PAPIN'S STEAM ENGINE.

BY PROFESSOR CHARLES A. JOY.

It is a matter of history that, as early as 1688, Denis Papin, Professor of Physics and Mathematics at the University of Marburg, proposed to substitute steam for powder in the engine invented by Huyghens, and that in 1695 he published a description of several new inventions, in which steam played an important part. The Elector Carl, of Hesse-Cassel, was anxious to be free from the annoyances and imposi tions practised upon his boatmen by the authorities at Münden, and he proposed to avoid that city by constructing a canal connecting the Weser with the river that flowed through Cassel. Much of the work was accomplished, and the half finished line of the canal can be traced even at the present day. Papin was authorized to build a powerful steam pump by which the supply of water was to be regulated. A working model of this pump was completed; and the Elector was on the point of visiting the laboratory to witness its operation, when a fearful explosion frightened the workmen, and afforded an opportunity for enemies to intrigue for the expulsion of Papin from the country. The model was preserved for a long time in Cassel; but at the time of the French invasion, it disappeared, and no trace of it has since been found. In writing about his inventions, Papin says, in 1695: "It would occupy too much space for me to describe in what manner this principle could be applied to removing water from mines, throwing bombs, sailing against the wind, and for many other similar purposes; everyone according to his wants can imagine the constructions that could be made. I cannot, however, refrain from remarking how much preferable this power would be to oars for those whose business calls them to the sea." And further on he says: "The steam cylinders could be employed for a great variety of purposes." One of the cylinders, which was to form a part of the pump, was cast at the foundry in Cassel, and after various vicissitudes has finally become the property of the Historical Museum in that city, where it will be preserved, with jealous care, from any further injury. During the recent exhibition of philosophical instruments in London, this remnant of Papin's invention played an important part, it having been generously loaned by the authorities for that occasion.

After the flight of Papin from Germany, the cylinder was used as a receptacle for iron turnings and borings in the royal works; and after the destruction of those works by fire, it came into the possession of Henschel, the founder of one of the most extensive locomotive works in Germany. This man fully appreciated the value of the historical relic; and when I visited him at the works, twenty-five years ago, he pointed out with pride to me the inscription on its side, "Papin's Cylinder," and said that he intended to have it placed upon a solid pedestal near the gate. His grandson has since presented it to the city, and its preservation from destruction or sale is now secured. A copy of the drawing made by Papin of the pump of which this cylinder was to form a part, and which was published in 1695, has recently appeared in Dingler's *Journal*, and I send it to you, hoping that you will have it engraved and perpetuated in your valuable paper. It is a peculiar combination of Savery's invention and Papin's piston engine, suggested for another purpose, and is a decided improvement on Huyghens' powder engine.

A is the boiler for the generation of the steam, provided with a safety valve (an invention of Papin). On opening the stopcock, C, the steam passes through B into the cylinder, D, and by its expansion drives the plunger, E, against the water contained in the cylinder, D, which is thus forced into the chamber, F, compressing strongly the air, which in turn expels the water through the pipe, G, to the height desired. K is a funnel for the fresh supply of water, and at I and H are valves opening upwards and downwards. After the condensation of the steam in D, a renewed supply of water, through K, forces the plunger, E, to the top of the cylinder, ready for the next action of steam. The strokes of such a pump could not be frequent, and it would not compare very favorably with the wonderful machinery exhibited in Philadelphia last summer; but it contains the germ of the idea, and is worthy of all honor. Having often seen it stated that Papin had invented a steamboat, I resolved during a recent visit to Germany to investigate the matter, and especially to search for the correspondence between Papin and Leibnitz in the library at Hanover. It will be borne in mind that two hundred years ago, on December 4, 1676, Leibnitz was appointed to take charge of the library in Hanover, and that he remained in this position until his death in 1716. He bequeathed his manuscripts to the library; and as he had the habit of writing upon all manner of loose scraps of paper, it has cost much labor to assort and classify them.

On making my application to the librarian to be permitted to see the correspondence between Papin and Leibnitz, my request was at once granted; and a table having been assigned me, I was able to examine these precious relics at my leisure. I was also shown a copy of an original treatise on the steam engine by Papin, which contained numerous marginal notes by Leibnitz. In one place, Leibnitz criticized Papin's method for condensing steam, and makes a drawing on the margin, showing a piston and valve which he thought would be more practical. It is somewhat remarkable that the Germans have not caused a fac-simile of this little volume to be published. After considerable search, I found a copy of the original letter addressed by Papin to Leibnitz in 1707, asking Leibnitz to assist him in obtaining the consent of the Hanoverian Government to navigate the river Weser with a sidewheel steamboat. The letter was dated July 7, 1707, and contained among other interesting passages the following sentence: "The new invention will enable one or two men to accomplish more effect than several hundred oarsmen." It is evident that Leibnitz was deeply impressed by Papin's letter, and he supported the simple and reasonable request contained in it by the following petition addressed to the Councillors of State. This communication from Leibnitz bears two indorsements, one by the clerk of the council, "*pro memoria* respectfully, in reference to the passage of a ship from the river Fulda into the Weser;" the other is in the handwriting of Leibnitz: "Papin's sidewheel ship." This last indorsement is of great value, as indicating the fact that Papin proposed to apply side wheels for the propulsion of his new invention. The following is a translation of Leibnitz' letter, the original of which I saw in the library:

