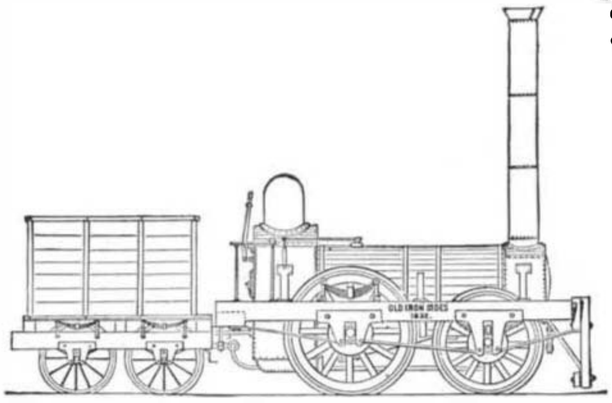
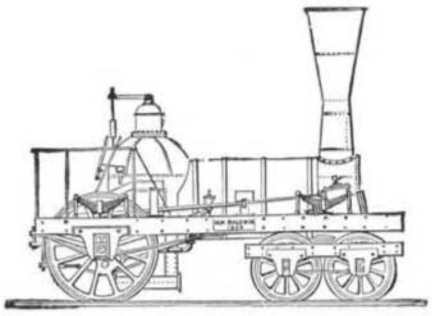
AMERICAN INDUSTRIES.—No. 90.

THE MANUFACTURE OF LOCOMOTIVES.

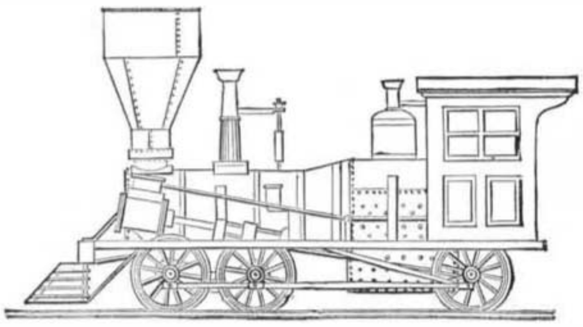
It has been a common remark, in connection with any disturbance of the money market since the war, that the country was building railways too fast. Ten million dollars a day was the estimated cash outlay on this account, according to Poor's Manual, for the three years up to the close of 1882, with a capitalization of nearly double this amount. Yet it was a felicitous comparison which suggested that even this great investment hardly exceeded that which either of three of the great powers in Europe annually expended in the maintenance of armies and iron clads in times of peace. The nation, as a whole, may therefore be truly said to have been putting only a moderate portion of its surplus into this most effective way of hastening the further development of its own resources, and though this may have afforded the opportunity, it has been in no way the cause, of any Wall Street panic.



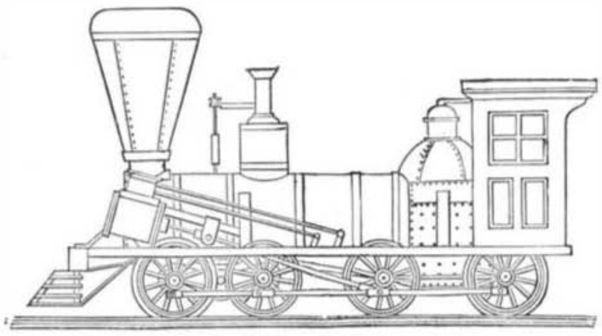
"OLD IRONSIDES," FIRST BALDWIN LOCOMOTIVE—1832.



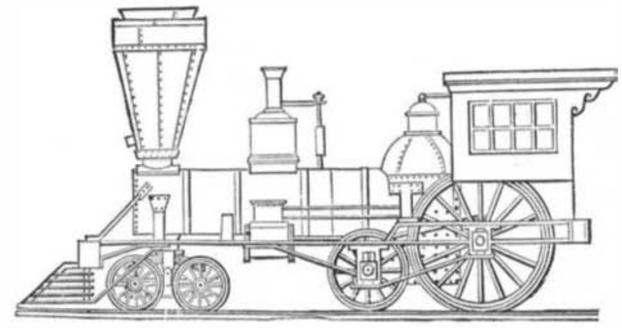
ENGINE OF 1834.



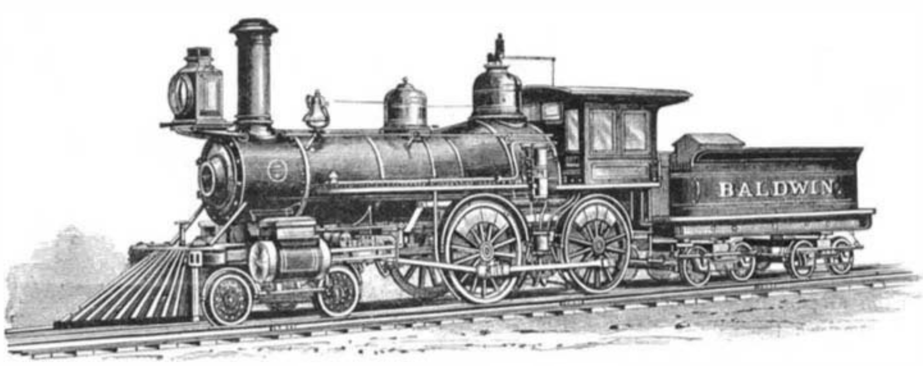
SIX-WHEELS-CONNECTED ENGINE—1842.



