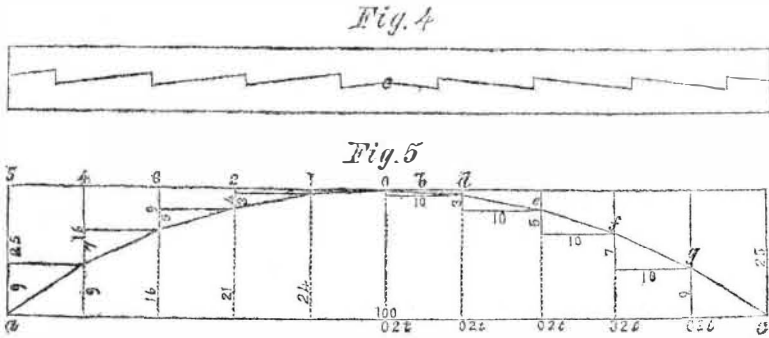


## Iron Girders and Beams.

[Concluded.]

Fig. 4, which may be considered a compound beam, affords a clear idea of the cohesion among the fibers along the center line of the beam. The two opposite forces in the upper and lower halves of the beam are met and resisted by the cohesion along this center line. *c* is the neutral point. Inasmuch as writers on the strength of materials have demonstrated that the curve of equilibrium for arches uniformly loaded is the parabola, I have a method of forming a parabolic curve that I have not seen published, which is very simple, and enables me to demonstrate that

the curve of equilibrium for an arch under the condition of a uniform load is the parabola. I have made the discovery that the successive deflections from lines drawn parallel to the tangent at the vertex of a parabolic curve, when the curve is divided into equal horizontal distances are in proportion to the odd numbers, 1, 3, 5, &c., and the total deflections from the tangent are to each other as the squares of the natural numbers, 1, 2, 3, &c., at the successive points, calling the first point from the vertex or tangent point, 1, second, 2, &c. Fig. 5 represents a parabolic curve formed as thus prescribed. I will now endeavor to apply the principle



[The horizontal and vertical distances in the above figure are not from the same scale.]

of the odd numbers to the demonstration of the curve of equilibrium, but will first assume that the horizontal thrust of an inclined brace or semi-arch, as compared to the weight producing the thrust, is directly as the ratio of the vertical distance to the horizontal distance, measured on lines drawn vertically and horizontally through the extremities of the brace or semi-arch, and terminating in each other, or inversely as the ratio of the horizontal to the vertical distance. Let the arch, *a b c*, be divided into any even number of equal horizontal distances, say ten, as in Fig. 5. Let it be supposed that the weight distributed over each division is two tons, and that it is concentrated at points, *b d e f* and *g*. The weight at *b* will be sustained, one-half by the left half of the arch, and the other half by the right half of the arch. One-half of two tons which is sustained by the right half of the arch corresponds to 1, the first deflection of the parabola, and the horizontal distance being 10, the horizontal thrust will be 10. The one tun at *b* will, through the arch, be transferred to the point, *d*, which, added to the two tons already there, make three tons, and three tons correspond with the deflection 3 of the parabola. The horizontal distance being 10 as before, and the vertical

distance being 3, the horizontal thrust for one tun will be  $3\frac{1}{2}$  tons, but for three tons will be 3 times  $3\frac{1}{2}$  tons, or 10 tons as before. The three tons at *d* are transferred through the arch to *e*, which, added to the two tons already there, make five tons, and five tons correspond with the 5 deflection of the parabola. The horizontal distance being 10, and the deflection or vertical distance being 5, the proportional thrust will be 2 and there being five tons at the point, the total horizontal thrust will be 10 as before.

Thus the calculations may be continued for any length of arch, or for any number of subdivisions—the greater the number of subdivisions the more perfect the arch. The weight on one-half of the arch is ten tons; if one half of this weight should be placed on the crown of the arch, it would produce the same horizontal thrust, as the whole weight concentrated at its center of gravity. The half span of the arch being 50, and the rise being 25, the proportional thrust is 2, and the thrust from five tons placed on the center of the arch is 10, as heretofore.

