duction of any superfluous keys or adjusting pieces which may either work loose or put it in the engineer's power to spoil his engine. These points and others which will appear as we proceed, have been kept carefully in mind in the design of this engine. First, in reference to the valve gear. It is well known by all familiar with the subject, that the use of a single slide valve to accomplish the admission, suppression and release of the steam to and from the cylinder is only possible when we are willing to sacrifice something of the peculiar characteristics which we should wish each of these elements of the distribution to have. In all engines therefore in which a correct distribution is sought ,the attempt to make a single valve accomplish so many different functions is abandoned, and in most cases, as in the Corliss, Sickles and other arrangements, four separate valves are set to admit and release the steam. This is the plan also which is adopted in the Allen engine, although as both exhaust valves are worked by a single stem, we might perhaps regard them as but a single valve in effect. A single eccentric moves all the valves, but the motion imparted to them is modified by interposing between each steam valve, eccentric rod and its valve stem, a bell crank rock shaft. The cut-off is varied by the govern or raising or lowering the ends of the rods which we have called the eccentric rods, in a curved slot or link formed in the eccentric strap itself, and in order that each steam valve may have exactly the motion required for its own functions, these rods, though starting from the same block, are made separate and of different lengths. This enables the following condition, which is the gist of the whole, to be obtained. Each bell-crank rock shaft is so placed that when the eccentric is at its full throw in the direction of opening its valve, the arm towards the eccentric is nearly on its center, or in line with the eccentric rod, while the arm connected to the valve stem is nearly vertical, or at right angles to the rod. By this means, it will be seen, a very slight motion of the eccentric produces a very rapid motion of the valve, while, when the eccentric is at the other extremity of its throw, the relative position of the arms of the bell crank being reversed, a very considerable movement of the eccentric produces but little motion in the valve. In other words it remains nearly at rest when closed until the time comes for it to admit the steam, when it rapidly opens a wide port and as rapidly closes it again. The exhaust valve receives a constant motion from the end of the link. The steam valves are placed in a separate chamber from the exhaust, the latter being situated beneath the former. There is a rather large amount of port space involved in this arrangement, but every care is taken to reduce it to a minimum. Equilibrium valves are used for the admission, constructed on a very simple and beautiful principle. The valve is a rectangular frame, like the four sides of a box without top or bottom. Over the back of this is a fixed plate which receives the pressure of the steam and under which the valve just freely slides. This plate is recessed on its under side, and its edges and those of the valve and seat are so situated that when the valve begins to uncover the port it also opens an equal space at each of its sides, top and bottom, thus giving in effect a port four times the length of the valve. The exhaust valve is also constructed so as to open twice its own length of port. The engine at work in the Exposition is running at 200 revolutions per minute, and the diagrams taken from it show a quick and free admission of the steam, giving an initial pressure but little below that in the steam chest (to which an indicator is also applied); a sharp cut-off, an early release, and complete escape of the steam before the returning piston, leaving but half a pound difference of pressure between the cylinder and condenser as measured by the same indicator, and lastly a small amount of compression just sufficient to ease the motion of the reciprocating parts.