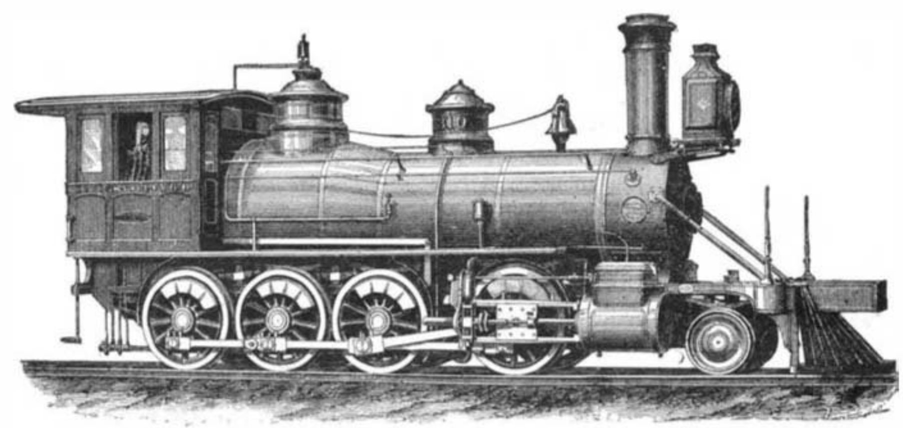
EIGHT-WHEELS-CONNECTED ENGINE—1846.



FAST PASSENGER ENGINE—1848.



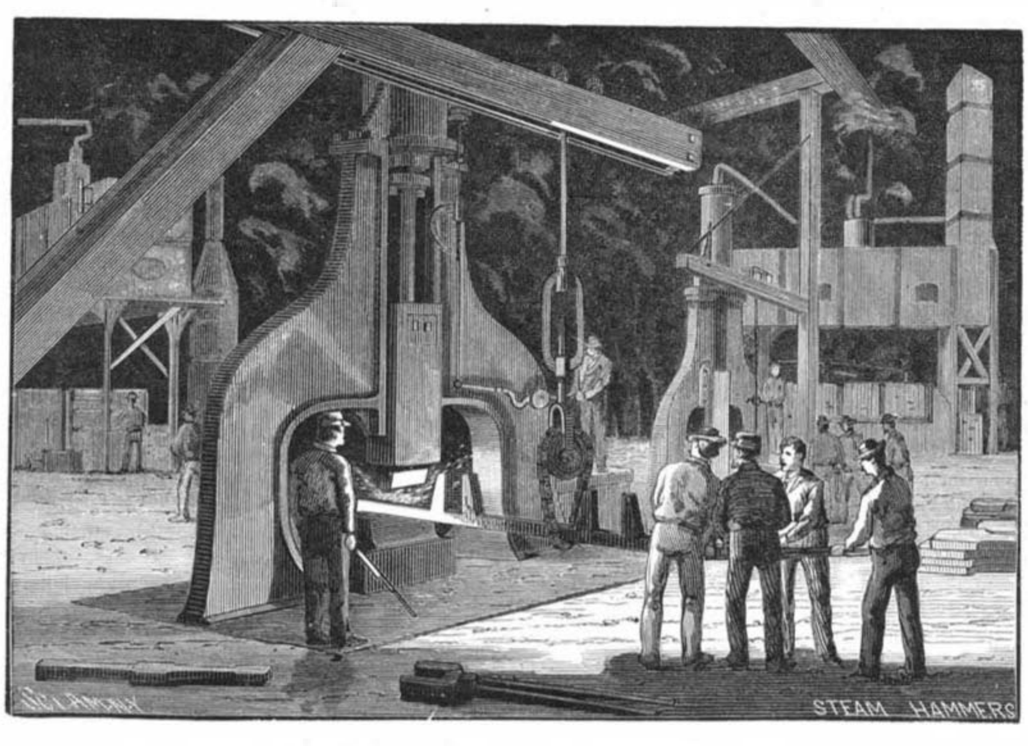
STANDARD PASSENGER ENGINE.



STANDARD FREIGHT ENGINE.

Side by side with this enterprise in railroad building, at once caused by and promoting it, has been the wonderful growth of every industry pertaining to the equipment and operation of railroads. There were a few locomotives imported in the infancy of railroad building here, which met with only indifferent success, but our own inventors and mechanics early began to take the lead in this branch of manufacture and in car building, which they have ever since held. The locomotive of to-day is one of the most wonderful of all the products of man's skill, and has reached a point of perfection from which it seems hardly possible to attain further progress, so long as we obtain power from coal and wood according to principles now understood.

