Each floor is attached, by separate suspenders, to a separate pair ot cables; though, of course, by means of trusses and other connections, any load is mutually borne by all the cables. The cables are, therefore four in number; each cable is 10¼ inches in diameter, and composed of 3,640 wires about one-tenth of an inch in diameter. These wires are made up into seven strands of 520 wires each, which are bound round at intervals to keep them in their places. The strength of all the cables is calculated at 12,000 tuns, each wire being able to bear 1,648 lbs. without breaking. The tota length of the top cables is 1,261 feet and of the bottom cables 1,194 feet. The cables supporting the lower floor descend 10 feet lower than the top pair, the deflection from a straight line being 54 and 64 feet respectively.

The suspenders are 624 in number, placed 5 feet apart.

The structure is remarkably steady and free from vibration; to secure which desirable object various means have been employed.

The principal cause of the stiffness of the bridge is the system of trussing adopted. On each side of the bridge the upper and lower floors are connected by wooden posts, arranged in pairs side by side, just sufficiently apart to allow the diagonal truss rods crosing between them. These truss rods are of wrought iron an inch in diameter, and extend at an angle of 45 deg. from the bottom of one pair of posts to the top of the fourth pair from it. As the posts are 5 feet apart, like the suspenders, the pressure above any pair of posts is by these truss rods spread over a space of forty feet. The truss rods are screwed at the ends; and thus, if the timber should shrink at any time, all can be made right again by simply tightening the nuts on the truss rods, which braces all tight up together again. In short the two floors, connected by the system of posts and trusses here described, give much of the rigidity of a tubular bridge, with only perhaps a tenth of its weight.

There are also a number of diagonal wire stays, extending from the top of each tower. These stays are 64 in number, and though they do not bear much of the weight of the bridge, Mr. Roebling believes them to gnard it considerably against vertical oscillation. A number of smaller stays are also attached to the underside of the structure, and anchored to the rocks below.

The inclination of the upper cables also greatly guards the bridge against horizontal vibration. The centers of the towers are 39 feet apart; but instead of hanging straight from tower to tower, the top cables are brought in the middle to within 13 feet of each other. The suspenders are also inclined inward; and the whole arrangement, though it puts a very slight additional strain upon the cables, tends greatly to maintain the steadiness of the structure.

The construction of the masonry is one cause of the economy of the bridge. Instead of a massive tower on each pier, as in most European examples, there are two towers one for each pair of cables, so slender that they look like mere chimneys, yet abundantly sufficient for the purpose. The basement is a mass of masonry 60 feet by 20 feet, pierced by an arch 19 feet wide, which forms the entrance to the lower floor at each end. Above this are built two towers, each 60 feet above the arch, 15 feet square at the base, and 8 feet square at the top. By this light construction' without incurring any risk, much masonry and money is saved.—*Lewis Wright.*

The Cattle Plague.

Our last accounts of the cattle plague in England show that up to the 3d of March, during the six months in which the epidemic has so far prevailed, 187,059 cattle have been infected, of which 117,654 have died directly from the disease, and 26,135 have been killed by way of preventing its spread. But this statement is only the Inspector's report, and does not pretend to give the whole number of cattle which have perished since the beginning of the pest in the latter days of August.

It appears that the general epidemic had increased steadily up to the latest mail from England, every step of its march becoming more alarming. The number of deaths, which averaged a thousand or more per week in September, increased from 1,700 to 2,000 in October. Up to November, 17,673 animals had been attacked, of which only 848 could recover or would be allowed to recover. By the middle of November, 20,000 (or as was stated), one in a thousand had perished; and up to December, 40,000 had caught the disease. By the 1st of January the number reached 73,549; 7,683 dying in one week; and in the last week of January, 9,243. By the middle of January, 107,098 had been attacked, only 15,527 remaining under treatment. The February papers picture the plague as positively awful in the country, and by the middle of the month, 150,000 cattle had become infected, and all but 40,000 had died.—*Tribune.*

[The number of deaths in a week, 9,243, is eqnal to 1,320 a day, 55 an hour, and very nearly one a minute. As the cattle of England are generally of fine quality and great value, this is a rapid destruction of property.

MARKETS FOR THE MONTH.

