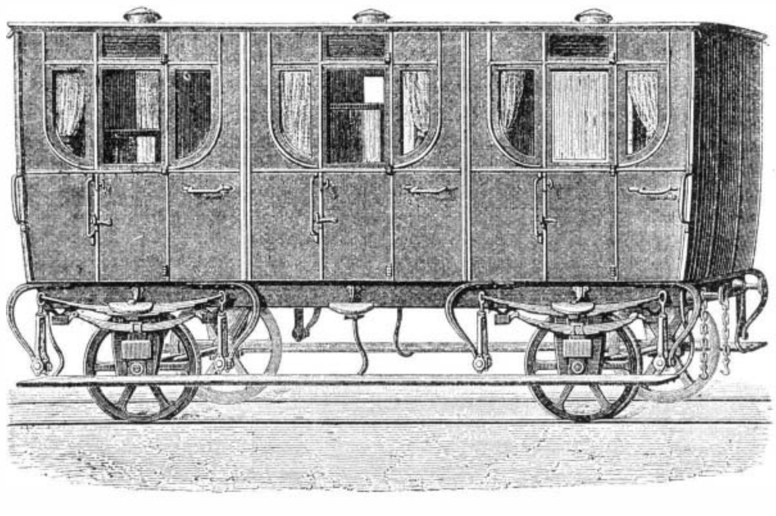
THE NEW GIFFARD RAILWAY CARRIAGES.

We recently gave an engraving of the new railway carriage, constructed after the designs of M. H. Giffard, a French engineer, and so built to be free from the oscillating or similar motions common to railway vehicles. While this device excellently answered the objects of its inventor in the respect mentioned, the systems of springs adopted added very materially to the weight of the carriage, thus increasing the labor and expense involved in its traction. To meet this difficulty M. Giffard has devised a new vehicle, which is represented in the annexed illustration, extracted from *La Nature*. The body is entirely separate from the trunk. The springs are of the ordinary leaf pattern. The novel feature consists in the mode of suspending the body from the springs, which is done by connecting the lower ends of the curved iron rods, four of which are fastened on each side of the vehicle, by means of universal joints, to the lower extremities of arms suspended from the ends of the springs. The weight of the carriage is reduced to about one tenth in excess of that of the ordinary car, while all the advantages of immobility and easy riding, described fully in our previous article, are retained.



GIFFARD'S RAILWAY CARRIAGE.

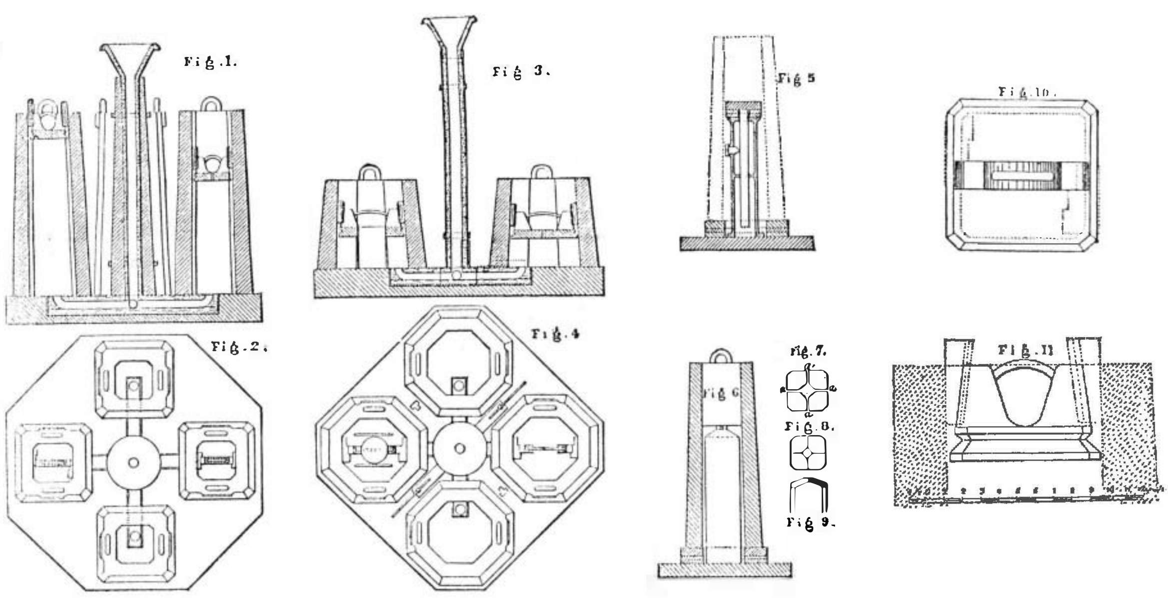
NEW METHOD OF CASTING STEEL INGOTS.