It is in itself an epitome of modern mechanical skill, representing almost numberless inventions, and the illustrations we to-day give, of the largest locomotive manufactory in the world, speak also of a history of its development during half a century.



VIEW OF PRINCIPAL STEAM HAMMER—SINGLE ACTING.

The Baldwin Locomotive Works, at Philadelphia, had an humble beginning. Matthias W. Baldwin, the founder, was a jeweler and silversmith, who, in 1825, formed a partnership with a machinist, and engaged in the manufacture of bookbinders' tools and cylinders for calico printing. Mr. Baldwin then designed and constructed for his own use a small stationary engine, the workmanship of which was so excellent and its efficiency so great that he was solicited to build others like it for various parties, and thus led to turn his attention to steam engineering. In 1831 he built a miniature locomotive, for exhibition, which was so much of a success that he that year received an order from a railway company for a locomotive to run on a short line to the suburbs of Philadelphia. The difficulties attending the execution of this first order were such as our mechanics now cannot easily comprehend. Tools were not easily obtainable; the cylinders were bored by a chisel fixed in a block of wood and turned by hand; the workmen had to be taught how to do nearly all the work; and Mr. Baldwin himself did a great deal of it with his own hands. It was under such circumstances that his first locomotive, christened Old Ironsides, was completed and tried on the road, November 23, 1832. It was at once put in active service, and did duty for over a score of years. It was a four-wheeled engine, weighing a little over five tons; the driving wheels were 54 inches in diameter, and the cylinders 9½ inches in diameter by 18 inches stroke. The wheels were of heavy cast iron hubs, with wooden spokes and rims, and wrought iron tires, and the frame was of wood placed outside the wheels.

The boiler was 30 inches in diameter, and had seventy-two copper flues 1½ inches in diameter and 7 feet long. The price of the engine was to have been $4,000, but only $3,500 was actually paid for it by the railroad company. The Ironsides attained a speed of thirty miles an hour, with the usual train, and was said at the time to be superior to English locomotives then made, on account of its "light weight, small bulk, and the simplicity of her working machinery."

In February, 1834, Mr. Baldwin completed his second locomotive, for a railroad in South Carolina. In it was embodied a "half crank" improvement which he had obtained a patent for, by which the boiler could be made larger and placed lower. The driving wheels were made of solid bell metal, the combined wood and iron wheels previously used having proved objectionable, and Mr. Baldwin obtained a patent for a cast brass wheel, his idea being that by varying the hardness of the metal the adhesion of the drivers on the rail could be increased or diminished. The brass wheels soon wore out, and no others of the kind were made, but the general features of this second locomotive were followed in most of the machines built by Mr. Baldwin for several years. The valve motion was given by a single fixed eccentric for each cylinder.

Five locomotives were built in 1834, when the new business was fairly under way, and in 1835 a building was erected for the works, which occupies a part of the present site on Broad Street, this original structure now forming the storeroom, boiler shop, and principal machine shops. All these engines built in 1834 had several patented inventions of Mr. Baldwin. They had the half crank, ground joints for steam pipes, and the pump formed in the guide bar, four-wheeled truck in front, and a single pair of drivers back of the fire box. The English engine builders were then making steam pipe joints with canvas and red lead, which would only permit of their carrying a pressure of some sixty pounds of steam, while Mr. Baldwin's locomotives were worked up to twice that pressure.

In the six years from 1835 to 1840, inclusive, 152 engines were turned out at the works, and, though there were not many changes in design, there was a call for larger engines. Three sizes were built: 12½ by 16 inches cylinder, weighing 26,000 pounds; 12 by 16 inches cylinder, weighing 23,000 pounds; and 10½ by 16 inches cylinder, weighing 20,000 pounds.

In 1842, Mr. Baldwin patented what has since been considered the greatest of his improvements in engine building, the six-wheel connected locomotive, with the four front drivers combined in a flexible truck. The first engine of this class weighed twelve tons, and its performance was so successful that orders for similar ones came in rapidly. The adoption of this plan of building also led to the immediate increase of the weight of locomotives, and in 1844 several were built weighing eighteen and twenty tons. In 1845 the present design of four drivers and a four-wheeled truck was adopted. At first the half crank was used; then horizontal cylinders inclosed in the chimney seat and working a full-crank axle, and eventually outside cylinders with outside connections. In 1848, Mr. Baldwin took a contract to build for the Vermont Central Railroad, for $10,000, a locomotive which would run with a passenger train at a speed of sixty miles an hour. It had one pair of driving wheels six and a half feet in diameter back of the fire box, and the cylinders were seventeen and a quarter inches in diameter and twenty inches stroke. This engine was used on the road several years, and the officers stated that it could be started from a state of rest and run a mile in forty-three seconds.