The prominent event in business matters during the month of March is the fluctuation in the price of gold, which fell from 140½ to 124⅞, and afteward rose to 128¼. Of course, it is not gold that fluctuates but our paper money; when gold is qnoted at 140, it is equivalent to saying that bank notes and Government legal tenders are worth 71 cents in the dollar; while gold at 128 means that the value of a paper dollar is 78 cents. These fluctuations in the legal measure of values create disturbances in business matters.

	Price Feb. 27.	Price Mar. 28.
Coal (Anth.) ₩ 2,000 lb.	$11 50 @12 00	$9 00 @10 00
Coffee (Java) ₩ lb.	27½@ 28½	27 @ 28
Copper (Am. Ingot) ₩ lb.	35½@ 36½	30 @ 31
Cotton (middling) ₩ lb.	44½@ 46	40 @ 42
Flour (State) ₩ bbl.	$6 60 @ 8 40	6 60 @ 8 25
Wheat ₩ bush.	2 20 @ 2 80	1 75 @ 2 90
Hay ₩ 100 lb.	80 @ 85	65 @ 70
Hemp (Am.drs'd) ₩ tun.	325 00@335 00	325 00@335 00
Hides (city slaughter) ₩ lb.	12½@ 13	10½@ 11
India-rubber ₩ lb.	75 @ 1 00	60 @ 85
Iron (American pig)	48 00 @50 00	43 00 @45 00
Iron (English and American refined bar)	100 00@110 00	117 50@122 50
Lead (Am.) ₩ 100 lb.	9 00 @ 9 12½	8 32 @ 8 55
Nails ₩ 100 lb.	7 50	7 @ 7 25
Petroleum (crude) ₩ gal.	27½@ 28½	25
Beef (mess) ₩ bbl.	16 00 @24 00	15 00 @24 00
Saltpeter ₩ lb.	22	20
Spelter (plates)	9¾@ 11½	9 @ 11½
Steel (Am. cast) ₩ lb.	13 @ 22	12 @ 21
Sugar (brown) ₩ lb	9 @ 16	9 @ 15
Wool (American Saxony fleece) ₩ lb.	72 @ 75	70 @ 80
Zinc ₩ lb.	14 @ 15	13 @ 13½
Gold	1 38	1 28¼
Interest (loans on call)	7	5 @ 6

Nitrous-oxide as an Anæsthetic.

The use of nitrous-oxide gas in the experience o J. M. Carnochan, M. D., of New York, as mentioned in his interesting article in the *Reporter* of Jan. 6th would seem to be preferable to the use of ether or chloroform.

It is preferable on account of its producing sound anæsthetic sleep in three-fourths of a minute, its administration being attended with no danger, whilst nausea and vomiting are never produced.

We have found it easy to prepare nitrous-oxide gas (NO) by heating nitrate of ammonia (NH4 O NO5), but the use of the present unwieldy bags, the heat, and nitrate of ammonia, will probably prevent the gas from coming into general use among practitioners.

If some apparatus can be devised, whereby nitrous-oxide gas can be administered as expeditiously and economically as chloroform on a hankerchief, then it is probable nitrous-oxide gas would come into general use as an anæsthetic. W. H. White, M. D.

Norfolk, Va., Jan. 1866.

[*Medical and Surgical Reporter.*

Statisties of Ohio.

The Toledo *Blade* publishes an abstract of the annual report of the State Commisioner of Statistics of Ohio, from which we extract the following summary:—

"The amount of land cultivated in 1864 was 700,000 acres less than in 1862. Machinery did the work of 50,000 persons while the men were at war. The average production in 1865 of crops was up to that of a series of preceding years. The crop of oats was estimated at 18,000,000 of bushels; corn, 90,000,000 of bushels, and hay 2,000,000 of tuns. From nine counties in the State was grown an aggregate of 13,144,779 pounds of tobacco.

"The destruction of almost the entire fruit crop of 1865 was traceable to the ice storms of winter, and the extraordinary humidity of the atmosphere in April, May and June.

"There are 3,340 miles of railroad in the State, with a paid up capital of $77,694,737, and an indebtedness of $58,931,686.

"The production of maple sugar, sorghum sugar, maple molasses, and sorghum molasses was, in total, sugar, 5,239,729 lbs.,; molasses, 2,933,697 gallons.

NEW PUBLICATIONS.

General Notions of Chemistry—By J. Pelouze and E. F. Fremy. Translated from the French by Edmund C. Evans, M. D., Philadelphia. Lippincott, Grambo & Co.

