bars are made of cord, and are quilted or stitched through the longitudinal bars a sufficient number of times to prevent the said cross bars from slipping through the said longitudinal bars. The end parts of the cross bars are stitched upon a sewing machine for a few inches.

Improved Printers' Galley.

Henry H. McWilliams, Sacramento, Cal.—On the bed plate is a raised bar. The same hollow bar is turned in the same manner across the end of the plate. On the inner edge of a slotted movable plate is a square hollow bar, made by turning over the edge, so that this square bar and the triangular bar on the other plate are of the same hight, and form a channel in which the type are contained and held. This bar is moved on the plate and the channel increased or diminished in width by means of slides and eccentrics and levers. By means of these eccentrics the movable plate is moved up, and the bar is made to compress the type.

Apparatus for Carbureting and Purifying Gas and Air.

Leander E. Fish, Washington, D. C.—This invention relates to certain improvements in apparatus for carbureting and purifying air and gases. It consists of a vessel having on the bottom thereof a detachable tank for containing oil for carbureting. Communicating with said tank is a pipe for introducing the oil, a gage pipe for regulating the amount of the same, and a perforated inlet pipe through which the air or gas is forced into the oil. Just above the oil tank is a detachable cover with distributing openings for the carbureted gas in its upward passage, and above said cover are located purifying pans with bottoms of perforated sheet metal or wire gauze. The top of the outer vessel is provided with an annular trough of water in which the detachable cover is located with a water-sealed connection, the said cover being provided with a pressure regulator and an outlet pipe for the gas.

Improved Ventilation of Railway Tunnels, etc.

Joseph Dixon, New York city.—This improvement is more particularly designed for underground railways, tunnels, etc, in cities where openings to the external air cannot be had without interference with the surface traffic of the street, or without purchasing adjoining lands and using the same for ventilating shafts. It is proposed to divide the tunnels into sections of a mile, to place midway of these sections a suitable fan blower, connected by suction pipes, extending right and left into the tunnel, and to place partitions, by means of pivoted doors, across the tunnel on either side of said suction pipes, said partitions occupying the entire space crosswise of of the tunnel; pending the arrival of a train, said partitions to remain closed. The doors may be opened by an approaching train, and closed again immediately after the train has passed, by the train itself operating suitable mechanism placed alongside the track. By thus dividing the tunnel into sections, and placing the ventilating apparatus midway outside the tunnel, the fan withdraws the foul air from, say, half a mile of tunnel on the left hand side, and at the same time, and by the same operation, it also acts in like manner on the length of tunnel on the right hand side, and discharges the foul air from both sections through a pipe of suitable size on the opposite side of the fan to the surface of the earth, and thence up a suitable hight above the surface by an ornamental hollow column.

Improved Steam Engine for Rock Drills.

James Brandon, New York city.—Grooves in the steam chest are so arranged in connection with the grooves in the valve piston that, when the slide valve is just over the steam ports, the small piston will have passed so far that the communication between the groove in the steam chest and the groove in the valve piston will be just closed at the same time the groove of the steam chest passage will be just opening. The steam passing will have full pressure until the piston closes the passage by its own movement. Consequently the valve piston will still have the expansion of the steam to carry it over.

Notes & Queries

R. W. J. will find a formula for proportioning safety valves on p. 363, vol. 29.—J. F. can blue steel by the method described on p. 123, vol. 31.—J. S. will find that bronzing on iron is described on p. 283, vol. 31.

(1) J. A. M. asks: Can I magnetize cast iron? A. Yes, temporarily, by enclosing it in a wire helix traversed by an electric current.

(2) S. L. asks: 1. Do you think that a young Irish retriever could be broken of the habit of running away when a gun is discharged? A. Take your dog to a pigeon or shooting match, and gradually approach the shooters with your pet, and encourage him. Most dogs can be broken of gun shyness in this way, but some of them can never be cured. 2. Please give me the name of some handbook on training dogs for the field. A. The best book ever published on the sporting dog is "The Dog," by Mayhew, Dinks, and Hutchinson; it is published by Orange Judd & Co., 245 Broadway, N. Y.

(3) W. C. asks: Is a building, having a lightning rod which is formed of a copper pipe or tube laid flat on the roof and fastened with small strips of zinc to the roof and walls of the building, perfectly safe during a storm? A. The above method of attachment of the rod to the building is correct. But the main thing pertaining to the use of a lightning rod is to have the rod properly connected with the earth. The bottom of the rod, in the earth, must be greatly enlarged, either by having the rod extended underground for a long distance, or by connecting the rod with iron water pipes or iron drain pipes in the ground, or by placing the bottom of the rod in contact with a large mass of charcoal, which may be laid in a trench. No building is safe if the rod is merely stuck down a few feet into the dry earth. This is the common plan, but it is unsafe. Safety can only be secured by having an extensive mass of good conducting material at the bottom of the rod, in the earth.

(4) T. S. and others ask: How is transfer or indelible paper made, for marking clothing? A. The paper is probably saturated with a solution of bichromate of potash, logwood, and a little carbonized sirup.

(5) D. G. S. asks: Will a cosmorama lens of 36 inches focus do for the object glass of a telescope which I think of constructing, combined with an eyepiece of ½ inch focus? A. A common lens will not do at all for the object glass of a telescope, as it gives too defective an image. You must consider that the image has to be enlarged by the eyepiece, which will enlarge all defects also. For a telescopic objective, it is imperatively necessary to have an achromatic lens made of a crown glass bi-convex lens, and a correcting plano convex lens of flint glass.

How can I obtain sulphuretted hydrogen? A. Pour diluted sulphuric acid on sulphuret of iron or on sulphuret of antimony.