A prominent feature in the conduct of the business of the Baldwin locomotive works is the extensive use of standard gauges and templets. An independent department of the works, having a separate foreman and a force of skilled workmen, with special tools, is organized as the department of standard gauges, where gauges and templets for every description of work are made and kept. The original templets are kept as standards, and never used in the work itself, but from them exact duplicates are made, which are issued to the foremen of the different departments. The working gauges are compared with the standards at regular intervals, in order to secure absolute uniformity in every detail. Frames are planed and slotted to gauges, and drilled to steel-bushed templets; cylinders are bored and planed, and steam ports, with valves and steam chests, finished and fitted to gauges. Tires are bored, centers turned, axles finished, and cross-heads, guides, guide-bearers, pistons, connecting and parallel rods, planed, slotted, or finished by the same method. Every bolt about an engine is made to a gauge, and every hole drilled and reamed to a templet, so as to secure uniformity and interchangeableness of parts. This system had been developed and perfected previous to the death of Mr. Baldwin, which occurred in 1866.

The heaviest locomotive built at the works up to 1878, and one of the heaviest ever built, was for the New Mexico and Southern Pacific. It was of the "Consolidation" type; cylinders, 20 by 26 inches; driving wheels, 42 inches diameter, four pairs connected; one pair truck wheels, 30 inches diameter; capacity of water tank on boiler, 1,200 gallons, and of tender 2,500 gallons; weight of engine, including water in tank, 115,000 pounds, and weight on driving wheels 100,000 pounds.

The works, when running full, give employment to 3,000 hands, and are capable of turning out 600 locomotives a year. Their actual production for the last forty-two years has been as follows:

1842	14	1863	96
1843	12	1864	130
1844	22	1865	115
1845	27	1866	118
1846	42	1867	127
1847	39	1868	124
1848	20	1869	235
1849	30	1870	280
1850	37	1871	331
1851	50	1872	422
1852	49	1873	437
1853	60	1874	205
1854	62	1875	130
1855	47	1876	232
1856	59	1877	185
1857	66	1878	292
1858	33	1879	398
1859	70	1880	517
1860	83	1881	555
1861	40	1882	563
1862	75	1883	557

There are about 15,000 locomotives of all kinds in actual use in the United States, the Pennsylvania Railroad leading with over 1,100, the New York Central coming next with 700, after which come in order Chicago, Milwaukee, and St. Paul, Baltimore and Ohio, Erie, Chicago and Northwestern, Philadelphia and Reading, and Chicago, Burlington, and Quincy—each with more than 500.

The Baldwin locomotive works has furnished a large proportion of all these, but it has further made locomotives for almost every country in the world. Russia has been a liberal purchaser, many have gone to Central Europe, Australia has many of these American engines, and South American roads have been principally supplied from here.

The area covered by the works, on Broad Street, Philadelphia, is rather more than nine acres. The view of the erecting shop shows a great number of locomotives under way, but it is only a faithful representation of the scene when our artist visited the works, and gives only a fair idea of the average amount of work in hand. This immense production gives the firm great advantages in the filling of orders promptly, and the fact that all parts are made interchangeable renders it possible for the purchaser to keep the expenses for repairs at a minimum, by keeping duplicate parts of pieces likely to break or wear out, or by ordering them as needed from the works. In the boiler shop, while there is some riveting done by hand, power machines are mostly used therefor, and the view of the wheel department illustrates the forcing of the driving wheels upon their axles. The steam hammer shown is one of several of the same kind in the works. It is single acting, 7,000 pounds weight of ram, drop four and a half feet, and piston rod five inches diameter.

The firm as now constituted was formed in 1873, under the style of Burnham, Parry, Williams & Co.

Noxious Manufactures.

There is just now a most wholesome activity in regard to the national health, and the public are peculiarly interested in the various details of our sanitary machinery. Of this, by no means the least important department is that instituted under the Alkali Works Regulation Act, 1881, or, in other words, the inspection of noxious works and factories. In connection with the pollution of rivers, this is an old grievance; but too little has hitherto been done to realize or remedy the evil in its general effects upon the public health. So greatly, too, have works prejudicial to health increased of late years, that their inspection has been decided upon none too soon. Probably, it will never be known how far the death rate has been influenced by this cause. It is, however, one of the unavoidable penalties of civilization that we should live under unwholesome conditions of life.

A multitude of influences injurious to health spring into active existence with the development of commerce and the growth of luxury. Most of these are evident enough. All the elements, indeed, are equally guilty. The earth, air, fire, and water are allied against civilized humanity; and modern science is constantly bringing to light disagreeable facts in this connection. We have long lived in the comfortable belief that Mother Earth was the great purifier. The reverse is, it seems, nearer the truth. Years after the germs of infection have been consigned to the ground, they have been disinterred, and found to be not a whit diminished in virulence. Archæologists should, we are told, beware of handling newly found relics, lest, perchance, they should contract some archaic disease. Even mummies, it appears, in spite of their venerable respectability, are objects of legitimate suspicion! Fire, too, has a dreary catalogue of sins to answer for. It not only robs us of much of the oxygen of which those of us who live in the towns have so scanty a supply, but it gives us in exchange unconsumed carbon in quantities which fill the air with smut. In smoke alone it furnishes us with food for reflection—and digestion—and probably will continue to do so for some time to come.