This is a small volume of 439 pages illustrated by 27 lithograph engravings, and from the high character of the authors, is, of course, trustworthy authority. It is intended for beginners, and the authors hoped to make it more easy and acceptable by omitting symbols, and, of course, any explanation of the atomic theory and equivalent proportions. We have no doubt that this is a mistake; the shortest, as well as the easiest and most agreeable road, to a knowledge of chemistry, is the mastery of Dalton's atomic theory. This is the key that unlocks the mysteries of the science.

Experiment with Traction Engines.

Messrs. Aveling & Porter, a firm of steam engine builders in England, who are making a good many traction engines, recently tried an experiment to ascertain the cost of transporting goods by steam engines on common roads—that is English common roads, which are macadamize turnpikes. The editor of the London *Engineer* was invited to take notes of the trial, and he gives the results on his own authority. The work performed consisted in hauling three wagons, loaded with 15 tuns of lime, stone, and coal, 26 miles; the whole weight of the train being 21 tuns. The train started at 5:55 A. M., and arrived at 6:30 P. M., occupying 12 hours and 30 minutes in the journey, including 33 minutes spent in trying to stop "a leak between cylinder cover and valve box cover." This is a speed of 2:8 miles per hour. The coal consumed was 23 cwt. and the expenses of the journey reduced to dollars and cents were as follows:—Tolls, $10 54; coal, 5 57; oil and waste, 84 cts. labor, $3 12; wear and tear and interest, $2 94; $23 01.

This is equal to $1 53 per tun for the 26 miles, and 6 cents per tun per mile; to which must be added the cost of loading and unloading. Our readers will not fail to observe that the tolls for this 26 miles of turnpike amounted to ten and a half dollars.

Hub, Spoke, and Felly Machinery.—We have constant inquiries for this class of machinery, from readers in all parts of the country. As we always refer such inquirers to those who advertise in our columns, we think that manufacturers will do well to advertise constantly in the Scientific American. The profits from a single advertisement will sometimes pay the expense of advertising for an entire year.

Portraits on Watches.—A novel idea was recently carried out by an individual in Philadelphia. Desiring to have a picture of his father constantly before him, he took his watch to a jeweler had the dial removed, and the likeness photographed upon it. Porcelain pictures have been taken for some time, but this is a new phase of them.

Trussed Connecting rods for Locomotives.—On some of the New Jersey Transporation Company's locomotives, trussed parallel rods have been applied. These rods are much lighter and stiffer than straight solid ones or should be if properly proportioned, and are therefore preferable. Such rods have been used on steamboat engines for some time, but not on locomotives.

Knitting Machines.—We are frequently written to from various parts of the country asking where the best of the above machines can be had. Makers will do well to keep an advertisement in the Scientific American.

Manufacture in the West.—A large woolen factory is going up at Warsaw, Illinois. It is to cost $150,000, and will employ one hundred operatives.

Collection of Projectiles.

A correspondent residing in Washington sends us a slip that contains the following facts in regard to a collection:—

A collection embracing all the different varieties of projectiles used during the war of the Rebellion. which has been made at the United States arsenal in this city, and systematically arranged in an apartment in one of the arsenal buildings specially fitted up for the purpose. Shelves are ranged completely round the room, while the center is occupied by two stands, upon which the shells and other projectiles are placed in regular order. In adnition to all the projectiles used by the Union forces, the collection includes a great variety of shells, solid shot, etc., many of English manufacture, which have been captured from the Rebels. Among those used by the Union forces we observed the James projectile, which was used to great advantage in the reduction of Fort Pulaski, in the earlier days of the Rebellion. The inventor unfortnnately lost his life while engaged in exhibiting his shells to several foreign officers and others. It appears that a workman attempted to remove a cap from a shell with a pair of pliers, when it exploded instantly killing the workman and General James, who was assisting him, and severely injuring several of the bystanders.

Several ingeniously constructed torpedoes, designed to be used in destroying the vessels of a blockading squadron, are suspended from the ceiling. Three of the torpedoes, taken from the James River, are constructed of common casks with conical floats attached to each end. They were to be allowed to float down the stream with the current, until they arrived in close proximity to the Federal ship-of-war, and were then to be exploded by means of a cord attached.

Upon one of the shelves we observed a number of singularly-shaped projectiles termed darts, invented by Floyd when Secretary of War, and by him forwarded to the arsenal for trial.