The condenser is a part of the engine on which considerable thought has been bestowed. The condensing chamber and hot well, which are side by side, form the upper part of a square casting of which the lower portion is a water chamber forming the air pump. Into this works horizontally a pointed plunger keyed to a prolongation of the piston rod, which by its displacement draws in and forces out a certain quantity of water at each alternate stroke of the piston. The movement of the water produced by this means is as gentle as could be wished at this speed, since it only rises one inch at each stroke and escapes freely at the delivery valves in the bottom of the hot well. The foot valves of the condenser are on the same level as the delivery valves, and open downwards, so that the air entering the air-pump chamber from the condenser remains on the surface of the water and is the first to pass out at the delivery valves, the top of the chamber being slightly inclined to facilitate its escape. This is a very important point, and the proof of it is to be found in the fact that the vacuum obtained remains constantly at 27¼ inches to 27½ inches. To particularize all the points in which the mechanical construction of the engine has been adapted to high speed, would occupy too much of your space. But so carefully has this been done that many who at the first glance exclaimed that such a speed was necessarily too much for any engine, have after a more careful examination of it, confessed that the conclusion was irresistible that an engine could be designed as suitable for that as for a lower speed. In every part the designer has studied to have as few loose pieces as possible. Thus his piston is shrunk on to the rod and held firmly by that means alone. In the smaller sizes the packing consists merely of small grooves turned in the face of the piston, the action of which in preventing the flow of gases is well understood. In the larger engines Ramsbottom's rings are employed, which render all springs or other means of adjustment unnecessary. The crank-pin brass in the connecting rod is held in the solid end of the latter, in which is a wedge of a large bevel, and held by a single good bolt at the top of the rod, and another at the bottom, by means of which it can be set and firmly held at any position, the two bolts locking each other through the intervention of the wedge acting as a deep nut. Great care has also been used in the design of the crosshead to secure lightness, strength, and ample and hard surfaces. The pin is surrounded by a bush of hardened steel, with a square formed on its ends by means of which it is let into the body of the crosshead and prevented from turning. The thorough lubrication of all the parts is another vital point, and has been amply provided for, constant lubrication being in all cases adopted; in the cylinder and valve chest by Ramsbottom's "displacement lubricator" and in other parts by suitable oil cups and wicks. The economy of oil by such means in proportion to the useful effect produced, is sufficiently evident to secure more general attention to its use. I have given this full description of this engine because it unites in itself more features of correct engineering than any other in the Exposition, and moreover being entirely American in design, though English in construction, it is something in which we may take some pride, the more so as the contents of the space allotted to us are not quite such as we should like to have had here to represent the skill of our inventors and machinists. SLADE.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

Velocity of Steam.

MESSRS EDITORS—In the SCIENTIFIC AMERICAN of June 8, 1867, on page 359 is the following paragraph:—"Velocity of Steam and other Gases.—Mr. R. D. Napier has demonstrated to his own satisfaction and that of others, first theoretically and afterwards by experiment, that the velocity at which steam will flow from a boiler through an orifice into a vacuum is rather less than half of that given in all published tables, and that it is no greater into a perfect or partial vacuum (at a pressure of two or more atmospheres) than into the air.—the general law is established, that a gas of any given pressure will rush into a gas of not more than half that at the same rate as into a vacuum."

There is an error in this paragraph, either on the part of Mr. Napier or his reporter. It is true that steam flows into a vacuum at only half "the rate" (or half the quantity in a given time) that is given in the published tables; not however because its velocity is less than the old theory assigns to it but because its density is reduced one half in passing the orifice. With this modification the views of Mr Napier as given in the paragraph are correct.

It would be a mistake however, to suppose that Mr. Napier was the first to advance these views. The same views were fully set forth and demonstrated theoretically in an article published in 1848 in the *American Journal of Science and Arts*, second series, Vol. 5, page 78; and the general law of the flow of elastic fluids which is there established theoretically, was afterwards shown to be in almost exact accordance with the results of experiment in another article published in the same work in 1851, Vol. 12, page 186. W.

FACTS ABOUT EXPLOSIONS OF STEAM BOILERS.

If the causes of boiler explosions are ever ascertained so that they may be prevented or at least their destructive effects reduced, the facts and circumstances attending their occurrences must be recorded. For this reason we make room for two communications, the facts contained in which are somewhat commented upon.

MESSRS. EDITORS:—I have perused with much interest your articles on steam boilers, and their explosions, to see if I would find a case of explosion similar to one I once witnessed. The boiler explosion I refer to was in a saw mill belonging to my father in the interior of this state and occurred several years since—in 1857 I believe. There were two 30 in. cylinder boilers, 30 ft. long, enclosed in the usual manner by brick walls. The mill had been running until about 11 o'clock when the engine had been stopped for about ten minutes to sharpen the saw. Steam was blowing off at 60 lbs., making considerable noise, as the safety valve was not inclosed by an escape pipe, when the person in charge of the mill ordered the fireman to hang an old stirup lying by on the beam. It had not been there more than three minutes when the explosion took place. Both boilers exploded simultaneously, with a report like artillery; it was but a single instantaneous report. One boiler parted about 8 ft. from the front end in the middle of a sound sheet, or an apparently sound one, both ends flying apart, that is neither end flying sideways. The other boiler was torn like wet paper, completely to pieces, or at least in 19 separate pieces, some of them torn across the joint or lap of the sheets, some flattened out nearly straight, others doubled up, but neither head of either boiler, which were of cast iron, was broken or separated from the sheet to which it was fastened. The large or longest end of the first boiler described was blown through the brick chimney, 7 ft. square at the base, from thence taking out all the side posts on one side of a blacksmith shop about 20 yards off, then striking ground a little more elevated ploughing a furrow, its depth of diameter, about 130 yards and there stopping.