Again, water is the most insidious enemy of all. The most indispensable of the elements—and we are reminded of our obligations to it pretty frequently—it is credited with doing the greatest harm. In league with unnatural substances, it has developed such an affinity for noxious matter that it appears that nothing short of boiling can possibly enable us to drink it with any security. To most people cold boiled water will not seem a very attractive beverage, but it has the advantage of being in many ways a safe one.

The air, too, is anything but true to the trust committed to her charge. We have long confidingly believed in her good will. Our sewers, drains, and chimneys discharge their pestilent exhalations into the air; but instead of carrying these away into space, she receives them only to bestow them upon us again.

The outlook is indeed gloomy, and unless we make some progress in sanitary science, it is not a little difficult to see how we are to continue to support the burden of civilized existence.

In this connection it is reassuring to know that something is being done to lessen these ominously numerous artificial dangers. The works which come within the scope of the Alkali, etc., Works Act, 1881, are very injurious to life. The manufacture of alkalies, acids, chemical manures, salt, and cement alike involve processes prejudicial to health. More than one thousand of these were visited by the inspectors, appointed in pursuance of the above Act, during the year 1882; and it is interesting to know that some intelligent means are being devised whereby the offensive character of these manufactures may be diminished. To take a single cause of mischief. The manufacture of alkalies and acids has long been conducted in such a way that the proportion of noxious matter which was allowed to escape into the chimney or atmosphere often reached from twenty to forty grains per cubic foot of air, twenty being a not uncommon amount. The maximum amount which might be allowed to escape with impunity has been estimated at four grains per cubic foot; and it is a very important feature of the Act that it has been instrumental in reducing this very considerably. In the alkali works proper the escape has been brought down to two grains, while in some cases it is under one. The sulphuric acid works alone are now conspicuous for their failings in this important respect, the average escape in those examined during the year being 5·5. Again, chemical manure works have long been a pregnant source of annoyance to the inhabitants of the neighborhood in which these are carried on.

It is, curiously enough, the smaller establishments of the kind which are the most harmful. The larger works have long employed the most complete processes, because the escape of effluvia would otherwise have been so great that it would have speedily aroused hostile action on the part of the public. The imposition of preventive measures in the case of the smaller works—in many of which no precautions whatever have hitherto been adopted—is attended with some difficulty, since it involves an expenditure which would in some cases be almost prohibitive. It appears, indeed, that no maximum of escape can be fixed in works of this kind, and all that remains to be done is to render it compulsory that processes should be adopted for washing out such gases as are soluble, and for burning those which are more susceptible to such a method of treatment. Since such pernicious agents as fluorine compounds escape during the action of sulphuric acid upon phosphates, the question is one of some urgency. Again, another cause of complaint is the escape of sulphureted hydrogen during the process of making sulphate of ammonia. In the larger gas liquor works the gas is burned, and converted into sulphuric acid in lead chambers; while in others it is passed through oxide of iron; and both these methods are perfectly satisfactory when properly carried out. Again, the discharge of sulphurous or muriatic gases evolved in extracting salt from brine is an evil which has remained unremedied almost down to the present time. Not the least curious feature of this question, too, is the fact that many of the products of distillation are so valuable that it is more than mere neglect to throw them away in the form of noxious gases. It is unnecessary to describe here the state of the salt districts. They might serve as a type of the abomination of desolation. The combined effect of the gases and the soot, which pour forth in prodigious volumes and from the chimneys of nearly a hundred salt works in Cheshire alone, is most deplorable.

The only possible conclusion from this report is that we are still far behindhand in these matters. We have, for instance, long continued to burn coal on the same principle, and are very slow to believe in any of the new methods which have been and are continually being introduced. Yet not only is black smoke very much more injurious to animal and vegetable life than when it has been rendered colorless by burning, but it is peculiarly wasteful. It has long been known that many valuable commodities could be obtained from coal; and but too little progress has hitherto been made in this direction. It is, then, all the more interesting to know that in some works in the north of England the gases from the blast furnaces have been cooled and washed, and ammoniacal salts obtained in such quantities as to make the process economical; while by the "Young and Beilby" process it is contended that not only can the fuel be consumed for nothing, but that there will be several shillings a ton profit.

So far as manufactures are concerned, there certainly seems to be no valid reason why the rule that they must consume their own smoke should not be much more freely enforced. In the case of the alkali trades, which have long been in a very bad state, it is, of course, an unfortunate time to suggest the necessity for the outlay of more capital in improved works. But the exigencies of the public health are paramount, and needlessly offensive processes cannot be tolerated much longer. Such a case as that reported from Widnes, where waste heaps of offensive matter, consisting chiefly of sulphur and lime, are allowed to accumulate, although the sulphur could be extracted at a profit, and so prevented from poisoning the streams for miles around, is certainly difficult to explain. The drainage from these heaps alone is estimated as carrying away twelve tons or seventy pounds' worth of sulphur a day. But perhaps as soon as some satisfactory system for eliminating the sulphur has been hit upon, this will be remedied. We have certainly much yet to learn in sanitary science. The old theories are one by one being exploded, and it will no longer do for us to poison the air we breathe, under the pleasing impression that its purifying properties are inexhaustible. Civilization has made such strides that she has succeeded in overturning the equilibrium of nature. The equilibrium must be restored.—*Chambers's Journal.*

Buildings that Resist Earthquakes.