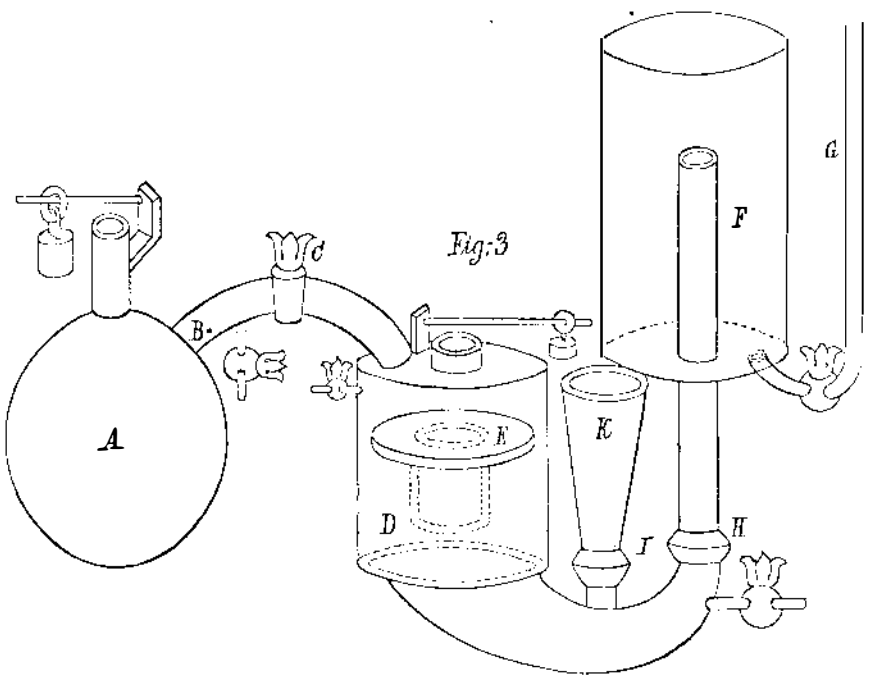

Fig. 3

PAPIN'S STEAM ENGINE.

"Dionysius Papin, Councillor and Physician to his royal highness the Elector of Cassel, also Professor of Mathematics at Marburg, is about to dispatch a vessel of singular construction down the river Weser to Bremen. As he learns that all ships coming from Cassel, or any point on the Fulda, are not permitted to enter the Weser, but are required to unload at Münden, and as he anticipates some difficulty, although those vessels have a different object, his own not being intended for freight, he begs most humbly that a gracious order be granted that his ship may be allowed to pass unmolested through the electoral domain, which petition I most humbly support. G. W. LEIBNITZ.

"Hanover, July 13, 1707."

This letter was returned to Leibnitz with the following indorsement: "The Electoral Councillors have found serious obstacles in the way of granting the above petition, and, without giving their reasons, have directed me to inform you of their decision, and that in consequence the request is not granted by his Electoral Highness. H. REICHE.

"Hanover, July 25, 1707."

This failure of Papin's petition was the deathblow to his effort to establish steam navigation. A mob of boatmen, who thought they saw in the embryo ship the ruin of their business, attacked the vessel at night and utterly destroyed it. Papin narrowly escaped with his life, and fled to England, where he endured great hardships and poverty, and all traces of him were soon lost, so that it is uncertain in what country he finally died or where he was buried.

This remarkable man was driven out of France on account of his Protestant faith, and found a refuge in Germany; here he was again persecuted on account of the injury that ignorant and jealous people believed his inventions would inflict upon the industries of the country; and when the climax of steam engines for pumping water and propelling ships was reached, the enlightened government of the period "found serious obstacles" in the way of granting him protection, and, without condescending to state what those "objections" were, secretly instigated the mob to make an end of the trouble. It is another instance, unfortunately too often repeated in history, of the mischief men dressed up in a little brief authority can work upon their generation. If Papin had been permitted to navigate the Weser with his ship, and to carry it to London, as was his intention, it is possible that we should have had steamboats one hundred years earlier than they were given to us by Fulton. The plan proposed by Papin was highly impracticable; but a knowledge of what Savery had done in the way of steam machinery, aided by the shrewd suggestions of Leibnitz, combined with the practical assistance of Englishmen, would, no doubt, have enabled him to improve upon his invention until it had obtained sufficient credit to be secure against the misfortune of being totally forgotten. After the lapse of 100 years from the date of Papin's invention, when the first steamboat was put upon the river Rhine, the vessel was fired into by concealed marksmen on shore, and navigation was more dangerous than it is now on the upper waters of the Missouri in times of Indian hostility. It was only after stationing troops along the banks of the river to protect the boatmen that the government, fortunately more enlightened than in the days of Leibnitz, was able to establish steam navigation on a secure footing.

I have thought it worth while to make this contribution to the history of steam navigation, particularly as I have been able to authenticate a portion of it by reference to original documents.

Columbia College, New York city, January, 1877.

The Speaking Telegraph.

We have heretofore given accounts of the wonderful success of Professor Bell in transmitting the vibrations of the human voice by electrical means over a telegraph wire. He has lately made improvements in his method of transmission, by which he dispenses with the use of the battery, and substitutes the magneto-electric plan of producing the current. The Boston *Transcript* describes a recent experiment with the new apparatus, by which conversation and singing was successfully carried on between Boston and Malden, a distance of six miles. The telephone, in its present form, consists of a powerful compound permanent magnet, to the poles of which are attached ordinary telegraph coils of insulated wire. In front of the poles, surrounded by these coils of wire, is placed a diaphragm of iron. A mouthpiece to converge the sound upon this diaphragm substantially completes the arrangement. As is well known, the motion of steel or iron in front of the poles of a magnet creates a current of electricity in coils surrounding the poles of the magnet, and the duration of this current of electricity coincides with the duration of the motion of the steel or iron moved or vibrated in the proximity of the magnet. When the human voice causes the diaphragm to vibrate, electrical undulations are induced in the coils environing the magnets, precisely analogous to the undulations of the air produced by that voice. These coils are connected with the line wire, which may be of any length, provided the insulation be good. The undulations which are induced in these coils travel through the line wire, and, passing through the coils of an instrument of precisely similar construction at the distant station, are again resolved into air undulations by the diaphragm of this instrument.