(6) A. B. says: I made a magnetic needle out of a rat-tail file; and while polishing it upon an emery wheel, I thought of testing the action of moving bodies upon it. Having no point ready, I stuck it upon a sharp pointed lead pencil and held it in front of one of the emery wheels. It instantly began to revolve at about 200 to 250 revolutions per minute, running from right to left. I thought it was the current of air striking it, and held the needle on the other side of the wheel. It instantly checked its motion, and started in the opposite direction. In this position, the air would strike it in the reverse of the first position. To further prove it I held it opposite the wheel on the other end of the shaft: and to my surprise it stopped and started revolving in the same direction. It was not produced by air currents. Held between the two wheels, it also revolved. To further prove it, I placed it upon a pin and cork, putting it in an iron pan so that all currents of air would strike the bottom of the pan: and it still revolved, but at reduced speed. I came to this conclusion: Each wheel has a north and south pole, and the north pole of one wheel is opposite to south of the other. It may be that, when in motion, one wheel forms a north pole and the other a south. The wheels have iron arms filled with wood segments, and are covered with leather and emery. Please explain the cause. A. Probably the wheels contain some residual magnetism, and one side is positively and the other negatively polarized. If the wheels are made of cast iron, this might readily be the case.

(7) C. C. P. asks: 1. Will leather scraps, ground down nearly to a powder, be of value as a fertilizer? A. Yes. 2. Are freshly ground bones in a fit state to be used as a fertilizer? A. Yes.

(8) J. C. asks: I have a piece of genuine moss agate which I would like to cut up in small pieces. How can I do this? A. Agates are cut by means of a small copper disk on a lathe, fed with emery. The surface is then coarsely ground by means of a grindstone of a hard reddish sandstone, and the polish is afterwards given on a wheel of soft wood, moistened and imbued with a fine powder of hard red tripoli.

(9) W. S. & S. say: We wish to make a siphon and draw the water from a well 52 feet deep with 75 feet fall. Can we form a vacuum and start the water running? A. The water could not be induced to rise out of the well without other aid than the mere pressure of the atmosphere.

(10) H. B. B. asks: Is there any cement or paint that would answer for lining a cistern to contain vinegar, that would not be destroyed by the acid nor spoil the vinegar? A. Vats of this character are sometimes coated with melted rosin.

Is the refuse of the blacksmith's forge and furnace beneficial to fruit trees? A. It has been recommended for this purpose. Give it a trial.

(11) J. M. T. asks: Can you give me a process for cleansing the dark color from steel blades after cutting fruit? A. Rottenstone is used for this purpose.

(12) F. N. asks: 1. How can I fix colors on caoutchouc or on gutta percha? A. Caoutchouc is probably lettered with rubber solution while it is stretched, the coloring matter immediately dusted over it, and the whole allowed to dry. 2. How can two pieces be made to adhere to each other by the edges? A. By means of a caoutchouc solution in naphtha.

(13) P. B. asks: I have a portrait that is being destroyed by cracking and scaling off of the paint from the canvas. The cause is attributed, by those who profess to know, to the picture's being varnished before the paint was perfectly dry. Is there any remedy for it? A. We do not know of anything except revarnishing.

(14) J. S. asks: Will the residue of sulphuric acid and carbonate of soda, or marble dust, after having been used in the manufacture of soda water, be of value for manure? How should it be prepared? A. The excess of sulphuric acid can be completely neutralized by limestone, and the dried residue used as gypsum. Or calcined bones can be employed, and a mixture of the sulphate and acid phosphate of lime produced.

(15) A. B. G. asks: I want to color glass for lantern slides. How shall I proceed, so as to show any or all the colors of the spectrum in the screen? A. The aniline colors are mostly used for this purpose on a surface prepared with albumen or some similar substance. These colors admit of exquisite shades of fineness and, for this purpose, are remarkably soft and rich in tone. See p. 390, vol. 30.

(16) J. C. G. asks: What is the reason that the second crop of clover yields more seed than the first? A. The crop multiplies itself by scattering its own seed in the fall. This, in the spring, takes root, and soon more than replaces that portion of the last year's growth which has decayed, and which now acts as manure.

What is a good work on mnemonics? A. Consult Appleton's "Cyclopedia."

(17) J. W. K. asks: Can artesian wells be bored here, in Eastern Virginia? A. Yes.

1. How can I mount pictures? A. You do not state whether the pictures were on canvas or paper, also whether they are oil paintings, prints, or photographs. 2. What preparation is used to obviate the necessity of glass? A. Varnish is used for this purpose. 3. What is the origin of the word "remontant," and its meaning? A. It is a French word. Le remontant=the belt strap or belly band of harness.

(18) R. K. says: I have a fine hop vine; but the caterpillars are eating it up. What can I smoke them with so as not to injure the vine? A. Place under the vine a dish containing a small quantity of ignited charcoal: throw upon the coals a quantity of sulphur, and, if necessary, move the dish so that the ascending vapor may temporarily surround each twig and leaf. This is the most effectual remedy known.

(19) M. A. B. asks: What is the rule for calculating the variation in an aneroid barometer, caused by high or low temperature? A. The only correction necessary for an aneroid barometer is a slight one for temperature, detected experimentally thus: Observe carefully its indication at any moment in the external air; remove it immediately before a fire, and heat it until the thermometer on the dial shall reach 100°; then notice the variation of the hand; this variation, divided by the number of degrees through which the thermometer has moved, will give you the correction, whether in defect or excess, to be applied for each degree of change.

(20) W. B. asks: 1. What metal is least liable to tin when coming in contact with a soldering iron? A. Copper or iron. 2. Is there any metal or substance that will not tin, and yet will stand the heat of the iron and be not liable to break? A. We do not know of any such metal.

(21) G. M. G. says: 1. I am making ink composed of nut galls, gum senegal, sulphate of iron, aqua ammonia, alcohol, and rain water. When first applied, it is a pale purple, and slowly turns intensely black. What can I use to make it black when first applied? A. Replace the ammonia and alcohol by a little alum. This we think would make a decided improvement. The addition of logwood to the ink would have the effect of rendering it black when first used, but such ink is much more liable to fade and corrode the pens. 2. Can you give me a cheaper and a better recipe than the above? A. Take 1 oz. extract of logwood; pour over it 2 quarts boiling water, and, when the extract is dissolved, add 1 drachm yellow chromate of potassa. This is an excellent blue black ink, does not fade, and, as it contains no gum, flows freely from the pen. It can be made for about 25 cents per gallon. If an old inkstand is to contain any of this ink, it must be thoroughly cleansed, as ordinary iron ink decomposes the chrome compound.