The volcanic eruptions in Java, the earthquakes in Ischia, and our own western tornadoes, have probably caused much more destruction of life and property than they would have caused if buildings had been specially adapted to resist them. In Japan, where shocks of earthquake are frequent, a contemporary says that it is not usual to dig foundations for any building, no matter how large or important it may be. Rocks slightly rounded at the top are placed where the corners of the house are to be. The corner posts, rounded at the end, rest on these. The timbers are all pinned together, not nailed, so as to allow of considerable movement without coming apart. In the central portion of the building the timbers are particularly heavy, and act as ballast. In high towers there are sometimes huge beams swung from the roof and reaching to within a foot of the ground, which prevent the building from being overturned either by earthquake or storm. The oldest building in Japan, the Treasury at Nara, is built in this manner, without the swinging beam, but with a very heavy ballast in the framework of the center of the floor. A well known artist is the inventor of a painting hut which is constructed in part on the same principle. It rests on stones at the corners, the timbers are keyed together, and it carries a heavy ballast under the floor. It is, however, in addition, secured to the ground by ropes and anchors. This hut will outride a gale in perfect safety.

"Deep Water Fishes."

The article in our paper of May 10 contains an error, from misprint, which should be corrected, as it conveys a false idea. "One of the results has been to reveal the fact that a remarkable group of fishes—*Malacosteus*—have their home only in those hidden depths." This is perfectly correct if the word *Malacosteus* is omitted, as it was in the original copy. There is no such *group* as *Malacosteus*. It is a single genus, with a single species, *M. Niger*, and the only specimen which has yet come to light is the one originally described by Dr. Ayres in 1851. The sentence might well read: "A group of fishes, of which *Malacosteus* was long the only one known, have," etc.

Dynamite Blasting under Water.

Some few years ago, when it became necessary, owing to the expansion of fuel shipments at Lydney-on-Severn, the chief shipping place for the Dean Forest coal field, to extend the depth of water, to accommodate vessels at the above docks, the resort to dynamite as an explosive proved sufficiently successful, that not only was the undertaking completed, but this was accomplished when other processes had practically failed. As indicated, the object involved the enlargement of the lower floating basin, the depth of water required being 15 feet. In the breaking up of the lower rock, under water, Mr. Keeling eventually determined to try dynamite, and under the recommendation of Mr. William Blanch Brain, of Trafalgar Collieries, the charges were exploded by electricity.

It has been recently determined to perform similar operations in the river basin, and it is in respect to these that some information as to the *modus operandi* may prove of service where blasting operations necessarily carried on under water are a *sine qua non*. Mr. Keeling has again resolved to employ Mr. Blanch Brain's method of simultaneous electric blasting, viz., the electric apparatus, Brain's electric fuses, cables, exploder, etc. The custom is, where operations of the character named are about to be introduced, a responsible person is sent to instruct, and take charge, until the local parties themselves are competent to undertake the operations. As the sides of the basin are slanting, it is intended to remove the rock in order that the lower bed of the dock shall be level across its entire width. The workmen are provided with a raft, about 20 feet by 40 feet, two gangs of men employing "jumpers," three men to each. A series of holes are made—say from four to eight. The fuses have about 9 inch wires attached to them, and to these are connected the joint, insulated with Chatterton compound and tape, with tough cables, to reach the raft from bottom of hole. The fuse is then inserted into a primer in the middle of a calico or canvas bag, containing half a charge in two-ounce cartridges.

Having been thus prepared the charge is dropped down a pipe, the ends of the wires being on the raft. When all the holes are so charged, the wires are connected in series, and to the two end wires are connected the cables from exploder, which is on the shore. This machine is turned from fifteen to twenty times, according to the number of shots to be fired, and by reversing the handle, say 3 inches, the electric charge is freed, and all the shots are simultaneously exploded. Brain's improved American frictional electric exploder is being successfully used, which machine is capable of giving a spark 3 inches in length. After the shots the wires are disconnected and drawn up. Where they are at all damaged by the rock they are cut off above the places, which may be about 6 inches for every shot, and can be used again. Mr. Carl T. B. Brain represented his father at the preliminary explosions, and the work is progressing. In the comparison of expense Mr. Keeling estimates that the present process costs 4s. per cubic yard, against 5s. 6d. with the powder system. It may be added that Mr. Brain's system is being extensively employed in colliery operations in both home and foreign coalfields. At Hawkwell Colliery, Dean Forest, the late Mr. Chivers experienced great difficulty in extending his shafts the last 30 yards, owing to the bottoms being always covered with 2 to 3 feet of water. The charges in that case were simultaneously blasted by the electric machine with the highest degree of success. To mining operations of all degrees where blasting is required the process of Mr. Brain is of great interest and utility, both in respect to its economy, safety, and expedition.—*Colliery Guardian.*

Fluids and Fat.