The experiments were as follows: Telephones having been connected with the private telegraphic line of the Boston Rubber Shoe Company, conversation was at once commenced. Stationed at the Boston end of the wire, Professor Bell requested Mr. Watson, who was at the Malden end, to speak in loud tones, with a view of enabling the entire company at once to distinguish the sounds.

This was so successful that a smile of mingled pleasure and surprise played on the features of those present. That it, however, might not be supposed that loud speaking was essential to intelligibility, Mr. Bell explained that soft tones could be heard across the wires even more distinctly than loud utterances, even a whisper being audible. In confirmation of this statement, Mr. Watson commenced speaking in turn with each member of the company; and after the efficiency of this method had been proved to the satisfaction of all, he took up a newpaper and informed the assemblage that gold had closed the previous evening at New York at 105⅝. As there were quite a number of business men present, the effect that this practical demonstration of the value of the telephone produced can scarcely be exaggerated. Other passages from the daily journals were then given, and by this time the desire for conversation having become general, Mr. Watson was plied with questions such as: "Is it thawing or freezing at Malden? Who will be the next President?" etc. It was remarkable that Mr. Watson was able to distinguish between the voices at the Boston end, he calling at least one gentleman by name as soon as the latter commenced speaking.

This went on for some time, until a lady at the Malden end sent the company an invitation to lunch per telephone, and an appropriate response was made by the same medium. At length the Boston company were requested to remain quiet while a lady at the other end conveyed to them the sweet strains of music. The assemblage thereupon listened with rapt attention while a young lady commenced singing "The Last Rose of Summer." The effect was simply charming. The sound of the voice penetrated into the Boston end of the telephone with a distinctness equal to that attainable in the more distant parts of a large concert room, and a unanimous vote of thanks was sent by the handy little instrument which had procured for the assemblage so agreeable an hour.

THE superb steam engine built by C. H. Brown & Co., of Fitchburg, Mass., which was illustrated and described on page 1 of our current volume, has been purchased by Messrs. Phineas Jones & Co., and is being erected in their extensive carriage wheel works at Newark, N. J.

Crossing a River on a Wire.

A reporter of the New York *Sun* wanted to realize the sensation of being suspended on a wire 275 feet from the surface of the earth. He applied to the engineer of the Brooklyn bridge for permission to cross the East river on a wire, three quarters of an inch in diameter, which hangs between the two towers. He was refused permission; but he finally saw the president of the company, who granted his request. Arriving at the appointed time, the engineer, Mr. Farrington, said: "Well, sir; whenever you're ready, I am."

"All ready, said I, as bold as brass outside, and as nervous as the Endorian witch on the inside. He walked on and I followed, when, Horror of Horrors—capital H's to both Horrors—instead of leading me to the 'cradle,' which I called a raft, he took me to a little square board held up by two crossed iron arms, called a 'buggy.' It was about three feet square, and depended from the 'traveler,' a three quarter inch wire which crosses the river, and is run from tower to tower over apparatus, by means of a stationary engine. It was too late to back out, but I didn't feel exactly prepared to plunge in. He did.

"He jumped in, and the little buggy swung from side to side, precisely as a swing does when you jump on the board and try to steady it by the ropes. I looked at him, at the scale—that's it; it's exactly like a pair of scales, with one scale—at the deep depths below us, and at myself. I imagined the ticklish thrill which would permeate my body when we started. I fancied the glories of the prospective perspective before me.

"'Come, hurry up, please,' interrupted Farrington, and with resignation I hurried down. He stood up. I crouched down. Perhaps you think you'd have stood up as he did. You're mistaken. I crouched down and held on tight. Make no mistake. I held on tight and waited for my thrill. It didn't come. Then I stood up, and Farrington gave the word 'Go.' 'Wouldn't you better take a rope along?' said one of the men. 'Yes, I think I would.' What did he want of a rope? He feared I would be nervous. He meant to grapple me in the middle of the river, and tie me in. I knew it. I felt it. But I didn't say a word.

"With a gentle jerk we started—slow, slow, very slow. Farrington stood in front and watched the wire. I stood behind and watched myself. I felt nothing. I was'n't exhilarated. I was'n't scared. I was'n't even timid. I can't look from the top of a house without desiring to jump off, but I looked down from the buggy and hadn't the least desire to jump. Farrington says: 'It's because it's so high up.' Well, we went on without any special sensation till the buggy struck against a stay rope which reaches from one of the cables to the tower. In the effort to free the buggy, Mr. Farrington gave a push which swung us out some little distance and back again, at which a little piece of indigestion seemed to be monarch of my interior, and for a moment I was on the verge of a sensation. Having passed the middle, the ascent was more labored. I waved my handkerchief to the people on the ferryboats. I looked out toward the sea. I looked up at the heavens. I even looked toward Harlem, but, like the buyer in the Bible, I said: 'It is naught, it is naught.'

"In about eight minutes we touched the New York side—all but ten feet. The red flag waved for the engine to stop. There we hung in mid-air 275 feet above the level, swinging to and fro like a drunken buggy, at an angle of forty degrees, and quite uneasy. The rope which was to haul us on was fastened to the iron—blest be the tie that binds—and with a few hearty pulls we were brought so near the New York tower that without difficulty we clambered up. I had made the trip, but I had not felt a feel. From the top of the New York tower I saw much, but the chief point of interest was the innumerable jets of steam which flourish in the air, and fantastically curl off into space.

"Again the steeples, the tower, and the long, narrow, dirty river filled the prospect, and the bright sun of a charming day lightened up the western sky That was all, except to say 'thanks and good-bye,' and descend the stairs. There were 417 of them stairs, and before I reached the bottom I was dizzy, faint, seasick, and filled with a decoction of tickle, so that I had to shut my eyes and rest from my labors.