A collection of hand grenades of different patterns will engage the attention of visitors to the model room. One grenade is in the form of a hollow sphere designed to be filled with powder. From the outer surface a number of common gun nipples project, upon which percussion caps are placed. The grenades are to be used to repel an assault of an enemy upon a fortification, and as they explode with but slight concussion, they would undoubtedly prove exceedingly destructive to the assaulting party. The Adams grenade is made in a similer shape, only differing in the manner in which it is exploded. It is the invention of a private in the army, who had observed that the hand grenades in general use frequently failed to explode. The hollow globe contains the explosive matter and a common fuse, over which is placed a friction primer. To the primer a lanyard several yards in length is attached, one extremity of which is securely held in the hand of the person using the grenade. The projectile is thrown in any desired direction, and when it reaches the end of its lanyard, the friction-primer is suddenly jerked out igniting the fulminating powder in the fuse, and consequently exploding the grenade.

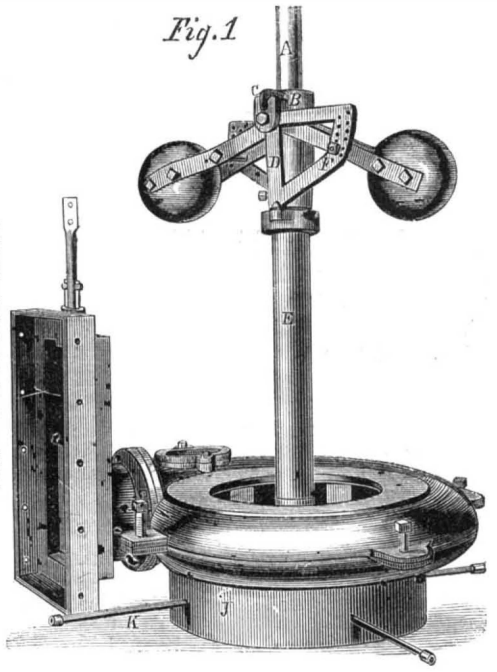
The collection contains a single specimen of a fire-ball, composed of highly combustible materials, which, when ignited, produce a powerful white light. It takes fire when discharged from the cannon, and is intended to be thrown in the direction of any point where the enemy are supposed to be engaged in throwing up intrenchments at night, in order that their correct position and the number of troops engaged in building them may be ascertained. The collection also contains a number of Hale's war rockets, which were extensively used in McClellan's Army during the disastrous campaign on the Peninsula.

The model room has been fitted up, and the shells and other projectiles carefully arranged under the supervision of Thomas Taylor, Esq., of the rifle-shell department. Every article in the collection is numbered, and Mr. Taylor is at present engaged in compiling a descriptive book to contain the names, distinguishing features, history, etc., of each individual shell or other projectile in the collection. We are informed that similar collections are being made at the Ordnance Department and Navy Yard, which will undoubtedly prove of immense benefit to army officers and scientific men interested in the matter.

LAKIN'S WATER-WHEEL REGULATOR.

Manufacturers who use water power know that it is as unsteady in action as any other motor, and the quantity admitted to the wheel must be governed by

Fig. 1

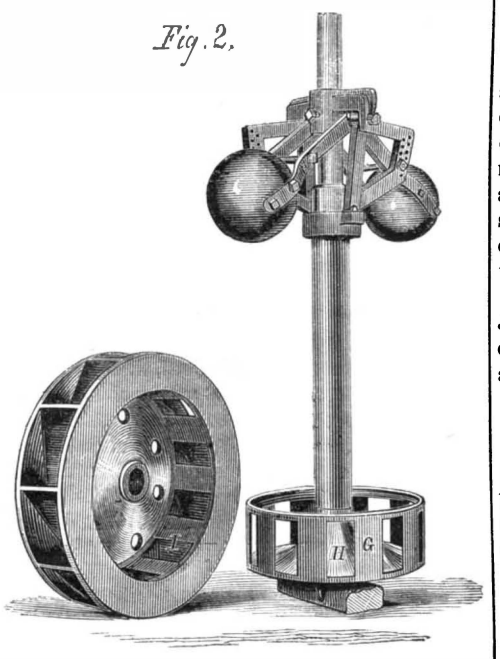


the duty to be performed at the moment, otherwise irregularities are manifest. This must be done by the wheel itself, automatically. It cannot be done by hand, for no human intelligence could foresee the precise moment when a machine was about to put on or off in the mill.