I cannot understand how steam, if steam it was, can tear a boiler almost to atoms. I have seen several explosions but none in which such fearful power was shown. The boilers contained sufficient water which was rather strongly impregnated with lime. The boilers were placed at right angles with the mill and about at the centre of the building, outside in a separate boiler house; so placed to guard against danger and destruction in case of explosion, it being supposed that the boilers would almost certainly fly sideways out of their bed. Is that supposition right, generally?

I am using now in a horizontal tubular boiler, water very strongly impregnated with sulphur; will that sulphur injure the iron or how will it affect it? My boiler primes badly; will carrying my steam pipe from the dome on the side from the engine, down the side of the boiler, and under the grate bars, thence upward as high as the dome and to the engine, infringe on anyone's patent for superheating steam, and will it not accomplish the object? W. B. VAN VALKENBURG.

St. Mary's, Ga.

This is undoubtedly a case of genuine explosion, some of the characteristics of which are an entire destruction of a boiler, the ruptures generally taking place in the strongest parts of the boiler, or, in other words, not in the parts where it was riveted, but through the solid sheets.

It is here proper to say that by actual experiment it is found that a single riveted joint loses 44 per cent. of the strength of a plate not riveted.

Now it seems one boiler was torn through a solid sheet and not in the line of rivets. If the rupture had been caused by a gradual accumulation of pressure it would undoubtedly have given way in the weakest part along the line of rivets, being there but about half the strength of the solid plate. The other boiler, its mate, it seems was thrown into a large number of pieces—rents at random—and all with the safety valve open!

The inevitable conclusion is that there must have been an instantaneous increase of pressure, so instantaneous as not to give the safety valve time to open more to relieve the boilers; in fact the entire destruction of one boiler was not sufficient relief to save the other!

The direction that the two pieces of the boiler took was that due to the force that propelled them. Under the circumstances the boilers could not have gone sideways. Had a rupture taken place on the side, the boilers would have been propelled in the opposite direction; if on the bottom the boiler would have gone up.

This is a very rare case. A prominent engineer with an experience of over 40 years with steam boilers has seen but three cases of the kind; the cause for these terrific explosions is not yet understood.

The sulphur in your water will, without doubt, cause your boiler to prime. You will be relieved of your priming by suspending a platform of wood or metal, at the water line directly under the point where your steam is taken off. Let it be of sufficient size (square) to fill the space at the water line. You will cool rather than superheat your steam by the method you propose of conducting your steam down the side of the boiler and under the grate bars.

MESSRS. EDITORS:—Your correspondent G. W. D., of Providence, R. I., was not correct in the statement of the cause of the boiler explosion that lately took place in Massachusetts, as given in your paper No. 23, Vol. XVI, page 358. The superintendent has never attributed the cause to an excess of water or yet to any known cause. The boilers were plain cylinder boilers, 36 ft. long 30 in. diameter, and carrying the usual amount of steam at the time of the explosion—"about 80 lbs." They were fed at the rear end, water being pumped through a tank into them, the pipes so arranged that the check valves could hardly be said to be nearer one boiler than another; the boilers were placed in two sections, four in each. The coal used was pea and dust mixed, consequently the fires had to be cleaned out at least once a day. At the time of the explosion the fires were about to be cleaned, having some six or eight inches of dead ashes on the grate bars, with two or three inches of fire on that, which was low in order to clean them out, usually done by pushing back the fire to the bridge wall, then drawing out the ashes, pulling the fire down on the grate bars, and adding fresh coal. Just before cleaning the boilers were always filled with water. The fireman had just stopped the pump as the agent of the mill came into the room, and trying the gages of each boiler himself and finding a full gage at the upper cock, he cautioned the firemen not to fill the boilers too full as he thought it not good economy in making steam. He went directly to the office and had hardly seated himself when the explosion took place. One of the center boilers was broken about six feet from the end, or the length of two sheets from the head of the rear end, parting in the rivet holes. The short end of the boiler lodged in the chimney, the other was thrown some 800 feet from its bed, almost in a direct line; the one next to it was lifted up and thrown over the other two outside of the building. All of them seem to have been lifted up as from a pressure below; the walls were leveled even with the ground, scarcely one brick left upon another, and even below the ground the flues leading to the chimney were more or less shattered. The explosion took place at once upon stopping the blower. There was heard a sound as of a heavy rush of air, as described by those working in a building near by. One hearing this sound jumped from his chair and reached the centre of the room before hearing the report of the explosion.