(22) D. W. U. says: I wish to know how to keep strawberries in their natural color, to take to the fairs as curiosities. I have strawberries measuring 4 and 5 inches in circumference. A. The fruit may be preserved in many ways. One of the simplest methods is that of immersion in some solution of strong antiseptic properties, such as salicylic acid. To retain the natural color of the fruit for any length of time, however, is something quite difficult. We would advise you to obtain photographs of your mammoth fruit as soon as possible.

(23) C. M. asks: 1. What effect will dissolving blue stone in water, in which iron is to be casehardened, have? A. First polish the metal, and then place it in a sand bath until the desired color is obtained, then plunge into water. The addition of blue vitriol to the quenching bath would only serve to copper plate the metal as soon as immersed in it. 2. What preparation is there that, when put on casehardened work, will give it the fine glossy appearance that the fine English guns have? A. Try the following varnish as a lacquer: Gum sandarac 8 ozs., pounded mastic 2 ozs., clear turpentine 2½ ozs., pounded glass 4 ozs., pure alcohol 32 ozs. Mix and dissolve.

(24) J. H. M. asks: What will absorb the ammonia, generated by the urine, etc., of horses in a stable? A. Sprinkle the floor and stalls with dry clay, which has a powerfully absorbent action upon ammoniacal vapors.

(25) W. H. P. asks: What acid is in rhubarb? Can it be extracted and concentrated, and how? A. The juice of the rhubarb contains oxalic, citric, and malic acids, the latter often in considerable quantity. We hardly think the plant can be utilized for lemonade, because of its characteristic purgative properties. The most objectionable acid of the three may, however, be removed in great part by chloride of calcium.

(26) H. J. E. asks: Do all kinds of iron crystalize under strain? A. No.

How is good mortar made? A. The lime ought to be pure, completely free from carbonic acid, and in the state of a very fine powder; the sand should be free from clay, partly in the state of fine sand and partly gravel; the water should be pure, and, if previously saturated with lime, so much the better. The best proportions are three parts of fine sand, four parts of coarse sand, one part of quicklime recently slaked, and as little water as possible. There should always be enough water added at first; if water is added after slaking has begun, it will be chilled and the mortar lumpy. The addition of burnt bones improves mortar by giving it tenacity, and renders it less apt to crack in drying.

Is the casting of small brass or iron articles smooth and without flaws considered as one of the lost arts? A. It is not; at present it is by no means impossible to make a perfect casting.

What is civilization? A. Civilization mainly consists in intellectual development, culture, and refinement.

(27) J. C. H. asks: How can I make the hardest alloy that melts below a red heat? A. Melt together 2 lbs. copper and 1 lb. tin.

(28) W. H. Jr. says: I have separated iodine from iodide of potassium by passing chlorine gas through a solution of it. The chlorine gas was made by the action of sulphuric acid upon calcium chloride. I now find that the solution of iodine contains some of the calcium chloride. How can the iodine be separated from it? A. It may be separated by distillation over a slow fire; but the temperature should not be allowed to rise above 350°.

(29) C. S. R. asks: What composition can be molded, either under pressure or otherwise, have a hard, smooth surface, and not be brittle nor liable to warp? A. Many metallic alloys, we think, would answer your purpose. See p. 11, vol. 31.

(30) S. E. M. asks: 1. Will the common gold fish spawn in a tank that holds 30 gallons water? A. Yes, if the tank be otherwise properly arranged. See pp. 36, 102, vol. 30, and p. 29, vol. 32. 2. What kind of plants will grow best on the bottom of the tank? A. Any of those indigenous to fresh water lakes and streams.

(31) R. B. R. asks: Suppose a suitable turbine wheel to be driven by a certain fixed quantity of hot water, forced through by high pressure steam, the apparatus being so arranged as to use the same water over and over again, such a quantity of water to be supplied only as will make good the loss by evaporation, and the steam used expansively: would such a motor be economical? A. It would be much more economical to use the steam in a well designed steam engine.

(32) F. H. B. asks: 1. Will good plumbago used in the cylinder of a new engine, be of service to prevent cutting? A. A true bore of cylinder and well fitted rings are the best preventives. It ought not to be necessary to use plumbago in a new cylinder. 2. Is there anything in the mixture of metal of which the cylinder and rings are cast, that makes some more liable to cut than others? A. Care is necessary in mixing the iron, to produce a quality that is tough and of uniform texture.

(33) W. asks: If I have a steam yacht for my own pleasure on the Mississippi river, would I have to get a license for her, and would I need a licensed engineer and pilot? A. Yes.

(34) T. S. W. says: A firm recently ordered a machine for making ice, and secured one of the following dimensions: Boiler 4 feet 6 inches x 2 feet diameter, with 8 two inch iron flues; cylinder 4x12 inches. Directions for use: Raise steam to 50 lbs., and run the machine at 130 revolutions. Good wood was first used, and afterward coal and rosin; but after a few revolutions steam would run down to 30 lbs., which was not sufficient to drive the machine. Reporting that the boiler was not large enough, or there was not sufficient heating surface, they received two iron blocks to be put, one in each end of cylinder, so as to reduce the stroke to 8 inches, and a new crank to suit this stroke, with a coil of lead pipe to be placed in water tank through which to exhaust. The exhaust had previously been into the smoke stack. The makers of the machine claimed that the boiler was large enough, yet sent the extra pieces, the putting in of which would make everything work all right. Please to give your opinion. A. The boiler was too small.