The apparatus here shown is to be attached to a central vent wheel, and controls the velocity of the same by obstructing or enlarging the issues. It also obviates in a measure excessive weight and labor on the step, and instead of increasing the strain, diminises it. This end is attained in the following manner:—

The upright shaft, A, of the wheel has a collar, B, on it, with two projecting arms, C. To these the upper end of the governor levers are jointed, and also

Fig. 2.



the end of a bell crank, D. The other end of the same connects with a coller on a cast-iron sleeve, E, fitting over the main shaft, and the governor levers also connect with it through the medium of a bolt, F. The sleeve, E, connects at the bottom of a regulator valve, G, Fig. 2.

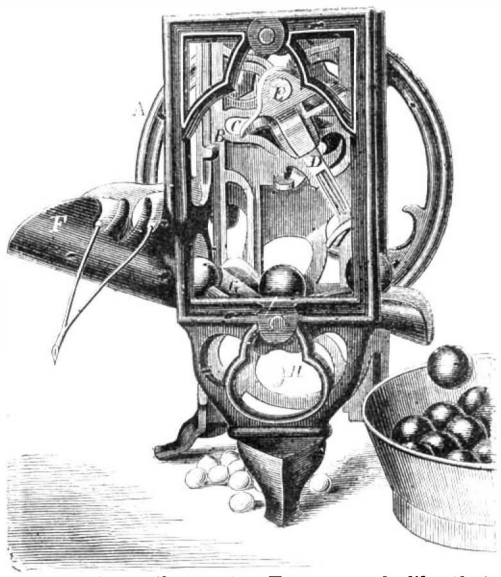
It is easy to see that, as the main shaft revolves, the governor will also, and that an increase or decrease of velocity will act on the balls and cause them to rise or fall, thereby affecting the position of the valve and its openings, H, with reference to the wheel and its issues, I. Any given velocity may be obtained for the main wheel by simply rasing the balls in the bell crank, D. The higher the point they are set at the greater velocity will be required in the wheel to raise them yet further.

Below the wheel is a water chamber, J, which has limited issues, as in the pipes, K. Upon this water, the result of leakage through the edges of the wheel and the scroll, the wheel and shaft rest in a measure, or in such a degree that great wear is obviated on the step.

A patent was issued on this governor to T. D. Lakin, on Oct. 13, 1863. This governor is manufactured by G. W. Davis & Co., Nashua, N. H., whom address for further information.

VAN KANEL'S CHERRY STONER.

This is a little machine designed to remove the pits from cherries that are to be preserved with sugar or dried. It is difficult to give a clear representation of this machine, owing to the nature of the framing, which is so open and light that the working parts become confused with it. In effect the work is done by turning a wheel, A. This has a pin in it which works a slide, B, inside the main frame. This slide rises and falls vertically by the action of the pin in the slot, C, and there is a fork, D, attached to it which receives the same motion; besides that, it ha



a movement on the center, E, very much like that given a paddle in moving a boat.

To stone the cherries they are taken by the stems and laid inside the trough, F, through notches in the edge. A little pull detaches them, and they roll down on to a table, G, which rises and falls alternately and throws one at a time under the fork, D; as it descends it pierces the cherry and pushes the stone out through the bottom, as at H, and by a dexterous flirt, throws the fruit out at one side into a vessel, completely pitted.

Rights for sale. For further information address Joseph Beare, Chester, Ill. Parties in Ohio and vicinity can address Babbitt, Harkness & Co., Nos. 18 and 19 Public Landing, Cincinnati, Ohio.

SPECIAL NOTICES.

Samuel Nye Miller, of West Roxbury, Mass., has petitioned for the extension of a patent granted to him on the 29th day of June, 1852, for an improvement in compound anchors.

Parties wishing to oppose the above extension must appear and show cause on the 11th day of June next, at 12 o'clock, M., when the petition will be heard.

Christopher C. Brand, formerly of New London, Conn., but now of Norwich, Conn., has petitioned for the extension of a patent granted to him on the 22d day of June, 1852, for an improvement in bomb lances for killing whales.

Parties wishing to oppose the above extension must appear and show cause on the 4th day of June next, at 12 o'clock, M., when the petition will be heard.

BACK NUMBERS.—New subscribers are informed that the back numbers of the present volume are out of print. Subscriptions are entered from the date of their receipt.