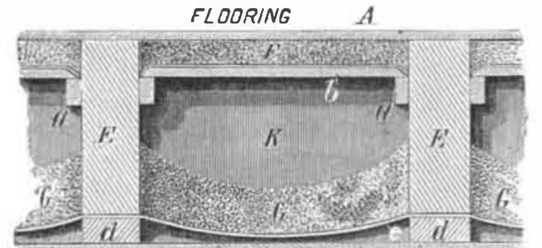
The removal of surplus fat from the body by appropriate means naturally forms a subject of interest to the well-to-do classes Various modifications of solid diet having bad their day, the consumption of fluids is now undergoing regulation in respect of quantity among those who find their own presence insupportable. There is something in this theory, inasmuch as liquids, merely as such, materially aid the digestion and absorption of the food with which they are taken. Again, several of the fluids in most common use are, directly or indirectly, fat forming. Thus cocoa contains a very large proportion of fat, coffee a considerable amount along with amyloid substances, which are also represented in tea to a much smaller extent, and which readily pass by chemical decomposition into the form of fat. Beer, wine, and spirit are all fattening, partly in consequence of their saccharine and starchy constituents, and partly from their tendency to hinder excretion of waste products of food, and, when acting on any but a languid frame, to hurry and to slur that methodical oxidation by the blood on which the maintenance of sound tissue depends. General opinion, we are sure, will bear us out in saying that when the solids consumed are moderate in amount and digestible, and when the fluid is merely fluid, not fatty or amyloid in its composition, and not stimulant, free drinking will not influence obesity. We can call to mind heavy drinkers of water and regular consumers of tea, moderate in diet otherwise, whose habits engendered not the slightest tendency to corpulence. We should without hesitation recommend their practice to the stout, and should rely for the reduction of their bulk not on any further alteration of their diet, which might easily be carried so far as to starve their more important tissues, but on the maintenance of regular and sufficient physical exercise.—*Lancet.*

DOLMAN'S FIRE DAMPERS.

The efficacy of ashes as a fireproof material and fire damper was forcibly demonstrated recently in this city, where an exhibition of Mr. W. H. Dolman's system of fireproofing took place. The object aimed at by the inventor is to make buildings with wooden floor beams as safe against fire as iron beams and tiling.

The accompanying illustration is a sectional view of the flooring timbers, B, the plastered ceiling, and A, the floor. After the joists or beams, E E, are in position, a sheet iron ceiling, *e*, is nailed on. One sheet may overlap another one-half to three-quarters of an inch, or each edge may be hooked half an inch. Upon this sheet iron ceiling about three inches of dry, finely-sifted ashes, G G, are placed, the ashes being settled down carefully and banked up against the sides of the joists.

Provision is also made for deafening the floor by constructing another layer, F, above the first, as shown, upon which the flooring is finally laid. Furring strips, D D, are nailed to the bottom of the joists to overcome the sagging of the sheet iron, and then lathed and plastered as usual.



DOLMAN'S FIRE DAMPER.

It will be seen that this method combines simplicity with cheapness. In the test made in this city, which we witnessed, the wooden beams of a structure so protected showed not the slightest indication of attack, after being subjected for more than half an hour to an intense heat; similar trials in Chicago and other cities have had the same successful results.

In small towns, where imperfect or volunteer fire departments exist, the danger from fires would be greatly reduced by this method. The excellence of this system is indorsed by underwriters. By its use any wooden timbered building, at a very small cost, may be greatly protected against fire.

Patented by Mr. Wm. H. Dolman, of No. 229 Broadway, room 15, New York city.

IMPROVED SEWER PIPE TRAP.

This is the invention of Mr. Herman Pietsch, of Flatbush, L. I. The construction and operation are the same as the ordinary trap, except that in the pipe above the water seal there is a light valve, J, as shown in the cut, Fig. 1.

The sewage pipe, C, dips within cup, F; and the overflow rises over the upper edges of same and escapes into box, A, and off through B. The extremity of C is always kept sealed by the liquid within cup, C. In the ordinary trap, when there is a downward suction in B, it is apt to draw out the water seal in F, and when this seal is gone

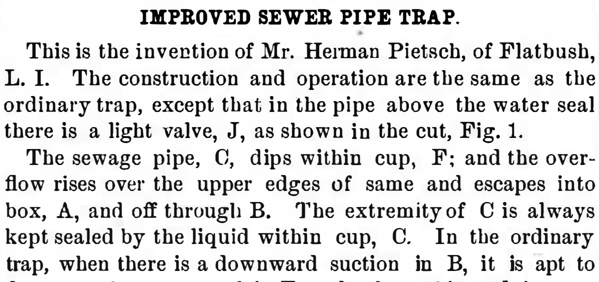


Fig. 1. Fig. 2.

PIETSCH'S IMPROVED SEWER PIPE TRAP.

there is nothing to stop the back flow or rise of the sewer gas into the room or house. But in the present improvement, when any down suction takes place in B, it causes the valve, J, above the seal to open, thus drawing off the gas *without disturbing the water seal in* F, and any rise or back pressure of gas closes valve, J, and is resisted by the water seal in cup, F.