(35) W. M. J. says: J. R. W. (vol. 32, No. 24, June 12) must have something wrong in the setting of his boiler or with his engine. I think it is in the valve; for it is certain that he should run his 8x16 engine and do all it could possibly do on from $\frac{3}{4}$ to 1 cord of wood. It is certain that a good return tubular boiler will save at least half the fuel used by a two flue boiler. A. We would be glad to receive some facts in corroboration of your views.

(36) J. C. G. says: I am 19 years of age. My occupation is that of a stationary engine driver. I have a good English education, and am considered very good in mathematics. Mechanical engineering is the only business I care for or think about. I have tried to get a situation in a machine shop to learn the trade; but owing to depression in business, I have not succeeded. Would it be best for me to enter a shop or a scientific school? Will I be prepared to superintend the construction and designing of engines by such knowledge as I could gain in such a school? A. It is very desirable to get such advantages as are afforded by the course of a good school of mechanical engineering, such as the Stevens Institute, Hoboken, N. J., the Massachusetts Institute of Technology, Boston, Mass., or Cornell University, Ithaca, N. Y. When one graduates from such a school, he has learned how to study, and has also acquired a great deal of practical experience, in addition to a knowledge of the fundamental principles and methods of the engineering profession.

(37) D. L. B. asks: 1. Would a solid iron bar sink in the ocean in the deepest part, or would it float at a depth where the amount of water, displaced by the bar, would be equal in weight with the bar? A. It would float under the conditions stated. 2. At what depth would the water be of such a density? A. We cannot tell you, as experiments have not been sufficiently extended.

(38) E. F. M. asks: Can rubber belts be renewed? A. No.

Which is the front end of a planer, where the boards go in, or where they come out? A. Where they go in.

What glue is best for cementing leather belt ends together? A. Use marine glue, or gutta percha dissolved in bisulphide of carbon.

Can brass in small quantities be melted in an iron ladle in a common blacksmith's forge? A. It will be better to use a crucible made of clay or plumbago.

How are plaster of Paris molds made? A. They are cast over the pattern.

(39) Z. W. B. says: 1. I have a small steam engine 5x8 inches, that cuts off at half stroke. How can I change it to make it cut off at $\frac{3}{4}$ stroke? The valve is a plain slide valve. A. You must lengthen it and increase the travel. 2. Is a $\frac{3}{4}$ circular safety valve large enough for a return tubular boiler 24x36 inches with fifteen $2\frac{3}{4}$ inch tubes 36 inches long, and a heating surface of 45 feet? A. Yes.

(40) H. D. & Co. say: 1. We are running a 400 horse power engine at 75 lbs. pressure. City water is very expensive, and artesian is very hard. Is it feasible for us to condense our steam, or a large part of it, by currents of air? Has any contrivance of that sort ever been perfected? A. There have been a number of plans proposed for condensing steam without the use of water, but we do not know of any that are in practical operation. There is, of course, no difficulty in arranging such a device, if it is made large enough. 2. Is it of any use to try to clear hard water by raising its temperature under pressure above 212° before entering the boiler, thus reducing the boiler scale? A. This treatment removes some of the impurities, and is generally found to be of great advantage.

(41) W. H. H. asks: I do the street sprinkling in our city, and force salt water 1,200 feet through a 4 inch pipe up a rise of 75 feet. I use a 10 inch steam pump, and 6 inch water cylinder with 12 inches stroke. I require 60 gallons a minute; my pipe has 5 elbows. I hire steam and take it 200 feet through a well protected pipe. A dispute has arisen as to the required horse power to do the above work, and it is agreed to leave the question to you? A. It would be necessary to make a test, in order to settle this question. From the data sent, we could only make a guess.

(42) L. S. asks: Who was the first inventor of the locomotive? A. The first locomotive was built by a Frenchman named Cugnot.

How long a piece is used in testing rope? A. Generally a piece not more than one or two feet long.

I have been firing a Baldwin locomotive, which has a mud drum, by blowing out at drum; the mud would not all come out unless I took the drum head off. Much mud has also settled between the bottom flues, around the drum. We have inserted rods through the drum, and also through plugs in smoke box, but could not do much good. We have also tried a strong stream of water, but to no effect. Can you give some good advice? A. Try the plan of hauling the fire at night, and letting the water remain in the boiler until it is quite cool. That may soften the mud, so that it can be washed out.

(43) H. A. A. says: I am using an engine which throws out much fire. What is the best cap to prevent this? A. You can purchase a spark arrester similar to those used on locomotives. Frequently a piece of wire cloth, placed over the top of the smoke stack, will remedy the trouble.

(44) C. E. B. says: In a boiler (say a rectangular one) filled partly with water and partly with steam, is the same pressure exerted on the bottom as at the top? If not, is the pressure greater on the top or on the bottom? What is the proportional difference, and would the proportion vary with the temperature, and in what proportion, if any, would the pressures vary as the volume of the steam and water might be respectively changed? A. At the top of the boiler you have the pressure of the steam: at the bottom the pressure of the steam, increased by the weight of the water and the steam. Suppose, for example, the weight of water in a boiler is such as to bring a pressure of 1 lb. on each square inch of the bottom of the boiler. If, now, steam is raised in the boiler until its pressure is 40 lbs. per square inch, the pressure per square inch at the top of the boiler is 40 lbs., and at the bottom 41 lbs.

(45) T. G. W. asks: What is superheating steam? What temperature and other conditions will produce superheated steam? A. Superheated steam is steam having a higher temperature than is due to the pressure. To superheat it, it is only necessary to let it pass through heated pipes or vessels having a high temperature, and in this manner it can be heated to any desired degree.