D. H. MORRISON.

Dayton, Ohio, January, 1859.

## Russia Sheet Iron.

The *Ottawa Register* has the following brief article on the above subject:—

"Atkinson says (speaking of Russia sheet iron, which is manufactured in Verkne Issetzskoi Zavod, a mining town, belonging to the Yakovlif family, about three versts from Ekaterineburg, in the Oural), 'the sheet iron made in this Zavod, and at some of the other works belonging to it, surpasses all other productions of the kind, either in the Oural or elsewhere. It is rolled for various purposes.—for covering the roofs of houses, for sheet iron stoves, also for the manufacture of a great variety of utensils. The metal is of so excellent a quality that I have seen it rolled as thin as post paper without either crack or blemish, and with a jet black polish. An enormous quantity of the various sorts of this manufacture is sent to America, where it is most used.'"

The editor, Mr. H. D. Post, says, in reference to this, that "the secret of the excellence of the Russia sheet iron is the quality of the metal, which is manufactured from the magnetic iron ores of the Oural. The experiment ought to be tried whether the Lake Superior iron would not roll into sheets of equal quality."

We have heard from some of our American engineers, who have been in Russia, statements of similar import to those of the above extract. It is not, however, the ductility of

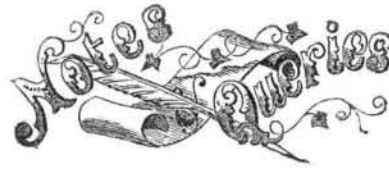
the Russia iron which constitutes its peculiarity, but its dark shining surface. It is not an enamel, as some have supposed, else it would soon crack off. Prussian and English iron has been rolled out into leaves much thinner than any sheet iron we ever saw, but these leaves did not have such a beautiful dark surface. Some American sheet iron approaches the Russian in appearance when new, but the surface appears to have a sort of scale or coating, liable to crack off in bending and by exposure to continued heat.

## Strength of Riveted Iron Plates.

MESSEURS EDITORS—I have made some experiments on the power of the riveted joints of plates to resist tension. From these I have deduced the following data:—Strength of the plates, 100; when double riveted, 70; when single riveted, 56. These results, however, are subject to some modification. The power of a joint to resist tensile strain must depend, to some extent, on the closeness of the rivets, or the number of rivets of a given size and in a given length of joint. The several experiments made by me give 22-519 tons per square inch when the plates were torn in the direction of the fiber, by the force being exerted perpendicular to it; and 23-037 tons when torn in the other direction, or across the fiber. Yours, truly,

JOHN MCRAY.

Washington, D. C., Feb., 1859.



\* Persons who write to us, expecting replies through this column, and those who may desire to make contributions to it of brief interesting facts, must always observe the strict rule, viz. to furnish their names, otherwise we cannot place confidence in their communications.

J. R. M., of Washington City.—Your improvement in skates seems to be new: but we advise you to call at our office in your city, corner of F and Seventh st., and take advice upon the matter.

W. H., of Pa.—Add one ounce of gum arabic to every pound of raw starch, and it will render linen more stiff than by the use of starch alone.

D. N. W., of Ill.—In No. 5, this volume of the *Sci. Am.*, you will find a notice of a family knitting machine. See also last number of our paper.

E. T. R., of N. Y.—The idea of suspending a telegraph wire across the Atlantic Ocean by means of balloons is a wild visionary scheme, and has neither merit or novelty to recommend it.

A. S., of Iowa.—A solution of borax will remove the scurf from the head, but it is said to be injurious to the scalp. It is our opinion that dandruff causes the hair to fall off.

G. P. T., of Wis.—The recoil of a gun is caused by the sudden back-pressure of the powder.

WATERPROOF ROBES.—M. A. Puckridge, of Newark, N. J., notices, in a letter to us, our remarks on page 141, present volume, in regard to the tunics prepared for the French army. He states that we regarded it as a new discovery; but we distinctly stated in the article referred to, that it was not a new discovery. He informs us, however, that the process described for waterproofing, with the addition of a compound mordant for fixing it, was once carried on by him in London; and he had thus prepared a great number of cloaks and overcoats for the British army. This business he has recently commenced at Newark.