Now, Messrs. Editors, what was the cause of the explosion? Was the space under the boilers charged with gas, a space perhaps, 20 ft. long, 3 ft. deep, and of the width of each section? Some have thought so. The fireman has since said his furnace doors have sometimes sprung open and the smell of gas was quite strong, particularly when the blower was being used, or the fires buried at night, at which time the damper was nearly closed. I think no argument would convince the agent of the mills that the cause was absence of water, after trying them himself. Could a boiler foam out its water in ten minutes, or less than that time, with such low fires as were burning at the time of the explosion?

Hebron Mills, Mass. C. T. CARPENTER.

[The above was probably not technically an explosion, but the giving out of the part under a gradually accumulated pressure. If all the facts were known, it undoubtedly would be found that the joint where it gave out was a forced one, or in other words, when the boiler was made, the parts did not fit, and were hammered cold to make the one larger and the other smaller, and then to make the rivet holes correspond; the drift pin was freely used—all tending to disintegrate, crack, and destroy the strength of the plates—a most vicious practice.

The supposition that gas externally had any thing to do with the rupture of the boiler, or the destruction caused by it, is absurd; the large quantity of water suddenly liberated at a temperature of over 315°, together with the explosion of the steam, which would be instantly made on liberating the pressure—to this add the steam contained in the boiler, which would expand about 4.7 times—and we need search no farther for the cause of the destruction, lifting boilers, etc.

With regard to the boiler "foaming out" its water in ten minutes. This would be impossible, and to keep the engine running, inasmuch as there was say 120 cubic feet of water in the boiler and to put that through the engine in ten minutes would probably knock it to pieces.

This occurrence will very naturally create a distrust of the remaining boilers. They should be tested by tbe hydraulic test to a pressure 30 per cent higher than the steam pressure required, and the steam gage should be examined to see if it is perfectly correct.—Eds. Sci. Am.

[For the Scientific American.]

THE SAMPSON SCALE.

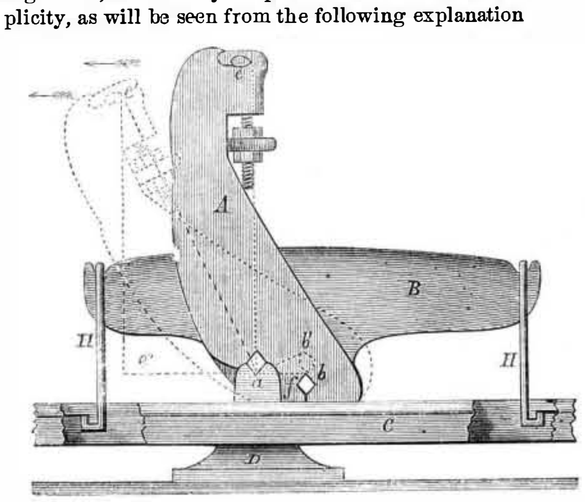
[Entered according to act of Congress, in the year 1867, by M. Richard Leverson, in the Clerk's office of the U. S. District Court for the Southern District of New York.]

A novel and interesting application of the mechanical laws of moments is to be seen in the Sampson Scale, in which the inventor, probably without knowing it, has afforded a beautiful illustration of those laws, and has produced a scale of uneqaled delicacy and which(equal workmanship being assumed) not merely is, but demonstrably must be more sensitive than any platform scale yet invented.

Our readers will no doubt remember that the moment of a force with respect to a point is the product obtained by multiplying the intensity of the force by the perpendicular distance from the point or center of moments to the line of direction of the force. This perpendicular direction is called the lever arm of the force, and the moment itself measures the tendency of the force to produce rotation about the center of moments.

The moment of a force with respect to an axis of moments is equal to the moment of the projection of the force upon a plane at right angles to the axis taken with respect to the point in which this axis pierces the plane as a center of moments.