The advantages of casting steel ingots in groups, from below, that is, filling a number of molds at the same time, from one runner, are so obvious and so great that many plans for casting in this way have been brought forward from time to time. The chief practical difficulty in casting in groups has been to find some entirely satisfactory mode of stoppering the ingots, when the molds have been filled to the required hight.

Durfee patented, some years ago, making molds for group-casting closed at the top, with the exception of a small vent hole: a plan that gives a very sound, clean ingot, but necessitates a different mold for each different weight to be cast, and renders it difficult to get out an ingot that may stick in the mold. Ireland uses a plain heavy casting stopper, dropped on the metal after the mold is filled, such as is used in casting ingots of tool steel from crucibles; a stopper of this kind, however, can only be used in parallel molds, made in two parts, bolted or cottered together; and in these parallel molds, even when planed all over, inside and at the joint, the ingots are apt to stick, and the molds, after having been in use for a short time, open at the joints, causing fins on the ingots. Mr. A. L. Holley has patented several modes of stoppering molds, to be filled also from below, but they have not come into general use.

In the plan of stoppering herewith illustrated, the stopper used is a cast iron block, about 2 inches thick, grooved round the edge, as shown in the accompanying sections, and of such a size as just to drop freely into the top of the mold. A small vent hole, about $\frac{3}{16}$ inches in diameter, is drilled through it, and is slightly conical, that the metal may not stick in it. The stopper is fixed in the mold by two cast iron wedges, as shown more clearly in the enlarged plan and section, Figs. 10, 11. To set the stopper in the mold, the latter is dropped over a post of such a hight that, when the stopper is placed in the mold, and on the top of the post, it is exactly at the hight required. A small shovelful of loam, such as is used in lining steel ladles, is then thrown in, and rammed into the joints by a rammer, 2 inches or 3 inches broad, and about ½ inch thick; the wedges are driven in, to fix the stopper in its place, and the mold is then ready for casting. The loam or mixed clay and sand used should be only slightly damped, so that it will just cohere when pressed together in the hand. The post is adjusted to the required hight by putting packing blocks or rings at its foot, to raise the mold, or by packing under its head, which for that purpose may be made loose and fixed by a set screw in the side. In order to prevent the squeezing down of a fin of loam between the post and the inside of the mold, if the loam is rammed in too hard, or if the rammer is thin, the head of the post should be a pretty close fit in the mold at the hight at which the stopper is fixed. For this purpose, several heads should be provided, to fit different molds, or different hights in the same tapered mold; or the top of the post may be made beveled, as shown, Fig. 6, and four small adjustable blocks may be placed on it when it is in position in the mold. These slide down the beveled faces of the post, into the corners of the mold, and close up the spaces through which loam might squeeze down. The only openings still left are those at *a*, *a*, *a*, *a*, Fig. 7, between the blocks; and in arranging the molds for casting ingots, such as those for tires, in which a perfectly smooth top is required, these are closed by laying over them small loose pieces of sheet iron, before dropping the stopper in. Tire ingots may be cast either in the form of solid cheeses, the more usual plan, or with a core, in order to save punching. Stoppers for both these plans of casting are shown in Figs. 2, 3.