"Thus ends the trip which filled my anticipatory imagination as the waters fill the sea, but which resolved itself in realization to a simple, childlike faith in the fixtures on the wire, and in the skill and competence of the man who guided them. MONSIEUR X."

Blue Glass Science.

There is nothing more reassuring in these days, when new "isms" of the scientists are slowly sapping the foundations of cherished beliefs, than to remember that, after all, the much vaunted dicta of Nature are yet opposable by the sound operations of honest common sense. See for example how one of our evening dailies, tossing the dogmas of so-called science contemptuously aside, evolves such profoundly original thoughts as these, to explain the lucid blue glass theory of General Pleasonton: "The blue glass presents an obstruction to the sun's rays which can only be penetrated by one of the seven primary rays—the blue ray; the remaining six rays, travelling with the velocity of 186,000 miles a second, falling upon the blue glass, are suddenly arrested; the impact evolves upon the surface of the glass friction, heat, electricity and magnetism; the heat expands the molecules of the glass, and a current of electricity and magnetism passes through it into the room; this current, falling upon animal or vegetable life within, stimulates it to unusual vigor. Certainly the results achieved, and abundantly certified to, are marvellous, and sufficient to provoke further experiments and inquiry." Prior to these splendid original discoveries of our contemporary, we ignorantly believed that blue glass only partially sifted out the orange and yellow rays from the spectrum, and that with this exception, it acted merely as a screen to diminish the intensity of all the rays. We also supposed that there was a sharp distinction to be drawn between sunlight after passing through blue glass and the blue spectral ray: that in one case all the colored rays were more or less present, and that in the other but one was. But think of the utter dismay of such pretenders as Helmholtz, Tyndall, and Henry when they learn that the undulatory theory of light with which they have so long taxed our credulity is overthrown—that of the seven primary rays, six bounce off from blue glass and distribute themselves over the adjoining neighborhood. That the glass is heated by the impact; and as the sun persistently emits more rays, there are more impacts and more heat. The glass gets hotter and hotter; but—mark the scientific acumen here—just as we are wondering whether it will reach the melting point, the pores open. It is the Turkish bath of Nature. Electricity and magnetism, no longer shut out, rush in between the separate molecules. Hand in hand, these great curative powers seek a proper subject. They meet (we learn from a report, also in our contemporary, of Pleasonton's latest triumph) a pig or a young lady whose hair has come out—a heifer, a rooster, or a rheumatic child. Forthwith the pig fattens, hair equal to that produced by the finest *tricopherus* pervades the female scalp, and "unusual vigor" and general happiness prevail. Such is the boon which Pleasonton bestows on humanity, as elucidated by the original genius of our contemporary.

Infectious Disease Propagation.

In view of the alarming prevalence of scarlet fever in many parts of the country, the following hints by the *British Medical Journal* are wholesome warnings: "There are three common ways by means of which infectious diseases may be very widely spread. It is a very usual practice for parents to take children suffering from scarlet fever, measles, etc., to a public dispensary, in order to obtain advice and medicines. It is little less than crime to expose, in the streets of a town and in the crowded waiting room of a dispensary, children afflicted with such complaints. Again, persons who are recovering from infectious disorders borrow books out of the lending departments of public libraries; these books, on their reissue to fresh borrowers, are sources of very great danger. In all libraries, notices should be posted up informing borrowers that no books will be lent out to persons who are suffering from diseases of an infectious character; and that any person so suffering will be prosecuted if he borrow during the time of his illness. Lastly, disease is spread by tract distributors. It is the habit for such well meaning people to call at a house where a person is ill and to leave him a tract. In a week or so the tract is called for again, another left in its place, and the old one is left with another person. It needs not much imagination to know with what result to health such a practice will lead if the first person be in scarlet fever or smallpox."

Dr. Hutton offers "a warning on the reckless manner in which parents allow their healthy children to run into the houses of acquaintances who have members of their families suffering from scarlatina, etc., and states that he has seen the infection thus carried from the patient, and several families attacked."

Toughened Glass Making in Brooklyn.

A *World* reporter has lately visited the works in Brooklyn where the manufacture of the La Bastie toughened glass is now in active progress. The manufacturer states that, in June last, his factory was destroyed by fire, and the introduction of the glass into our markets has for that reason been delayed. Only one kind of goods, lamp chimneys, are now made, and the process is as follows: A workman, having in his hand a pole about eight feet long, with a knob on the end of the size of a lamp burner, fits a chimney on the knob and plunges it into the flame of a furnace. He withdraws it twice or thrice that it may not heat too quickly, turning the pole rapidly the while, and when the glass reaches a red heat quickly shoots it into one of a dozen small baths fixed on a revolving table, and seizes another chimney. A boy keeps the revolving table always in position, and as the chimneys come around to him, having been the proper time in the bath, he takes them out to be dried, sorted, cleaned, and packed. The bath has to be of just the right temperature, as, if it be too hot or too cold, the chimneys are liable to explode. In either case the process of annealing is imperfect. By working the tables at a certain rate, the baths are kept at the right temperature by the immersion of the red hot glass. Oil or tallow is used in the bath. Any greasy substance will do, though tallow has proved most satisfactory.

M. De la Chapelle, the manufacturer, states that he has already sold $150,000 worth of the chimneys. The toughened chimneys are about 60 per cent dearer than those of ordinary glass. The factory is in Delavan street, Brooklyn, N. Y.

Alexander Bain, Electrician.