(46) C. C. says: I enclose you some facts in regard to our engine: Cylinder is 14x20, steam pressure 55 lbs., revolutions 120, cut off at $\frac{5}{8}$ stroke, indicator shows 23 lbs. mean pressure, exhausts into a feed heater. Power is $45\frac{1}{2}$ horse. Running at 60 lbs. boiler pressure (vacuum gage showing 24 lbs.), revolutions 120, cut-off at $\frac{1}{8}$ stroke, showing 9 lbs. mean pressure, and 9 lbs. mean vacuum, she shows steam 35 horse power, and vacuum 17, total 52 horse power. The engine (high pressure) has been changed to a condensing, and the indicator cards and other particulars were taken before the alteration and after, respectively. Coal bill was reduced 33,000 lbs. a month by the change. The work was about the same; if there were any difference, it was more in the last case. Coal used was slack or fine soft coal in both cases. A. This is a very good illustration of the gain from condensers, and will, doubtless, be interesting to all steam users. We would be obliged to our correspondent if he would send us the amount of coal burned before the change, the original cost of the engine, and the cost of attaching the condenser.

(47) O. C. M. asks: How can I make a mold for zinc castings, so as not to have airholes in them? I want to make a small engine, $2\frac{1}{2}$x4 inches stroke, of zinc. A. Use a brass mold made warm.

(48) C. W. S. says: We have a railroad locomotive that we are using to run a sawmill with; her dimensions are: Two cylinders 10x16, running at 120 revolutions per minute. Boiler has 120 copper tubes 8 feet long x $1\frac{1}{2}$ inches diameter; fire box is 3 feet deep, 3 feet wide, 26 inches long, open on on bottom. Wishing to burn sawdust, we constructed a firebrick fireplace underneath and opening up into the firebox of boiler. The fireplace is built of firebrick something after the form of tanners' ovens. It is 7 feet long, 51 inches wide, and 3 feet deep. We have not draft enough to take the heat through the flues; our stack is 50 feet high and 18 inches in diameter. The fireplace makes a quantity of smoke which is very black and seems to clog in the firebox. We cannot make enough steam, but we can make heat enough in the fireplace, if we could draw it through the flues. Do you think a blower would answer? A. A blower or steam jet would probably be of some service. For dimensions, it would be best for you to address a manufacturer.

(49) M. A. O. says: I wish to make a vessel for household use, and in its construction I will have to use a piece of brass or copper, 2 inches square, in a vessel to hold 1 quart. Would there be any fear from corrosion if the vessel was not cleaned properly every time it was in use? It is to be used for milk, vinegar, etc. Would copper be better than brass? A. Both copper and brass would be dangerous.

(50) C. P. V. asks: What size of lens is required for a camera obscura, to take a picture 8 inches square at a distance of $\frac{1}{4}$ of a mile? A. The distance at which a picture is to be taken and its size do not depend on the size of the lens, but on its focal length, which is determined by its curvature. To take a good picture of 8 inches square, the focal length of lens must be at least 12 inches. If the scene is so far off that there are too many objects in the picture of 8 inches square, and the details are too small, you must take a lens of longer focus, which will make the details larger in proportion to its focal length; it will also make a large picture if needed, but a small one just as well. As a larger lens admits more light, it will require less time to make the picture than a small lens, which of course admits less light. In any case it is well to use a diaphragm placed about 2 inches in front of the lens; this makes the picture sharper, but protracts the time necessary for taking it. It will not reduce the size, even if you make the opening as small as a pinhole.

(51) W. D. M. asks: Is there any one man who can turn 80, 100, or 140 feet of 2 or $2\frac{1}{2}$ inch shafting on any machine in one day of 10 hours? A. Yes, with a special tool.

(52) J. B. P. asks: What are the objections to the following plan for running street cars? Use all the available space in the bottom, sides, and top of car as a reservoir for compressed air, which is to be supplied to the cars at street crossings from a pipe or air main, laid along the tank and beneath the surface. The pipe is to connect with a large tank centrally located, and the pressure kept up with air pumps run by stationary steam engines or other power. The car driver could connect and receive his supply while passengers were changing at street crossings. With a sufficient capacity and pressure to start with, the car would run several squares without being replenished, and might draw another car. The air main should be of a sufficient capacity to avoid friction in the flow of air, and to supply the cars quickly. A. We could hardly form an opinion without having more data. We believe the difficulties of this form of motive power have been with the arrangements for compressing the air, and its cooling effect when used in the engine. A great many inventors have turned their attention to this subject, but so far we have not heard of any system which is a complete success.

(53) C. P. L. asks: Please give me a recipe for a cement to fasten oiled wood together. A. Melt together in an iron vessel equal parts of common pitch and gutta percha.

(54) C. G. asks: How can I make large lumps out of small bits of sal ammoniac? A. Dissolve in water, and allow to crystalize slowly by evaporation.

How can I make cheap liquid manure for young plants on poor ground? A. Fill a large barrel with old rotten manure, fill with water, allow to stand one week, and draw off as required.

How can I magnetize knife blades on a Tom Thumb telegraph apparatus? A. While the current is passing, place the middle of the knife on one of the poles of the magnet (taking care not to let it touch the other pole) and gradually move the blade along from the middle towards one end. Repeat this several times, taking care always to move the same pole in the same direction.

(55) E. E. says: I have a cistern which leaks badly. The water penetrates through the cement and brickwork. Can I put on new cement over the old, and make the cistern tight, or must I remove the old before putting on the new? How would it do to cement on the outside of the cistern? Would it stop the water from coming through? A. Remove all water from it and get it as dry as possible; then put on a good coat of Portland cement in clean sharp sand, and give it time to set before you put water into it. After it becomes hard, let the water into it, and you ought then to have a tight cistern.

(56) C. W. S. asks: Is it practicable to make and use a light carriage on common roads, propelled by other than horse power? Can a 2 or 3 horse power engine and boiler be made (of iron, steel, or other metal) sufficiently strong, light, durable, and cheap, to be economical to use to propel a light carriage to carry one or two persons on common roads? A. We believe there are no serious difficulties in the way of designing such a machine. Steam road rollers, traction engines, and steam plows are in successful operation, doing the work more economically than it can be accomplished by animal power.