The molds when arranged on the base plate are filled through a central runner, with a branch leading into each mold. The central runner is made in two parts, bolted together, or clamped, as shown in the illustration, by rings driven over them; or by rings put on loosely, and tightened up by wedges, in the same way in which the halves of ordinary molds for casting steel tool ingots are put together. The funnel-shaped top of the runner is in a separate piece, put in after the lining is completed. The runners are dried by setting them over holes in a thick cast iron plate, heated below by a fire, or by a gas flame; and in order that the lining may dry readily, they should be perforated all over with ½ inch holes, placed pretty closely together. Where there is plenty of crane power, to handle the runners, they are most conveniently made of cast iron, but where they have to be carried by hand, they may be of light wrought iron. Both these forms of runners are shown in Figs. 1 and 2.



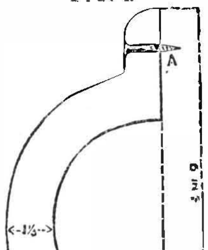
HACKNEY'S METHOD OF CASTING STEEL INGOTS.

A HOME-MADE COMPOUND MICROSCOPE.

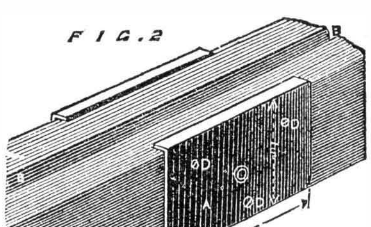
A correspondent of the *English Mechanic* sends the following description of a microscope stand, which may be manufactured at a trifling expense by any one having a little mechanical skill: "Of course I suppose him to have odd pieces of sheet brass of different thicknesses, brass tubing, screws, wood, etc., as, if he has to resort to the shop for everything, he will find it make a very different figure to what mine cost.

I give average dimensions, which any one can vary to suit himself. To begin, procure a piece of oak, beech, or some other heavy wood, 6½ x 3½ x 1 inch. At each corner of either end and in the center of opposite side, fix a small round knob to enable the stand to be firm in any position. Next draw a line across the center of the board at right angles to the longest side, and on this line at 1 inch from the center make two mortises, ½ inch in diameter, with center bit (the measurement is to center of mortise), for the uprights, the dimensions of which should be 7½ x 1½ x ⅜ of an inch each, and at the end of each carefully make tenons to fit the mortises. Having rounded off the upper corners, put them in position (none of the parts should be finally fixed until the whole is completed). If properly done, you will now have a space of about 1⅛ inches between the uprights. Now cut out from board of this thickness a piece of the shape and dimensions in Fig. 1, and in the place indicated in the engraving, and also at about ¾ of an inch from top of the uprights, cut, with a center bit, a hole about ⅜ of an inch in diameter; through these put a bolt the size of the hole, with a round head at one end and a nut at the other. This bolt should be about 3 inches long. By this you will be able to fix the body in any position. Next plane up very truly a piece of wood 1 x 1½ x 6 inches long, and through the middle of the widest face make (lengthways) with a ½ inch plow a groove about ½ or ⅝ of an inch deep, and in another piece of wood, ⅜ x 1½ x 6 inches, make a similar groove, but only $\frac{3}{16}$ of an inch deep; and if you do not intend making a rackwork adjustment, plane a strip of wood so as to move truly in the groove ½ or ⅝ of an inch in width and 6 inches long, which piece glue in the groove formed in the smaller piece of wood; and the pieces of brass on the sides, as afterwards mentioned, must be put on. If you intend making a rack adjustment, a rectangular rod of brass ½ x ½ x 4 inches long must be fixed at the end of the upper groove, which is intended to be nearest the object, and in the remainder of the groove should be inserted a strip of wood of the same size; this will save brass. A clock pinion—that which works the count wheel in old case clocks is the best, and can be procured of almost any dealer in old brass, etc.—must be fitted on an iron axle 3 inches long, in the middle of which is a square arbor to fit the hole in center of pinion. This had better be turned in a lathe, the ends just small enough for the pinion to pass over easily, and a small portion the thickness of the pinion (which must not be wider than the groove) left larger in the middle, to be afterwards filed down to fit the pinion tightly. Sometimes a steel pinion can be had with axle already fixed (having formed in this shape a portion of a clock), when none of this work is of course required. Now comes the most difficult part of the job, to file teeth in the rack to fit the pinion, which must be done very exactly, or it had better be left undone and a sliding adjustment used. My rod was of lead, in which the teeth are more easily cut, and although it has been in constant use for two years it is still in good working order; but of course brass is preferable and would repay the extra trouble. In the larger piece of wood, at a distance of 3½ or 4 inches from the end toward the stage, the groove must be deepened for a short distance to allow room for the pinion, and in the best position, to be ascertained by careful measurement, a round hole (the size of pinion, on the opposite side, and concentric with the other hole) the size of the axle; or it may be made larger, and a metal bearing put in on both sides instead of one. You will now have your pinion in the center of the groove, and an inch of axle projecting on either side, on which to fix the knobs or milled heads with which to turn it; but before putting these on, two pieces of brass (Fig. 2) must be cut out, and about $\frac{1}{16}$ of an inch of the upper edge turned at right angles, and a slit made in the sliding top in which this will work, for which purpose the bent edge should be about $\frac{1}{16}$ of an inch above the upper face of the board on which it is fixed, and care must be taken that it is perfectly parallel. The engraving will show the method of fixing. Now put on a pair of milled heads, or any knobs which