This ingenious man, whose inventions in connection with the electric telegraph entitle his name to be held in grateful remembrance, died in January last at the new Home for Incurables at Broomhill, Kirkintilloch, near Glasgow, Scotland, and on Saturday his remains were interred in the burying ground in the neighborhood of that town known as the Old Aisle Cemetery. Mr. Bain, who was about sixty-six years of age, was a native of Thurso. He was the inventor of the electro-chemical printing telegraph, the electro-magnetic clock, and of perforated paper for automatic transmission of messages, and was author of a number of books and pamphlets relating to these subjects. Sir William Thomson, in his address to the Mathematical Section of the British Association at its meeting in Glasgow last year, said: "In the United States Telegraphic Department of the Great Exhibition at Philadelphia, I saw Edison's automatic telegraph delivering 1,015 words in 57 seconds. This was done by the long neglected electro-chemical method of Bain, long ago condemned in England to the helot work of recording from a relay, and turned adrift as needlessly delicate for that." Mr. Bain was stricken by paralysis, and suffered from complete loss of power in the lower limbs. For some time he had received a pension from the government, obtained for him, we believe, through the instrumentality of Sir William Thomson. Mr. Bain was a widower, and has left a son and daughter, the former of whom is in America, and the latter at present on the Continent. Photographs of him by Mayall were recently presented to the Society of Telegraph Engineers and the American Society of Telegraphers at Philadelphia.—*The Engineer.*

Self-Reliance Necessary to Success.

Self-reliance, conjoined with promptitude in the execution of our undertakings, is indispensable to success. And yet multitudes live a life of vacillation and consequent failure, because they remain undetermined what to do, or, having decided that, have no confidence in themselves. Such persons need to be assured; but this assurance can be obtained in no other way than by their own successes in whatever they may attempt for themselves. If they lean upon others, they not only become dissatisfied with what they achieve, but the success of one achievement, in which they are entitled to but partial credit, is no guaranty to them that, unaided, they will not fail in their very next experiment.

For want of self-reliance and decision of character, thousands are submerged in their first essays to make the voyage of life. Disappointed and chagrined at this, they underestimate their own capacities, and thenceforward, relying on others, they take and keep a subordinate position, from which they rise, when they rise at all, with the utmost difficulty. When a young man attains his majority, it is better for him, as a general rule, to take some independent position of his own, even though the present remuneration be less than he would obtain in the service of others. When at work for himself, in a business which requires and demands foresight, economy, and industry, he will naturally develop the strong points of his character, and become self-reliant.

A glance at the business men of any community will show who have and who have not improved the opportunities of their earlier years. The former transact their business with ease, promptitude, and profit. They rely upon themselves, and execute what they have to do with energy and dispatch. But those who shirked everything in their youth are compelled to rely on their clerks and salesmen for advice, and are never ready to act when occasions of profit arise. Many parents commit a lamentable error in this respect. They lead their children to believe that they can do nothing without the constant assistance of their superiors, and after awhile the child becomes impressed with that idea. Fortunate will it be for him when he emerges from the parental roof, if he can at once acquire the self-reliance which has been kept down at home—otherwise he must necessarily fail in whatever independent enterprise he undertakes; and in such a case, while the misfortune is his own, the fault lies at the door of misjudging parents rather than at his own.

Something to Do.

It is an old trick of despots, and a good one, to employ their subjects. Why? To keep them out of mischief. Employed men are most contented. There is no conspiracy. Men do not sit down and coolly proceed to concoct iniquity so long as there is plenty of pleasant and profitable employment for body and mind. Work drives off discontent, provided there is compensation in proportion to the amount of labor performed. There must be a stimulant. God never intended a man should sweat without eating of the fruits of his labor—reaping a reward—more than he intended the idle man should revel in plenty and grow gouty on luxuries. Industry is a great peacemaker—a mind-your-own-business citizen. Something to do renders the despairing good-natured and hopeful—stops the cry of the hungry, and promotes all virtue. The best men are the most industrious; the most wealthy work the hardest. They always find something to do. Do you ever wonder that men of wealth do not "retire" and enjoy their substance? We know some young men look forward with anticipation to the time of "retiring." It is doubtful if a man should ever retire from business as long as he lives. We think we know men who, were they to abandon business, would be ruined, not pecuniarily, but mentally—their lives would be shortened. God never intended man's mind should become dormant. It is governed by fixed laws. Those laws are imperative in their exactions.

Something to do! "Oh, if I had something to do!" There are young men who sigh for it, yet one thing they can do—that is, seek for a job. Once found, provided it is an honest one, do not hesitate to perform it, even if it does not pay as well as you expected.

Moneyed Men.

The Cleveland *Herald* said, twenty years ago, during a stringency of the times, that moneyed men are the veriest cravens on earth: so timid, that on the least alarm they pull their heads, turtle-like, within their shells, and, snugly housed, hug their glittering treasure until all fear is removed. The consequence is that a few days' disturbance of the monetary atmosphere brings on a perfect dearth of not only the precious metals, but even of paper money, their representative. Moneyed men never adopt the tactics of mutual support; hence, as soon as a shot is fired into the flock, they scatter, each looking out for himself, each distrustful of the other, and each recognizing only the great law of selfishness, which is to take care of number one. Courage has saved many an army, even when ammunition was low; and many a foe has been scattered by one yell of defiance when there was not a cartridge left.

NEW BOOKS AND PUBLICATIONS.

ARCHOLOGY, OR THE SCIENCE OF GOVERNMENT. By S. V. Blakeslee. Price $1.25. New York and San Francisco: A. Roman & Co.

This book is a very metaphysical treatise on theories of government and the duties of citizens to the law, each other, and themselves. Theoretical politics are little in favor with thinking men of this day; and the social difficulties of our age will have to be solved by practical wisdom founded on experience. The people that knows that a certain course of legislation has destroyed an empire, and that a contrary policy has developed one, will care little as to whether or not "the will controls the feelings by mediate and indirect force." We are unable to find in this book any attempt to apply the finely worded theories stated to practical use and popular instruction in political science.

GRAPHICAL ANALYSIS OF ROOF TRUSSES, FOR THE USE OF ENGINEERS, ARCHITECTS, AND BUILDERS. By Charles E. Greene, A. M., Professor of Civil Engineering in the University of Michigan. Chicago, Ill: George H. Frost.