J. E. K., of Mass.—The use of pumice-stone as a medium in a burner, as you propose, for purifying the gas, is old.

E. C., of Pa.—There is no first-rate work on American millwrighting published. Nor is there one on hydraulics that comes up to the science and practice of the present day.

J. F., of —.—The camphor mixture for a "storm glass" is composed of camphor first dissolved in strong alcohol, after which ten per cent of water is added. A little nitrate of potash may also be added, but it is not positively necessary.

W. H. W., of Mass.—If you will get "Dick's Practical Astronomer," it will teach you how to make telescopes. To make a cheap one, you can use tin for the tubes instead of brass. It will be better for you, however, to purchase the lens from some optician, as they are difficult to grind. The tubes only require to be coated with black varnish inside, and the glasses set in, to make a cheap telescope.

J. C. S., of Ind.—A top is made to spin on its point by the action of two forces—first, the one applied to rotate it, and second, that of gravity. The former gives it the spinning motion on its axis, and maintains its heaviest end uppermost the latter keeps it on the ground.

H. W., of Md.—There is no good work published on the manufacture of coal oil. You will learn more about it in the pages of the *SCIENTIFIC AMERICAN* than any other published work. The new edition of Knapp's Technology is published by H. Balliere, 290 Broadway, this city.

F. E. C., of N. Y.—You cannot repair your meerschau so as not to show where mended. The best way to join the pieces is by a paste made of plaster of Paris and white of eggs.

J. L., of Ky.—The color you notice on your boiler is produced by oxyd of iron, the tint of which is lightened by the lime in the water.

CONSUMPTION OF PRODUCTS.—It has been calculated that the inhabitants of cities consume, in food, clothes, fuel, &c., thirty times their own weight annually. The population of New York city, numbering 600,000, with an average weight of 120 pounds each, will thus consume 216,000,000 pounds annually. All parts of the world are laid under contribution for their supplies.

J. S. D., of Burlington.—Your plans for a sugar mill we should think, are very complete, but we do not discover anything in it that is patentable. Had you given us your address, we should have written to you by mail at length.

J. W. N., of Conn.—The surface of cast iron, after being filed into shape, may be case-hardened by covering it with a paste of flour and prussiate of potash, allowing it to dry, heating red-hot, and then immersing in cold water.

M. B., of N. Y.—If it could be shown that A had abandoned his invention to the public, the patent would be invalidated. If B patents an invention previously invented by A, and by him abandoned to the public, B's patent would be valueless.

J. S., of Ga.—None of the dangerous burning fluids will explode by thrusting an ignited match into them. The fluid used in "vesper light" lamps is camphene, which is not held to be explosive. None of the fluids become explosive until they are evaporated into gas, and mixed with eight volumes of the atmosphere; all burning fluids will become explosive when so combined. The most volatile fluids are the most dangerous.

L. & D. T., of N. Y.—Yes; you have a right to repair a machine obtained and in use prior to the grant of the extended patent.

J. H. B., of —.—A party selling a patented article without the word "patented" and the date of the pat-

ent marked on it, is liable to a fine of \$100 for every offense. If the machine contains parts covered by several patents, the date of each should be marked on it, to comply with the strict letter of the law.

J. N. C., of Ind.—The reason why it feels colder on a windy day, when the thermometer indicates a temperature no lower than on a calm day, is owing to the rapidity with which the air in motion carries off the heat of the body; fresh quantities of cool air are being continually brought into contact with the body, in the same manner that a condenser cools the steam of an engine. A siphon thirty feet high may be used to empty a sinking ship. It is supposed that there is a circuit of a single current in a magnet, and also in a telegraph line, and that it passes out of one pole and enters by the other. This theory is adopted to explain why a negative pole in one magnet repels the negative pole of another one, and *vice versa*.

A. C. L., of Pa.—There is no small elementary work on machinery published. There was a process employed in England for silvering glass globes with pure silver instead of an amalgam. At present we cannot give you the particulars in regard to its practice.