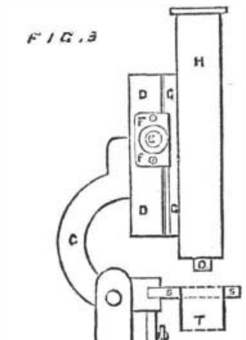
FIG. 1.



A, fastening for pinion block; B, hole for bolt; C, groove for fixing stage.

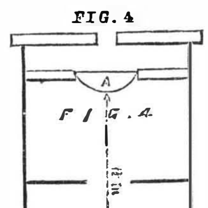


A, brass guides; B, groove; C, axle hole; D, screws.



A, base; B, upright C, crane arm support; D, pinion block; E, milled head; F brass guide; G, focussing slide; H, body of microscope; O, objective; M, mirror; S, stage; T, tube fitting do.; I, crank to mirror.

FIG. 4.



A, eye lens, 1in. focus; B field do., 2in. focus; C, diaphragm with aperture.

A HOME-MADE MICROSCOPE.

will enable the pinion to be worked evenly, slide the top in its position, and if everything has been done correctly you will have a rack adjustment which will work as truly as in many of the cheap brass microscopes, in fact better than some. Be careful, in screwing on the brass plates, that the screws do not project into and spoil the groove. The best plan for getting the sliding piece to work smoothly on the other is to work them backwards and forwards on each other, and on no account must the faces in contact be either stained or polished, except naturally, although the exposed portions will be much improved in appearance if stained and polished. As regards wood, any that will not split easily and will take a good smooth surface will do. Now fasten the piece of wood with the pinion on the opposite side to the groove, to the flat face of the curved piece of wood (Fig. 1, A), leaving one inch projecting toward the stage (which is to be fixed at B), and the end to which the pinion is nearest is to be placed uppermost. The tube, which may be of brass, zinc, or even brown paper, according to what is most convenient or procurable, is the next thing to be made, and it should be rather greater in diameter than the amplifying lens if the eyepiece is not constructed, and, if so, of a size that the eyepiece can slide closely into. It may be fastened to the sliding piece by means of strips of brass going round it and screwed into the wood, or, what is far better, by two screws through the middle of the sliding piece (in the groove), one side of the tube, and fastening into two small bits of wood inside; or the heads may be inside the tube, and small nuts used to tighten it. The tube, which should be 8 or 10 inches in length, should reach, when the two sliding pieces coincide, to within ½ inch of the opposite side of the curved piece of wood. The stage, which should be a piece of wood 2½ x 3½ x ¼ of an inch thick, should be let in by one of the shortest sides into the slit, C (Fig. 1), and screwed firmly in that position. Exactly opposite the center of the tube make a dot; and with this as a center and a 1¼ inch center bit, cut a hole, into which fit a brass tube 1 inch in length, to fit the apparatus into. Two springs of sheet brass, cupped so as to allow a slide to be slipped in and pressed just sufficiently to hold it in any position, should be fixed at the sides of the stage; or a sliding ledge, on which the slide may rest, may be used instead. Under the stage, in the position indicated in Fig. 3, which represents the completed instrument, a strip of wood, ½ of an inch square and of such a length that when the microscope is placed upright it may touch the base, must be mortised in, on which to fix the mirror, the manner of doing which is shown in Fig. 3, the crank and U-shaped piece being strips of brass screwed so as to be capable of being turned in any direction. The mirror may be either