The author of this work truly says that any designer who fairly tries the graphical method will be pleased with the simplicity and directness of the analysis, even for apparently complex forms. The hindrance to the general use of the method is the want of knowledge of the higher mathematics, which are largely used in most treatises on the subject. Professor Greene has avoided this stumbling block, and given us a treatise which may be understood and appreciated by any one of common school education. We therefore give his work a hearty commendation, and we hope that every carpenter and builder may be induced to analyze the stresses which affect the different parts of structures, which he can readily do by carefully reading this volume.

THE HUB: a Journal devoted to the Carriage Building Trades. Published monthly. Subscription price, $3.00 a year. New York city: The Hub Publishing Company, 323 Pearl street.

This journal is widely known for its accurate and extended information as to carriage building, trimming, lining, painting, etc.; and since its first issue it has maintained its reputation, and given the public an immense amount of instruction in a spirited and practical manner. The illustrations and typography are excellent, and every number shows how extended an area it serves as an authority on the important industry to which it is devoted.

ASSIGNATS AND MANDATS: the Money and the Finances of the French Revolution of 1789. By Stephen D. Dillaye. Price, free by mail, 30 cents. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

Mr. Dillaye differs with the Hon. A. D. White, President of Cornell University, as to the relative merits of money and promises to pay money; and he begins with the assertion that the President's "object is to depreciate American credit, stability, and honor." Further perusal, to ascertain the meaning of this attack on a patriotic and useful member of society, shows us what Mr. Dillaye thinks he means. He talks of credit being the vital element of national power; and from this he argues that the more "credit" a nation has—that is, the deeper it is in debt—the more powerful it becomes. In short, he confuses credit as opposed to discredit with credit as opposed to cash—a grievous blunder, surely. A nation's credit is like a merchant's; it becomes greater only as his debts become smaller; and people trust a government for the same reason as they trust an individual, mainly because every previous obligation has been honorably observed. It is gratifying to know that persons of Mr. Dillaye's way of thinking are few and unimportant, and their number is diminishing daily.

CROTON WATER SUPPLY FOR THE CITY OF NEW YORK: an Address by George B. Butler to the New York Municipal Society. New York city: Published by Order of the Society, 87 Madison avenue.

A review of the whole subject of our water supply, its sources and the area they drain, the geographical features of the district, and the works erected by the city. Mr. Butler maintains that the Croton valley, with proper storage reservoirs, can abundantly supply the whole city; and that no new aqueduct need be constructed in the present condition of the public debt.

EINE KURZE ALLGEMEINE EINLEITUNG ZU DEN AROMATISCHEN NITROVERBINDUNGEN. Von Peter Townsend Austen. Leipzig, Germany: Winter, Publisher.

We are glad to see that an American is able to publish a very useful chemical treatise in Germany, the great head center of chemistry. Dr. Austen, one of our most distinguished young chemists in the field of original research, has produced a work which bears the marks of much patient thought and study. The book is dedicated to the renowned German chemist, Professor A. W. Hofmann.

OUR YOUNG FOLKS' MAGAZINE: a Monthly Journal of Instruction and Amusement. Subscription price, $1.60 a year. Boston, Mass.: Post Office Box 3090.

A readable little periodical, well calculated to amuse the little ones for whom it is intended.

GLASS FOR THE STUDIO AND DARK ROOM. By Thomas Gaffield. Philadelphia, Pa.: Benerman & Wilson.

There is much useful information in this little pamphlet, and photographers especially should read it. The matter first appeared in the Philadelphia *Photographer*.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GANG PLOW.

Ezra Peak, Montana, Kan.—This invention is so constructed that it may be easily raised from and lowered to the ground, and adjusted to work at any desired depth in the ground. It is claimed to be of lighter draft than plows constructed in the usual way, also to be simple in construction and inexpensive in manufacture. The wheels, the faces of which are notched to give them a slight up-and-down movement as they are drawn forward, slightly jar the plows, and thus cause them to be easier drawn than when smooth wheels are used. The shaft can be provided with a ratchet wheel and pawl to hold it in any position into which it may be turned; and to it is attached a rope or chain, the other end of which is attached to the forward end of the frame, so that by turning the shaft the plows may be raised from, lowered to, and adjusted to work at any desired depth in the ground.

IMPROVED PLOW.

James Willis Hendley, Cedar Hill, N. C., assignor to David N. Bennett and Samuel T. Wright, of same place.—The objects here are simplicity and cheapness of construction, and such arrangement of parts as will prevent the plow becoming clogged with weeds, etc. The mold-board is welded to the land side, or cast in one piece with it, so that no brace or other connection is required between the mold-board and standard; secondly, the curved beam is attached to the heel of the land-side and supported by a brace, which is bolted to the middle portion of the latter, and arranged in such relation to the mold-board that a space is left between them, into which the trash will fall, and thus be drawn into the furrow and covered.

IMPROVED GRAIN DRILL.

George W. Osborn, Parkville, Mich.—This is an improved attachment for seed drills, for gaging the depth at which the grain shall be deposited in the earth. It consists in an adjustable spring gage bar attached to the shank of each drill tooth, whereby the teeth may be made to enter the ground a greater or less depth. It is claimed to ensure the planting of seeds at equal depth in hard or soft ground, and to diminish the draft.

IMPROVED HORSE HAY RAKE.

Joseph B. Wakeman and John L. Wager, Deposit, N. Y.—The construction of this implement is such that a large space is afforded beneath the rake head for the collection of hay. The pivots of said rake head back are also brought back, so that the teeth may be readily raised to discharge the collected hay. By an ingenious lever arrangement the driver is enabled to hold the rake to its work by the pressure of his foot, and also readily to discharge the hay gathered.

IMPROVED BEE HIVE.