(57) E. N. B. asks: Will you tell me how fast to run a $\frac{1}{4}$ inch twist drill to drill iron? A. At 250 revolutions per minute.

(58) C. S. F. says: During the late spring we planted some tomato and radish seed. The seeds were placed in two cups with a solution of chloride of lime. The water in the tomato cup froze solid, while the radish seed did not freeze at all. Both were set side by side in the open air. Why did not the radish freeze? A. It was due to a difference in the amount of cooling in the two vessels, dependent upon some undetected difference in the surroundings of the two vessels, the thickness of the glasses, or some similar cause.

What is the address of the Stevens Institute of Technology, and is it a free university? A. Hoboken, N. J. It is free only to poor students who have distinguished themselves for great merit.

1. What can I use to gum pressed leaves and flowers into an herbarium, so as not to curl and stain the pages, or discolor the flowers or leaves? A. Try pure gum arabic. 2. What can I put on leaves or flowers to make them retain their color when pressed? A. Copal varnish.

(59) M. T. J. asks: What is the best compost for celery in a sandy soil? A. Well rotted pig manure.

(60) N. F. B. says: We have recently heard it asserted by one of our manufacturers that it was more profitable, or fully as much so, to pump fresh water into boilers for the purpose of making steam as it is to allow the hot condensation water to be returned to the boilers. He contends that water once made into steam loses in a measure its life and vitality to be re-used for that purpose, and that fully as much or more fuel is required than if allowed to run off and fresh water is used. We would like to know if this is really the case. We have our pipes so arranged that the steam, which is used for heating purposes, passes from the boilers, and the condensation water returns directly back again without contact with the air, at nearly a boiling point. Would the value and vitality of the water (if lost) be restored by pumping air in with it, or allowing the water to be exposed to the air before going again into the boiler? A. We think that your present arrangement will answer as well as any other. It is true that water which contains no air acts differently when heated from the water ordinarily used in boilers, but we do not think that it has been proved that the specific heat is much different. Besides, it is exceedingly doubtful whether your condensed water is entirely free from air. The United States Commission on steam boiler explosions intend to make some experiments on airless water, if they do not take up the time till cold weather in getting ready as they did last season.

(61) C. L. K. asks: Water in shallow vessels put into a cellar will prevent vegetables from freezing. I have seen ice freeze to two inches thick in one night, and potatoes remain unfrozen by the side of the vessel in which the water was. A. It is true that water in melting gives out a large amount of latent heat; but the question is whether, under the circumstances mentioned, the potatoes might still have remained unfrozen, the water being absent.

(62) D. H. S. asks: How can I cleanse a well which has become foul, the water being impregnated with water from a drain? A. Pump it dry if possible, and have it cleaned out. Then pump as much water from it as you can every day for a week. Let the water settle and then test it: if not yet good, keep exhausting the water until thoroughly washed out, and the water becomes pure.

(63) B. & G. H. ask: How can we make a frost-proof house? A. The outside wall may be 8 inches thick and the inside wall 4 inches, the walls tied together with iron anchors or with brick withs. Sawdust is sometimes used for filling; and sometimes the air alone, when unventilated, is considered a sufficient non-conductor of caloric without filling.

(61) K. K. K. says: I have a number of fish globes and aquaria. I use well water drawn with an iron pump. Occasionally I notice that the water in some particular aquarium or globe has a peculiar crystal-like brilliancy, different from that in others treated in the same way. What is the cause, and how can this beautiful effect be with certainty obtained? A. The clear water is free from suspended animal matter and dirt. 2. Would filtered well water be suitable to replenish aquaria? A. No. 3. What is a good cement for aquaria? A. Put an egg-cup-ful of oil and 4 ozs. tar to 1 lb. rosin: melt over a gentle fire. Pour the cement in a heated state, but not boiling hot, into the angles. The cement will be firm in a few minutes.

How is terra cotta made? A. It is made from a pure clay and a fine-grained clear sand or calcined flints, mixed with crushed pottery, made into a paste, in which state it is molded, dried slowly in the air, and then in a kiln until of the hardness of stone.

(65) S. A. S. asks: What will make a good flux for brass? I am melting up a good deal of old scrap and sometimes use glass for a flux, but it makes the brass too hard. A. Glass is a good flux. Do not overheat your brass.

(66) J. W. asks: Can a small achromatic lens one inch in diameter be used to correct a large one of crown glass, say from 6 to 8 inches diameter? A. A small concave flint lens may be used to correct one more than twice as large of crown glass by placing it half way in the tube, and then you have what is called a dialytic telescope.

(67) R. L. asks: 1. I have good lenses for a 3 inch achromatic astronomical telescope. The 3 inch object lens is of $42\frac{1}{2}$ inches focus, and the Huyghenian eyepieces are of $\frac{3}{4}$ to $\frac{1}{2}$ inch focus. How long should the main 3 inch tube be, and how long should the sliding focus tube be? A. The main tube should be 40 inches, and the sliding focus tube 8 or 10 inches long. 2. What is the best and cheapest metal to make it of? A. Brass or German silver is the best material for the sliding tube, and wood for the large tube. Paper, well varnished, is also good. 3. Where should the diaphragm, if any, be placed? A. One diaphragm should be placed, of course, in the Huyghenian eye piece, between the lenses. Another diaphragm should be placed in front (outside) of the 3 inch lens, in case the image is not sharp; and it is well to have several of them, and use them according to the necessities of the case.

(68) J. S. asks: 1. How are chilled iron rolls used for rolling in paper mills, made? A. They are chilled in the mold. 2. How are they turned, and what is the shape of the tool? A. We have heard that a wrought iron tool is made, of ordinary diamond-pointed form, and iron cast around it in a chill.