These are the only principles involved in the Sampson scale to which attention need be called, their application being novel, remarkably simple, and beautiful from their simplicity, as will be seen from the following explanation



The top yoke, B, carrying the frame or bottom yoke, C, hung from it by the links, H, rests upon a knife edge, *b*, between the ear-shaped connected arms or uprights, A, which rest by their knife edge, *a*, on D. A chain connects by another knife edge at *e*, and according to the capacity for which the scale is designed connects either by a bell crank directly with the short arm of the steelyard, or with that short arm through other levers constructed on the same principle with the first, until the desired multiple of the scale weight is obtained.

In a scale capable of weighing 20,000 pounds, the first lever was in the proportion of six to one, a second was in the proportion of three to one, and a third in the proportion of six to one, while the steelyard was in the proportion of a little more than six to one—so that three pounds at the extremity of the long-arm of the steelyard should balance 2,000 pounds upon the platform.

The platform rests upon four carriages, C, one at each corner of the floor. The weight W, resting upon the platform; it is obvious that *a* is an axis of moments, with respect to the weights, W, and with respect to the weight, P, which rests on the steelyard, and which two weights are in effect two forces tending to turn the rigid body, A, round the axis *a*, in opposite directions. The weight, P, is a force, P, applied in a horizontal direction at *e*, and the weight, W, is a force, W, applied in a vertical diretion at *b*, and it is by making the angle, *eab*, a right angle, that the extreme delicacy of the scale is secured, while the shortness of the lever arms, *ab*, *ae*, frees the scale from the *spring*, which is the chief source of error in almost all the ordinary descriptions of scale, absolutely unavoidable when a long lever arm is employed.

So long as the moments of P and W, with respect to the axis of moments, *a*, bear the same proportion to one another, so long is the utmost sensitiveness insured. When P and W are ballanced, $P\times ae=W\times ab$, but suppose $P\times ae$ is unequal to $W\times ab$, and let

$$\frac{P\times ae}{W\times ab}=Q \text{ be greater than 1,}$$

then P will pull the scale over (raising the weight, W,) into, say, the direction indicated by the dotted lines, *ae' ab'*.

The moment of the horizontal force, P, tending to revolve the body, A, about the axis, *a*, in one direction is $P\times e'e''=P\ ae' \cos.\ ae'e''=P\ ae \cos.\ eae'$, and the moment of W tending to revolve the body, A, in the opposite dirsotion about *a* is $=W\times af=W\ ab' \cos.\ b'af=W\times ab \cos.\ e'ae$ (*e'ab'* being a right angle and the angle *b'af* therefore equal to the angle *e'ae*.)

Then the ratio of the moments of P and W, when the body has been drawn to the position indicated by the dotted lines is

$$\frac{P\times ae \cos.\ eae'}{W\times ab \cos.\ eae'}=Q \text{ as before.}$$

But if the knife edges had been otherwise disposed these ratios would have varied with every change in position of the rigid body A.

Suppose the angle *e'ab'* or *eab* not to be a right angle, then the moment of P with respect to the axis, *a*, would have been$=P\times ae$, cos. of the angle which *ae* makes with the axis of *y*. Call this angle Y, and the moment of W with respect to the same axis, *a*, would be $W\times ab\times$cos of the angle which *ab* makes with the axis of *x*. Call this angle X, and the ratio will be

$$\frac{P\ ae \cos Y}{W\ ab \cos X}$$

Let the body A be drawn over say by P, as before. Then the angles made by the lever arms of P and W wjth the axes of *x* and *y* respectively are increased by the same quantity, *v*, and the moments of P and W become respectively $P\times ae \cos (Y+v)$ and $W\ ab \cos (X+v)$, but

$$\frac{P\times ae \cos (Y+v)}{W\ ab \cos (X+v)} \text{ is unequal to } \frac{P\times ae \cos Y}{W\times ab \cos X}$$

except when $v=0$ or some multiple of 90°. Hence it is that a scale constructed without the very strictest regard to placing the knife edges at the angles of a right angled triangle must be deficient in sensitiveness.

The platform of the Sampson scale rests at its four corners on four carriages, C, which swinging feeely by the links H, keep the platform perfectly horizontal and preserve it from rubbing or jamming against the frame. The entire floor covered by the scale constructed to weigh 20,000 lbs. is only 15 feet by 10 feet 3 inches, and so far as its weighing properties are concerned the scale could easily have been built in one fourth or even one sixteenth the space.

The following experiments conducted in our presence show the beautiful results obtained by attention to the simple laws above mentioned, combined undoubtedly with skillful workmanship.