George W. Akins, Bridgeton, Pa.—In this hive, holes are bored in the sides of the compartment for ventilation, and windows are flared for the purpose of inspecting the inside of the hive. A frame is used whenever it is desired to have the honeycomb of any particular shape. It consists of a form of tin or other suitable material, placed on a frame or slide, and having the shape required in the comb. Bees will build inside of the form, leaving about one fourth inch space between the form and the comb. The tin sheet receives a portion of the refuse matter, and can be readily taken out and cleaned. On the 1st of May the bees are driven out into another hive and the frames examined. Three frames are taken out and set in a new box, and three empty frames are put in their place. The old queen must be put with the new colony, and half of the bees must be put in each box and shut up, and put on a stand. The hives are to be opened the next morning. At the next natural swarming time the swarms can be again divided. The hive cannot freeze, and it is proof against mice.

IMPROVED PLOW STOCK.

Robert Weber, New Ulm, Texas.—In this invention, by loosening a nut, the point of draft attachment may be raised and lowered to cause the plow to work deeper or shallower in the ground, or turned to one or the other side, to cause the plow to take or leave land, and may be secured in place when adjusted by again tightening the nut.

IMPROVED COMBINED HAY TEDDER AND SIDE RAKE.

John Huber and Henry Snell, Girard, Ill.—This machine may be used simply for stirring up and turning the hay, or for turning the hay and gathering it into windrows. The shaft of a reel revolves in bearings attached to the side bars of the frame near their rear ends. To the bars of the reel are attached spring teeth, which, as the machine is drawn forward, take hold of the hay, carry it up and over the reel, and drop it to the ground in the rear of the machine. A carrier takes the hay from the teeth, when it has been brought to the top of the reel, carries it over the shaft, and discharges it into a trough, down which it slides, and is deposited in a windrow along one side of the path of the machine.

IMPROVED GRUBBING MACHINE.

Ira Burley, Redwing, Minn.—This invention consists in the combination of wheels and axle, tongue, adjusting bar, adjustable brace, uprights, cross bar, two ropes, and four pulley blocks with each other. To the forward end of the tongue is attached a loop or clevis, to receive an iron pin, to be driven into the ground to keep the machine from moving about while being used. To the pulley block is swiveled a hook, to be hooked into a loop, attached to the forward end of a lever. The rear end of the lever passes through a slot in the upper end of a fulcrum post, and has a notch formed in its lower side to receive a bolt or pin, attached to said post to serve as a fulcrum to said lever. Several notches are formed in the lever to receive the fulcrum bolt, to enable the position of the fulcrum post to be adjusted to regulate the leverage, and as circumstances may require. To the lever is attached a strong clevis, to receive the hook of the chain, that is secured to the stump to be pulled.

IMPROVED SEED PLANTER.

Daniel J. Davis, Red Boiling Springs, Tenn.—In this invention two wheels revolve upon the journals of the axle. Upon the end parts of the axle are attached the rear ends of side bars, the forward ends of which are bolted to the outer sides of the forward ends of the plow beams. The forward ends of the beams are bolted to the ends of the front bar, to the center of which is secured the forward end of the central bar. To the beams are attached the plows for opening furrows to receive the seed as it passes from the conductor spouts. The lower ends of the spouts or tubes pass in through the sides of the plows, so as to conduct the seed into the bottom of the furrows before they have been partially filled by the falling in of the soil. The dropping plate is concaved around its dropping holes, and is provided with a plate that may be adjusted to cover one set of dropping holes to drop the hills twice as far apart as when both sets of holes operate.

IMPROVED ANIMAL TRAP.

Thomas N. Hughes, Muddy Creek, Tenn.—This trap is for animals of all kinds, as rats, mice, and larger animals, as foxes, minks, coons, etc., that are allured by bait, and is automatically set again by the animal caught, to be ready for the next animal attracted by the bait. It is divided by a longitudinal partition into two main sections, in which the working parts are disposed. The entrance at the end of one section has a drop door, which is arranged back of the same, resting, when closed, on side strips in inclined position, and being supported on an upright arm, of a centrally pivoted treadle door, at the bottom of the trap, when the trap is set. The treadle door is only required to swing sufficiently on its pivots to release the drop door from the arm, suitable seats at the under side of the trap, at both sides of the treadle door, preventing the door from swinging farther than necessary. The bait is placed in a grated receptacle, near the treadle door, and entices the animal to pass in, so as to close the drop door when it arrives at the part of the treadle door near the bait. The back end of this section is perforated or grated to admit light, which attracts the frighteued animal and induces him to pass toward the light. The top part of the trap may be grated to admit air, and the glass door at the end made to slide, to admit the taking out of the animals for killing them.

NEW MISCELLANEOUS INVENTIONS.

APPARATUS FOR THE HYDRATION OF CHLORINE GAS.

William Maynard, New York city.—This invention relates to an improved construction of apparatus for the hydration of gases, and more particularly chlorine gas for the manufacture of chlorine water for use in the industrial arts of bleaching, etc. It consists mainly in a case having an inlet for the water above, an inlet for the gas below, and provided with an intermediate water percolating medium; combined with a reservoir located below the level of the case and having a water-sealed communication therewith, which reservoir receives the hydrated gases, and which water seal prevents the heavy gas in the case from passing out through the bottom inlet. The case for the percolation of water and the absorption of the gas is made of conical shape, with the largest diameter at the bottom, to produce the greatest absorption of the heavy gas when first admitted; while horizontal partitions, or shelves, in said case are provided with upwardly projecting tubes which hold a permanent surface of water on the said partition or shelves. The tubes permit, by their peculiar shape, the water to pass down on one side and the gas up on the opposite side of said tube, while their alternating arrangement in the alternating shelves gives a zigzag and long continued passage to the gas and water in moving in opposite directions through the case.