(69) H. L. A. C. asks: How is it that the moons of Jupiter can be so plainly distinguished with the aid of an ordinary looking glass, when they are invisible to the naked eye? A. You do not see in an ordinary looking glass the moons of Jupiter, but the planet itself is made visible several times by the repeated reflection of the upper and under surfaces of the glass. For proof: First shift the position of the mirror so as to give a more oblique reflection, and the supposed moons will go further apart. Secondly, let the mirror be nearly vertical, and then lay it horizontally, and the position of the apparent moons will always be in the plane of reflection. Thirdly, watch the movements of the moons in the mirror every night; and if you place it in the same position, they will never change their positions as the real moons do. Fourthly, compare the position of the supposed moons seen in the mirror with those of the real moons seen in the telescope, and you will find them very different. Fifthly, look at Venus or Mars, or even a bright button, in the same way, by help of the mirror, and it will show in the mirror the same moons as you suppose Jupiter does, and in exactly the same position. Sixthly, take mirrors of different kinds of glass, and each mirror will show different positions and different numbers of moons; with some mirrors, you may see six and even more moons near to Venus.

(70) J. B. N. and others.—The potato is a native of America, and was not seen in Europe till Sir Walter Raleigh introduced it there, after his return from this continent.

(71) W. & R. ask: What is a good and cheap ointment or varnish to prevent rust on polished iron and steel exposed to dampness, or to a sea voyage? A. Tallow and white lead. A. Is there known a process which facilitates the union of steel to iron cast around it, that obviates the necessity of pouring the iron very hot and in large quantities, as now generally done, to the frequent injury of the steel? A. Dry the mold and cast endways.

(72) J. H. W. says: A drop of turpentine n a grain of chlorate of potash, with the addition of a drop of strong sulphuric acid, produces immediate combustion. Can I obtain similar results by the mixture of any solids? A. Sugar may be made to replace the turpentine in this experiment; but there is nothing that will replace the oil of vitriol, unless it be the anhydrous sulphuric acid, and this is not a pleasant substance to handle.

1. Ganot's "Physics" states: "For physiological or chemical effects, the wires on the bobbins (of a magneto-electrical machine) should be fine, and each from 500 to 600 yards long. For physical effects, on the contrary, they should be thick, and only from 25 to 35 yards in length." I want to produce the longest spark; which arrangement, other portions of the machine being similar, will accomplish my object? A. The fine wire will produce a current of the highest tension, and consequently the longest spark. 2. Can I increase the spark by passing the induced current of one of the above machines (constructed for medicinal purposes) through an induction coil, or would such an arrangement only add to the resistance? A. It is requisite that the inducing current in a Ruhmkorff coil should be one of quantity; and as the current referred to in the preceding question does not possess this essential attribute, it is useless for this purpose.

1. Does mercury evaporate? A. Yes. 2. Which would be more durable as a valve seal, subject only to climatic changes of temperature, mercury or glycerin, the seal being in a position difficult of access for adjustment or inspection? A. Although both have objectionable features, the mercury would probably answer your purpose best.

I wish to construct a small but powerful battery, to be placed in a position difficult of access, but arranged with cord and pulley in such a way that I can lift the electrodes out of solution when not in use, and produce strong electric action immediately on replacing them. Under such conditions, I wish to employ such materials as will be most constant. The battery will not be used more than five or six times in a day, and then for only a few seconds. What form would best answer the purpose? A. Arrange a number of large plates of zinc and carbon alternately, and connect for quantity, that is, all the zincs together to form one pole, and all the carbons to form the other. Place in a lead-lined wooden trough, containing a cooled solution consisting of one part by weight of bichromate of potash in ten parts of hot water and five parts of oil of vitriol. The plates are readily arranged so as to be lifted together out of the solution.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. B.—It is clay with yellow ocher; it contains oxide of iron, but only in small quantity.—A. L. H.—All the specimens are oxide of iron, except No. 2, which is asphalt.—P. D.—They are cubical crystals of iron pyrites.—J. T. W.—Silver was not detected in the sample forwarded. It would be necessary to take a larger sample to subject it to careful assay.—F. H. D.—Quartz.—J. M. R.—It is slate, with a small percentage of bituminous matter. Not valuable.—F. H. F.—It is wulferite or molybdate of lead, and contains 51 per cent lead and 39 per cent molybdic acid.—D. L.—No. 1 is a rock containing sand, clay, and oxide of iron. No. 2 and 3 are dolomite, No. 2 containing some clay.—C. H. W. Jr.—No. 1 is quartz with carbonate of copper. No. 2 is galena.—E. F. R.—The water holds a considerable amount of oxide of iron in solution, which on contact with the air is separated, and gives the iron stains shown on your paper. It is probable that the water is impregnated with matter from a cesspool, as it contains a large amount of organic matter.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Use of Superphosphates. By T. B. S.
On the Altitude of Thunderclouds. By ——.
On the Grasshopper Plague. By J. S.
On Astronomy. By J. R.
On the Potato Bug. By J. C. B.
On a Cold Water Engine. By R. J. W.

Also inquiries and answers from the following:
A. F. K.—N. H. W.—J. C. T.—R. J.—N. F. R.—A. N.—J. T. B.—R. H. S.—J. F. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells sundials? Where can salicylic acid be obtained? Where are small printing presses sold? Whose is the best paint for ship's bottoms?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH
Letters Patent of the United States were Granted in the Week ending June 15, 1875,
AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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DESIGNS PATENTED.

8,386.—HAT BLOCK.—T. Agens *et al.*, Newark, N. J.
8,387.—GLASSWARE.—W. Leighton, Jr., Wheeling, W. Va.
8,388.—MEDAL.—J. W. Liegg, Philadelphia, Pa.
8,389.—KNIFE HANDLE.—L. J. March, Deerfield, Mass.
8,390.—MUGS, ETC.—T. C. Pears, Pittsburgh, Pa.
8,391.—HEAD LIGHT.—T. S. Ray *et al.*, Buffalo, N. Y. city.
8,392.—DRINKING FOUNTAIN.—W. Tweeddale, Brooklyn, N. Y.
8,393.—RANGE PLATE.—N. S. Vedder *et al.*, Troy, N. Y.
8,394.—RANGE.—H. A. Wood, Bangor, Me.
8,395.—COFFIN HANDLES.—M. H. Crane, Cincinnati, O.
8,396 & 8,397.—CHAIN PUMP CURB.—H. L. Fry, Cinn., O.
8,398.—GAME BOARD.—C. G. Harger, Jr., Watertown, N. Y.
8,399 to 8,403.—OIL CLOTHS.—J. Hutchison, Newark, N. J.
8,404 & 8,405.—CARPETS.—T. J. Stearns, Boston, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
June 15, 1875.