A weight of 4,000 lbs. being placed upon the platform and exactly balanced by a weight of 6 lbs. at the extremity of the steelyard, the addition of half a pound only on the platform caused the steelyard to strike the upper stop. The scale was then balaneed by adjusting the index weight to the half-pound point upon the steelyard and the half-pound weight then removed from the platform, when the steelyard fell and rested on the lower stop.

After exhibiting the deflection caused by the addition or subtraction of a half-pound weight on the scale while 4,000 lbs. were on the platform, the weights were heaped up first on one corner of the platform and then indifferently on different parts of the platform without the slightest deviation in the result or straining of the parts.

A scale constructed on this principle is in use at the weigh lock at Waterford, on the Champlain Canal and elsewhere, and has been very favorably reported on by the State Engineer and Surveyor in his report for 1862, but no explanation of the principle on which its remarkable delicacy depends has, we believe, ever before been given to the public.

The 20,000 lbs. scale referred to above is, we believe, to be seen at the company's office, No. 240 Broadway.

M. Richard Leverson.

New Mode of Operating Hay Forks.

A very simple and useful contrivance for unloading hay from the cart and depositing the same at any desired part of the barn, has been recently invented by D. L. Miller of Madison N. J. He uses a clutch pulley through which a rope is extended horizontally from one portion of the barn to another near the roof. To the pulley is another rope extending vertically from the way rope to which the fork is attached. It will be understood how easily with such an arrangement one man can unload and deposit in any part of the barn. The invention consists in the arrangement of rigging, it being adapted to the use of the well known large forks.

Blue Coloring Matter.

M C. A. Girard, of Paris, has patented improvements in the manufacture of blue coloring matter. He introduces into a distilling apparatus two parts of commercial diphenylamine and three parts of sesquichloride of carbon, and heats the mixture, taking care to maintain the temperature between 170 deg. and 190 deg. Centigrade. The blue color is rapidly developed, and in five or six hours the mass assumes a bronze aspect and becomes brittle on cooling. The melt with the bronze aspect is powdered and treated until complete exhaustion in a displacement apparatus with benzole or ether at a gentle heat. In this apparatus the warm solvent filters through the powdered melt and is afterward distilled, the vapor is condensed and returned on to the melt, and so on continually. The untransformed sesquichloride of carbon and commercial diphenylamine are dissolved as well as a small quantity of bluish violet; the greater part and the best part of the blue remains undissolved. The blue is then collected and dried, and may, after being dissolved in alcohol or methylated spirit, be at once employed in dyeing or printing; but, if it be desired to purify it further it may be dissolved in boiling alcohol, filtered and precipitated from the filtered solution by hydrochloric acid. The inventor has observed that pure ditolylamine yields under the same conditions a brown coloring matter; pure diphenylamine yields a blackish violet blue; and penyltolylamine a bluish violet or violet blue; but a mixture of diphenylamine and ditolylamine and of diphenylamine and phenyltolylamine in any proportions yields a blue. He, however, remarks that some proportions are better than others, and that two parts of diphenylamine and one part of ditolylamine are good proportions.

NEW PUBLICATIONS.

Appleton's Hand Book of American Travel—The Northern Tour. By Edward H. Hall. D. Appleton & Co., 443 Broadway, New York City.

Beginning with sensible and plain advice to travelers, as applicable to foreigners as our own people, this volume presents all the information required for a tour from Nova Scotia to California, including all the Eastern, Middle, and Western States and the Canadas. Plain directions as to railway and steamboat lines, hotels, objects of interest, and brief descriptions of places, without annoying and wearying with useless trash, give a peculiar value to this book, which some other more pretentious volumes do not possess. Maps of the country and plans of the cities through which the tourist may pass are bound in the book, and will be found to be a great convenience.

Bradshaw's Hand Book to the Paris Exposition, London. J. Wiley & Son, 535 Broadway, New York City.

This volume contains an alphabetical index of the classes of articles in the Exposition, with all the instruction necessary to visitors relative to the plan of the building, its approaches, prices of admission, and brief and comprehensive details of the general features of this great world show, with a fine map of Paris and its environs. It is timely and interesting, whether the reader is a visitor or only a home seeker for knowledge.

History of the Atlantic Telegraph. By Henry M. Field. Second Edition. Charles Scribner & Co., 654 Broadway, New York City.