G. L., of —.—We have never seen a stove constructed for the simple purpose of heating a bath tub. The glass is put upon shirt collars by the friction of the flat iron; a little gum arabic is mixed with the starch, to give it greater stiffness. The flat iron should be very warm, and rubbed over the linen rapidly. Use a hard block under the collar to iron upon. It requires skill to do it in style.

H. J. B., of Pa.—We cannot tell what pressure a boiler can withstand unless we know the thickness of the metal; also the diameter and length of boiler. The space of three inches exposed to high heat in your boiler, when this water is flush with the lower gage cock, will not readily become red-hot; still, you should never allow the water to fall so low.

R. E. M., of Ohio.—Machines to keep up currents of air in hot rooms, and to brush away flies and musquitoes, are known and used in some sections. As early as 1830 Commodore Barron, of the United States Navy secured a patent for a mechanical device of this character.

M. A., of Pa.—The question is not "who first filed the caveat," but who first made the invention. When applications for the patent are made by each inventor, then the Office will, before issuing patents to either, require proof upon the question of priority of invention.

A. J., of R. I.—An opening  $8\frac{1}{4}$  inches and  $1\frac{1}{4}$  wide, under a head of 30 $\frac{1}{2}$  feet, will discharge 1,800 cubic feet of water, and your turbine wheel, with 80 such openings, will therefore discharge 54,270 cubic feet per second.

THE word "botany" is derived from the Greek word *botane*, grass or plant, and it is hence applied to the science which treats of the nature and varieties of plants.

The largest star seen in the sky is one in the South, called the Dog-Star. From calculations, it is known that its distance from us is not less than nineteen millions of millions of miles. Other stars have been calculated to be forty-two thousand times more distant than it, and light, which travels at the rate of a million of miles in five seconds, must be sixty-three thousand years in traveling from them to the earth.

S. W., of N. Y.—Milk is sold in a frozen state in our Northern cities, and also in Canada. You could not get a patent for such a discovery. You may be able to obtain a patent on a useful machine for scrubbing floors; it would be a humane invention for the ladies. A machine to wash milk pans and dms would also find favor with the fair sex. Churns are so numerous in form and character, that we cannot give advice until you have developed your plans more fully. Candles, in our large chandlery works, are dipped in frames.

H. A. N., of N. Y.—Five parts pure silver and one part of brass, make a soft silver solder. Some persons use pure tin as a soft, cheap silver solder, which flows easily.

O. P. S., of N. Y.—You are perfectly right in assuming that a cubic foot of hewn timber is just as heavy as a cubic foot of round lumber of the same sort. The weight of a cubic foot of oak is about 60 lbs.; of a cubic foot of cedar, 35 lbs.; and a cubic foot of lignum-vitæ, 23 lbs.; from which you will see that 40 feet of oak make about a ton, while 50 feet of cedar would only weigh 1,755 lbs.

L. K., of Pa.—You state that about the latter end of July, 1857, an agent in your place undertook to get out an English patent for an invention, for which he was paid \$500; and that the inventor had not been able, as yet, to get his papers; and that you had purchased the right under this patent for the Canadas. This all comes of employing a man who knows nothing about the business. Our charges are much less than the above sum, and we can usually deliver the patent in four or five months after the case comes into our hands. An English patent does not cover the Canadas, therefore you have purchased and paid for that which has no legal existence or value. Inventors make mistakes when they entrust their cases to the hands of unskillful parties.

F. W. E., of N. Y.—A round barn of 50 feet diameter will contain 1,982 $\frac{1}{2}$  square feet of floor area; a barn of a rectangular form, 180x50, will contain 9,000 square feet of barn floor area. We cannot advise you to build a round barn, because it is troublesome to match the doors and other timbers. We prefer the rectangular form, one side of which can be effectually sheltered from the north winds, which would not be the case with a circular barn. Slate roofs require to be pointed with mortar to keep out fine drifting snows.

R. A. W., of Ala.—A ball descending from a certain point on an inclined plane arrives at the lowest point with a velocity which would be exactly equal to the velocity which the ball would obtain by falling down from the starting point to the level of the lowest point in a vertical direction, and this velocity would be just sufficient to elevate the ball to the same height from