a plain one with two pivots, or, what is better, one of the sixpenny reading glasses, which should be unscrewed out of its handle, the slit soldered to act as one pivot and a piece of wire soldered on the opposite side for the other. Now get two pieces of thin looking glass, and get a glazier to cut them to fit the brass rim of the lens, cement them back to back, and fix them in the rim of the lens, when you will have one side plain and the other equivalent to a concave mirror. You have now only to construct your eyepiece and objective to have the microscope complete. For the eyepiece, procure a plano-convex lens 2 inches focal distance, and another 1 inch; fix them in a brass tube 1½ inches apart—convex sides of both toward objective—and in the focus of the eye lens fix a diaphragm, with a circular aperture about ⅜ of an inch in diameter; and a brass plate with a small hole should be placed between the eye and the eye lens (Fig. 4). The objective, which may consist of a double or plano-convex lens, should have an aperture of about ⅛ of an inch for a 1 inch power, and smaller for higher powers; it must then be fixed at the other end of the tube, and be sure that it is exactly centered, and its axis coincident with that of the tube. If you have carefully followed these directions you will have a really useful microscope, which will afford you hours of instruction and enjoyment."

Lowe's New Process for Gas.

Mr. G. L. Dwight, of Mont Clair, N. J., sends the following description of this process, which is now in practical use in Utica, N. Y.:

In general terms, the product is the result of a decomposition, by heat, of water and crude petroleum, but it is as different, in its character and quality, as the method by which it is produced differs from all others.

The system of retorts or equivalent vessels, heated externally, has been in all other methods in some degree adhered to. In this, however, it has been entirely abandoned, and the materials for decomposition are introduced directly into the fire itself, by which means there is secured the greatest possible economy of heat; while certain constituents, ordinarily wasted, are utilized as fuel, some being burned, which in other processes are carried forward with no advantage to the product. However trivial this difference of principle may appear, it is proven to be radical by the accomplishment of important differences in result. No other residuum than pure ashes is drawn from the generator. This generator is substantially a small cupola furnace of about 3½ feet internal diameter, built of firebrick, with air space between double walls, which is charged with anthracite to a depth of 3½ feet and driven to the proper heat by a blower. The draft is carried into the base of, and upwards through, a second cylindrical chamber, much like the first, but higher and filled with firebrick laid up with interstices, through which the gases of combustion are carried and ignited, evolving a high temperature. When suitable heat is attained (a dull cherry red in the generator, and a white in the superheater, as the second chamber is termed) the base is closed against atmospheric air, the valve passage to smoke stack shut, and dry steam is admitted directly into the incandescent coal, a little above the grate bars, while crude petroleum is dropped from above upon the same. The gases therefore are generated in the same vessel at the same moment, and pass together into the secondary chamber.