To any one who cares to read the record of a successful undertaking which puts to shame the wildest imaginings of romancists; who desires to know what human energy and determination can accomplish against the adverse operations and the almost insuperable obstacles of nature, we commend this volume. It seems, even in the details of the enterprise, like the fabulous and incredible statements of ancient story tellers, yet the result is apprehended every day by the people on both sides the Atlantic. The facts about the great submarine telegraph, although appearing occasionally in newspaper paragraphs, have never been so clearly stated as in this volume. We shall draw from them hereafter. Meanwhile we recommend the perusal of this book to all who believe in the ultimate sovereignty of man over nature. They cannot fail to be deeply interested.

Kellogg's United States Mercantile Register for 1867–8. Kellogg, Johnston, & Co., 116 Nassau street, New York City.

This work is a compendium of information of inestimable value to every business man. It is divided into two parts, the first including an amount and variety of useful information which otherwise must be sought in ponderous and numerous volumes. The internal revenue laws, including licenses and stamps; the tariff; weights and measures of all nations; general statistics of the country; value of foreign coins; the United States bankrupt law; mercantile laws of all the states; domestic and foreign postage; list of post-offices and telegraph stations, and many other convenient items of information are contained in part first. Part second is a business directory of all the principal cities of the Union, alphabetically arranged and handy for reterence.

Trow's New York City Directory. Compiled by H. Wilson, for the year ending May 1, 1868. John F. Trow, 52 Greene street, New York City.

This is one of the books, which, like the dictionary, contain only hard facts, and is of immense value to the business man, the resident, and the stranger. The compiler in his preface says: "It has required almost a half century of constant effort and unremitting practice to bring the complicated organization of forces into perfect working order which are necessary to the annual production of this work. But as the magnitude of the Directory has increased, its defects, we believe, have decreased." This issue contains 177,317 names.

Principles of Mechanism and Machinery of Transmission. By Wm. Fairbairn, Esq., C. E. Henry Carey Baird, 406 Walnut street, Philadelphia.

This volume is a synopsis or abridgement of the author's large work on "Mills and Millwork," and is better adapted to the wants of American millwrights, machinists, and operatives than the former. It contains, in the "Principle of Mechanism," descriptions of most ot the general combinations of machinery, with plans, formulas, and explanations, and the chapters devoted to "Machinery of Transmission" give details of all the different varieties of pulleys, gears, screws, clutches, etc., with a treatise on shafting It is illustrated with engravings, diagrams, and plans, and has a copious index.

The American Annual Cyclopedia and Register of Important Events of the year 1866, Embracing Political, Civil, Military, and Social Affairs; Public Documents; Biography, Statistics, Commerce, Finance, Literature, Science, Agriculture, and Mechanical Industry. Volume VI. pp. 800, 8vo. New York. D. Appleton & Co.

This important and elaborate Annual makes its appearance with its usual characteristics, which are well summed up on the title page as quoted above. A record of one of the memorable years of the world's history, it could hardly escape a plethora of matter more fascinating and marvelous than fiction, and such as every intelligent person wishes to have embodied, indexed and at hand for ready reference in the future. It is appropriately garnished with a portrait of the central political figure of the year, Count Bismarck, and also with the attendant figure of King William I, of Prussia, and with that of Garibaldi as a background.

Chemical News—Reprint.

We are glad to learn that W. A. Townsend & Adams, Publishers, of this city, have undertaken the republication of the *London Chemical News*. This is one of our best foreign publications, but the high price which it has cost subscribers in this country, has prevented a large circulation. The reprint will be afforded so cheap that the publication must have a large circulation. A prospectus giving full particulars may be found in our advertising columns.

The Correlation and Conservation of Gravitation and Heat, and Some of the Effects of these Forces on the Solar System. By Ethan S. Chapin. Springfield, Mass. Lewis J. Powers & Brother. pp. 120.

The writer of this book is evidently an independent and fearless thinker. He does not hesitate to disagree with doctrines which have stood for centuries. The book is speculative, and treats of the most exalted subjects.

Railways in Italy.—By the transfer of Venetia to the kingdom of Italy, the network of Italian railways has been increased to the extent of 600 miles. An uninterrupted line of railway has now been established on the eastern side of the Italian Peninsula. The opening of the line from Ancona to Foligno and Rome, puts the north in communication with Naples. Florence has now also uninterrupted railway communication with Rome.