IMPROVED PROCESS OF PREPARING GAS FUEL.

Martin N. Diall, Terre Haute, Ind.—This inventor saturates wood by immersing it in any hydrocarbon oil for from six to twelve hours, as required by the nature of the wood, so that it may take up the necessary quantity of oil for the required strength of gas. The wood is then immersed in a bath of water, for taking up a quantity of water outside the oil, and is then charged in the retorts, the same as coal, and distilled in the same way. By this process the inventor claims that he produces fixed gas equal to coal gas, much faster, and with less expense, the wood and water furnishing the hydrogen, and the oil furnishing the carbon.

IMPROVED FISHING LINE LEADER.

Welmer T. Jahne and Anthony Moors, Jersey City, N. J.—This consists of a leader made of spring wire, bent into V form, provided with a swivel and eye at its middle part, and with eyes or loops at its ends to receive the line and snells. By this construction the snells and hooks will be kept apart however the line may be thrown, and however they and the leader may be turned about by the tide or current. The device is one well calculated to meet with a favorable reception from fishermen.

IMPROVED ABDOMINAL CORSET.

Christina Lascell, Newark, N. J.—The object of this invention is to furnish an improved abdominal corset, which supports the weight of the abdomen in a perfectly comfortable and easy manner, and throws the strain on the shoulders and hips of the wearer. The corset is adjustable to the varying conditions of the abdomen, does not interfere with the motion and different positions of the body, and is readily put on and taken off. It has adjustable elastic shoulder straps, and opening at the sides by lacings and elastic bands and buttons. The front part of the corset is stiffened by a stay that slides in a pocket to provide for stooping. A central front and lacing admit the front part of the corset to expand. The lower extension part of the corset has short stiffening stays, and it is connected independently of the upper stays by short side lacing and elastic straps to the side or hip parts of the corset. A hernial band extends from the lowermost part of the corset-extension between the legs to the rear, and is attached by adjustable hip straps to the sides of the corset.

IMPROVED FIRE ESCAPE.

John F. Werner, New York city.—The terrible disaster in the Brooklyn theater is serving as a stimulus to induce the invention of devices looking to the prevention of a like occurrence. The present inventor has devised a new fire escape for theaters, concert halls, and other public places of amusement, by which the space at the upper parts of the entrances, halls, or vestibules of the buildings is utilized for the purpose of forming additional passage ways for the persons in the buildings, to be used in case of fire for the more convenient and less dangerous exit of the same. The invention consists, mainly, of a movable floor, suspended by chains, pulleys, and weights, near the ceiling of the entrances, and lowered in case of fire. It is supported on projecting rests of the side walls, at suitable height above the floor. Sliding extensions and swinging stairs and rear sections connect with the ground outside of the door, and with the staircases of the gallery, so as to form separate exits above the regular entrances.

IMPROVED ELECTRO-MAGNETIC DENTAL PLUGGER.

James E. Dexter, New York city.—This invention consists, first, in a magnet having a centrally bored iron core, surrounded by a magnetic coil, which is enveloped by an iron shell that is concentric with the central core, and is attached to a flange formed on the lower end of the said central core. One side of both shell and core are split for the purpose of obviating residual magnetism. The invention also consists in combining a spring yoke, a vibrator, and a spring contact piece, as hereinafter particularly described. The third part of this invention consists in the arrangement of the key for completing the circuit, which is made with an insulating exterior, and is provided with one of the termini of the magnet coil, and bears against the side of the key to insure a constant contact of the surfaces. The various parts of the plugger are combined, so that pressing the key with the finger makes the circuit, and a succession of regular strokes is produced, the force of which may be varied by an adjusting screw.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COTTON GIN.

Joseph W. Thorn, Iuka, Miss., assignor to himself and M. W. Beardsley, of same place.—In this machine there is a new construction of the brush drum for simplifying the same, and facilitating the application of the brush wings, so that they can be readily taken off and put on; also, an arrangement of the ribs between the saws for facilitating the separating of the seed from the cotton without breaking and injuring the fiber. There are also ingenious devices for preventing the seed from gathering and clogging at the ends of the saw drum.

IMPROVED SAFETY CHECK FOR ELEVATORS.

Nathan H. Fogg, Boston, Mass.—When the car is suspended normally from the rope, the rubber balls, arranged in sockets near the lower part of the car, are supported on their seats in a state of rest; but the instant that the rope breaks or gets detached from the bolt the action of a spiral spring throws an actuating plate downward, and levers and ball-carrying rods upward. The balls are thus thrown off their seats and wedged between the inclined sides of the pockets and the guide posts of the elevator so as to stop thereby the car.

IMPROVED COMBINATION LOCK.

Achille Parise, Naples, Italy.—This is a new combination lock for doors, trunks, safes, etc., that admits of a large number of combinations, and may be opened and closed quickly. It consists of sliding tumbler plates, having longitudinal slots and a number of perforations placed at different relative positions to the slots of each tumbler. The trunks are connected by screw set pins attached to face slides, and passing through any one of the perforations, admitting the setting of the tumblers and opening of the lock by outer projections or buttons of the slides to fixed exterior guides.

IMPROVED MACHINE FOR WIRING AND BINDING HATS.

Mari A. Cuming and Judson Knight, New York city.—This is a machine for binding hats, felt skirts, and similar articles, by a uniform and parallel pressure on the rims, and by facilitating the applying and taking off of the articles from the machine, and accomplishing the cutting of the binding or braid and wire in a reliable and improved manner. Pressure rollers attach the binding and the wire, if one is required, in connection with a grooved gage that is supported on a seat of the shaft of the lower pressure roller. The wire is guided by annular recesses or chamferings at the rear circumference of the pressure rollers and the groove of the gage. The gage is so connected to its seat that it may be turned and another guide groove of the same be exposed to face the pressure rollers, so as to adapt the same for a variety of work.