We believe this is almost the only trap which carries with it an effectual means for preventing the siphonage of the water seal. In many cases, especially where the old styles of traps are used, and it is inconvenient to attach ventilating pipes to them, the substitution of this improved trap will instantly remove all troubles from back flow of gas. This trap has, after thorough trial, proved to be superior, and is highly spoken of by several prominent sanitary authorities. The American Institute declared it to be entitled to a higher award than any article of the kind on exhibition, and among its qualities the judges said it could not be siphoned, and it was impossible for back pressure of sewer gas to go through the seal.

Architects and others who wish to provide their structures with an economical but really good safeguard against sewer gas dangers, will do well to examine this improvement.

Wax Matches.

At the Nice Exhibition were two machines employed in the manufacture of wax matches and match boxes, shown by M. Perrier, of Marseilles. The first of these is used to cut the matches to the proper length. The wick covered with the wax coating is wound in long lengths upon the reels, one placed above another and revolving freely. These reels are divided around their circumference and for their whole length into separate compartments, in each of which the match material is wound. Altogether, in the machine shown, there are 100 independent lengths, 50 on each reel, and each length is brought to the front of the machine through a row of horizontal guides placed at equal distances apart. Here they are held, and a slight reciprocating and intermittent motion is given to them in order to feed them forward at each stroke. In front of the machine provision is made for holding a stout wooden frame, having, however, only three sides, the two vertical sides being slotted to receive the ends of a number of narrow wooden strips, covered on each side by cloth. These strips are, before the machine is started, held up clear of the wooden frame before mentioned, and at each stroke of the machine one strip is allowed to fall into the frame; at the same time the latter is moved down slightly. The machine being started, the ends of all the wax-covered wicks are fed forward sufficiently to bring them on to the bottom bar of the frame. As soon as this is done, the lowermost of the strips falls into the frame and lies on top of the ends that have been fed forward, at the same time holding them. A knife is then traversed across the machine, cutting all the wicks to the desired length. After this the frame falls sufficiently to allow the ends of the wicks to be again fed forward, another strip falls, and the operation is repeated. In this way the action is continued until the frame is full, with from 10,000 to 30,000 pieces, according to the size of the machine. The fourth side of the frame is then introduced, and the whole assemblage is securely locked. To convert these blanks into matches all that remains to be done is to dip their ends at one operation into the igniting composition.

The second machine, exhibited by the same maker, is for completing the well-known sliding boxes in which the matches are sold. It is somewhat on the type of an envelope-making machine. The blanks of the boxes or cases, whichever may be in course of manufacture, cut to form and decorated, are placed in a trough, one end of which is fitted with a spring that presses the row of blanks against a gumming device that forms the other end of the box. The operation of drawing the blanks successively from the trough deposits the gum on the exact places required. The attendant then inserts the blanks one after another into a former, which doubles them to the required shape, and delivers them as finished cases or boxes, as may be. But if after being thus finished they were discharged from the machine, the gum would be still wet and would not hold. This difficulty is got over by the use of a large and broad wheel placed in front of the machine. Around the periphery of this wheel, and parallel with its axis, are formed a large number of grooves the width and depth of the boxes. The width of the wheel is equal to the length of four or five boxes, and light strips of brass are placed around the circumference at intervals. As soon as the completed box is delivered from the former, instead of falling to the ground it is forced into one of the grooves in the wheel, the motion being so regulated as to bring a groove opposite the mouth of the former each time a box is delivered. But the action of forcing one box into one side of the groove displaces another on the opposite side. The wheel is then moved forward; another box is completed by the time the next groove is presented, and so on. By this arrangement each box remains in its groove until the wheel, which travels slowly, has made several revolutions, and thus sufficient time for the gum to dry elapses before the turn of any box comes to be ejected.

Egyptian Remains.

At Ekhmeem, a large provincial town of Upper Egypt, situate about halfway between Assiout and Thebes, Prof. Maspero, returning from his annual trip of inspection up the Nile, has just found, according to *Nature*, a hitherto undiscovered and unplundered necropolis of immense extent. As far as has been yet ascertained, the necropolis dates from the Ptolemaic period; but, as the work of exploration proceeds, it will probably be found that it contains more ancient quarters. The riches of this new burial field would meanwhile seem to be almost inexhaustible. Five great tombs or catacombs, already opened, have yielded a hundred and twenty mummies, and, within the short space of three hours, Prof. Maspero verified the sites of over a hundred more similar catacombs, all absolutely intact. The necropolis of Ekhmeem, at a rough estimate, cannot contain fewer than five or six thousand embalmed dead. Of these, perhaps not more than twenty per cent will turn out to be of archæological or historical value; but the harvest of papyri, jewels, and other funeral treasures cannot fail to be of unprecedented extent. Ekhmeem is the ancient Khemnis—the Panopolis of the Greeks. Its architectural remains are insignificant.