4,837.—S. T. Gustin, Mescico, N. Y., U. S. Animal poke. June 15, 1875.
4,838.—E. A. Kitzmiller, Pittsburgh, Pa., U. S., *et al.* Broom handle painting machine. June 15, 1875.
4,839.—J. H. Myers, Rochester, N. Y., U. S. Harvester rake. June 15, 1875.
4,840.—J. L. Clark *et al.*, Westminster, England. Floating docks and pontoons. June 15, 1875.
4,841.—A. A. Wilson, Montreal, P. Q. Compound paint. June 15, 1875.
4,842.—J. A. Egginton, Montreal, P. Q. Colored relief letters. June 15, 1875.
4,843.—J. C. Ramsden, Halifax, England. Apparatus for the combustion of fuel. June 15, 1875.
4,844.—H. W. Murdock *et al.*, Toronto, Ont. Pocket door fastener. June 15, 1875.
4,845.—T. Foster, Lindsay, Ont. Hame fastening. June 15, 1875.
4,846.—R. Taylor, Guelph, Ont., *et al.* Rail joint and nut lock. June 15, 1875.
4,847.—J. L. Bond *et al.*, Sarnia, Ont. Pawl and ratchet mechanism. June 15, 1875.
4,848.—W. C. Barker, Millport, N. Y., U. S. Chain pump. June 15, 1875.
4,849.—E. J. Brooks, New York city, U. S. Metallic seal. June 15, 1875.
4,850.—C. E. Patric *et al.*, Springfield, O., U. S. Seeding machine. June 15, 1875.
4,851.—G. B. Peters, Marshall, Mich., U. S. Lubricating compound. June 15, 1875.
4,852.—W. F. Wheeler, Boston, Mass., U. S. Fertilizer holder and distributor. June 15, 1875.
4,853.—E. R. Stockwell, Theresa, N. Y., U. S. Slat iron for carriage top. June 15, 1875.
4,854.—J. F. Donoghue, Springfield, Mass., U. S. Anti-incrustation battery for boiler. June 15, 1875.
4,855.—W. Griffith, Toronto, Ont. Lever mortise lock. June 15, 1875.
4,856.—J. L. Gregory, St Louis, Mo., U. S. Egg beater churn, and ice cream freezer. June 15, 1875.
4,857.—A. Taplin, Forestville, Conn., U. S. Formin sheet metal screw-threaded collars. June 15, 1875.
4,858.—H. W. Merrill *et al.*, Lynn, Mass., U. S. Boot and shoe tip. June 15, 1875.
4,859.—A. Tolton, Eramosa, Ont. Pea cleaner and pneumatic chaff carrier. June 15, 1875.
4,860.—D. Lister, Toronto, Ont. Welding process and composition. June 15, 1875.
4,861.—L. Brush, Buffalo, N. Y., U. S. Passage ticket. June 15, 1875.
4,862.—E. McMullen, Montreal, P. Q. Manufacturing tobacco. June 15, 1875.
4,863.—W. N. Whiteley, Springfield, O., U. S. Mower and reaper. June 15, 1875.

MASON'S PAT'T FRICTION CLUTCHES are manufactured by Volney W. Mason & Co., Providence, R. I. Agents, L. B. BROOKS, 60 Cliff street, New York; TAPLIN, RICE & CO., Akron, Ohio

P. BLAISDELL & CO.,
Worcester, Mass.,
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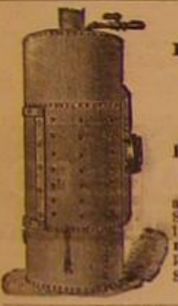

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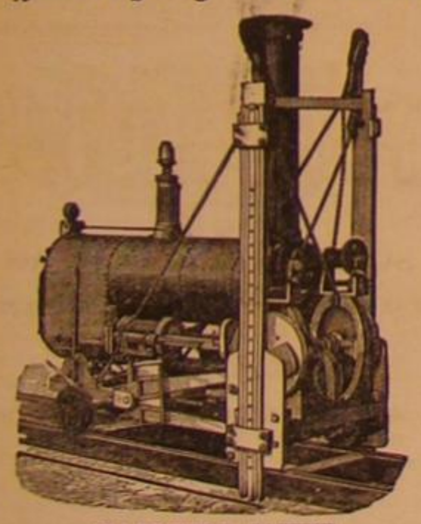

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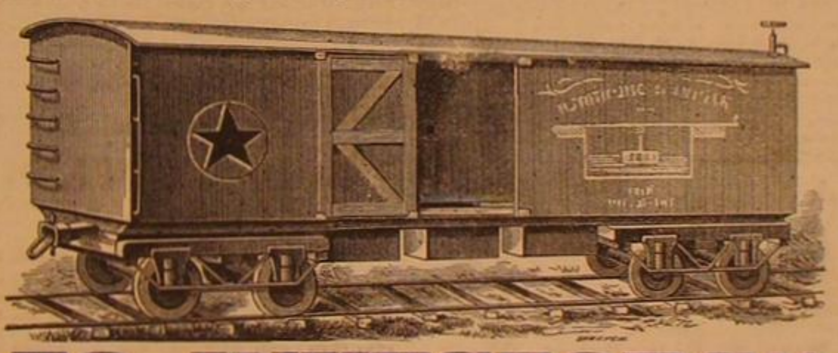

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