It will be remarked that the mass of coal is gradually being cooled by the passage through it of the steam; but as the gases escape from the furnace very hot, they do not greatly diminish the heat of the second chamber, which, by its uniformity and hight of temperature, equalizes and thoroughly fixes the product. Thence it passes, through the washing and condensing apparatus, onward through the lime boxes to the holder.

In practice at Utica, which is the largest place yet lighted by this system, two generators are employed (though four were set up), being used alternately. No. 1 is heated while No. 2 is making gas, and so on, so that continuity of production is ensured. One generator is used for 30 minutes, and then another, this length of time being, on the whole, the most economical, as the fire is not, during that period, so far checked as to involve delay in re-firing. The mass is then stirred slightly with an iron rod, a small quantity of coal added, and the blast re-applied. Each run gives an average of 3,000 cubic feet. The management of the apparatus is stated to be exceedingly simple, requiring no skilled labor beyond a little experience in judging of heat and in the gaging of the oil flow. In the Utica works, two men by day and night, at laborers' wages, make all the gas required by that city, the coal system having been for some months entirely superseded. Continuous daily operation there has clearly demonstrated that 60 lbs. anthracite, costing $6 per tun, and 3 gallons petroleum costing 6 cents per gallon, yield 1,000 cubic feet of gas, which, with the labor and time added, makes a cost, in the holder, not exceeding 50 cents per 1,000 cubic feet, for gas of a quality not less than 20 candles. No difficulty is found in maintaining a uniform standard, and no indication of stratification or of deposition in the pipes is met with. The flame is remarkably white and intense, and its combustion perfect. Extreme experimental tests, or (better still) the practical experience of the past winter, at Phœnixville, Pa., where the thermometer sank to 17° below zero, have shown conclusively that this product is less sensitive than coal gas. Mr. Dwight considers himself justified, by the facts, in claiming for the Lowe process the following advantages over all others:

1. Great simplicity of apparatus, and consequent low first cost.

2. Solidity of mechanical construction, whereby the minimum of wear and tear is secured.

3. Ease of management, which largely reduces the labor.

4. The comparative cheapness of materials employed, and their thorough utilization.

5. The high quality of the product, and, for the above stated reasons, its very low cost.

Vertical Motion of Vessels.

Mr. Thorneycroft, the well known builder of fast steam launches, proves that at high rates of speed the body of a vessel actually rises above its ordinary load water line, and, as the speed increases, continues to rise still higher. The experiments from which these results were deduced were conducted with the steel torpedo launch lately built for the Austrian government, with which a speed of 19·4 knots was attained. The differences of level were determined by means of three plumb bobs hanging from a bowsprit at various distances in front of the bow, from observations with which the altered water surface was measured, and some exceedingly instructive diagrams made therefrom. From these it appeared that, up to a speed of about twelve knots, the vessel sank more deeply in the water; but on being driven to a higher speed, she seemed to make an almost sudden leap up, and continued gradually to rise above the normal water line as the speed increased.

A Buried Forest.

A man living in Essex county, Virginia, in digging a well recently, at a depth of about thirty feet came upon the trunks of large trees several feet in diameter, which were found upon examination to be cypress. Fearing the water would be injured by the wood, he determined to abandon his well, and dug another some distance off. When he had reached about the same depth he again encountered the trees; and a third attempt, at a still greater distance from the first well, again brought him in contact with this subterranean forest, the trees of which are of great size and well preserved.

There are portions of land in New Jersey, near the coast, where buried trees are also found, and considerable business has been done in unearthing them.

Cable Telegraphing.

The ocean telegraph operator taps the key as in a land telegraph, only it is a double key. It has two levers and knobs instead of one. The alphabet used is substantially the same as the Morse alphabet—that is, the different letters are represented by a combination of dashes and dots. For instance, suppose you want to write the word "boy." It would read like this: "— . . . — — — — . — — —". B is one dash and three dots; O, three dashes; and Y, one dash, one dot, and three dashes. Now, in the land telegraph, the dashes and the dots would appear on the strip of paper at the other end of the line, which is unwound from a cylinder, and perforated by a pin at the end of the bar or armature. If the operator could read by sound, we would dispense with the strip of paper, and read the message by the click of the armature as it is pulled down and let go by the electric magnet.

The cable operator, however, has neither of these advantages. There is no paper to perforate, no click of the armature, and no armature to click. The message is read by means of a moving flash of light upon a polished scale produced by the deflection of a very small mirror, which is placed within a mirror galvanometer, which is a small brass cylinder two or three inches in diameter, shaped like a spool or bobbin, composed of several hundred turns of small wire, wound with silk to keep the metal from coming in contact. It is wound or coiled exactly like a bundle of new rope, a small hole being left in the middle about the size of a common wooden pencil. In the center of this is suspended a very thin, delicate mirror about as large as a kernel of corn, with a correspondingly small magnet rigidly attached to the back of it. The whole weighs but a little more than a grain, and is suspended by a single fiber of silk, much smaller than a human hair, and almost invisible. A narrow horizontal scale is placed within a darkened box two or three feet in front of the mirror, a narrow slit being cut in the center of the scale to allow a ray of light to shine upon the mirror from a lamp placed behind said scale, the little mirror in turn reflecting the light back upon the scale. This spot of light upon the scale is the index by which all messages are read. The angle through which the ray moves is double that traversed by the mirror itself; and it is, therefore, really equivalent to an index four or six feet in length, without weight.

To the casual observer there is nothing but a thin ray of light, darting to the right and left with irregular rapidity; but to the trained eye of the operator every flash is replete with intelligence. Thus the word boy, already alluded to, would be read in this way: One flash to the right and three to the left is B. Three to the right is O. One to the right, one to the left, and two more to the right is Y, and so on. Long and constant practice makes the operators wonderfully expert in their profession, and enables them to read from the mirror as readily and as accurately as from a newspaper.—*Boston Herald.*

A Suicidal Epidemic.

A recent number of *Chambers' Journal* gives an entertaining article on suicides, from which we copy:

"Sometimes," says the writer, "a person determined to destroy himself will wait months and years for an opportunity of executing the deed in the particular manner he has marked out for himself, and the very inclination to suicide may be removed by withdrawing the particular objects that would awaken the idea. Thus a man who has tried to drown himself will be under no temptation to cut his throat. Example, it is well known, is a powerful cause of excitement to the suicidal act. We were once told by a physician that a hypochondriacal patient used to visit him invariably the day after reading the report of a suicide in the daily papers, possessed by a morbid fear of imitating the act of which he read. Sir Charles Bell, surgeon of Middlesex Hospital, was one day describing, to a barber who was shaving him, a patient's unsuccessful attempt to cut his own throat, and, on the barber's request, pointed out the anatomy of the neck, showing how easily the act might be accomplished. Before shaving operations were completed, the barber had left the shop and cut his own throat according to Sir Charles Bell's exact instructions. Sometimes there is an epidemic of suicides, as at Versailles, in 1793, when out of a small population 1,300 persons destroyed themselves in one year; or as in the Hotel des Invalides in Paris, when six of the inmates hanged themselves on a certain crossbar within a month. Very often the disease is hereditary, and at a certain age the members of one family will all in turn evince the suicidal tendency, while even children of very tender years have been known to end their short lives by their own act, from force of example. Curious, too, are the methods of self-destruction, but they are too painful to bear description. A Frenchman once attempted to ring his own death knell, by tying himself to the clapper of the church bell, which thereupon began to swing, and alarmed the villagers by its unwonted tones. All cases of determined suicides are characteristic of confirmed insanity; whereas, in a case of impulsive insanity, the perpetrator will often regret the act before it is completed and endeavor to save his life, as did Sir Samuel Romilly, thus demonstrating that the very attempt may effect the cure of the disordered brain. The months of March, June, and July are the favorites with men, September, November, and January for women, in which they voluntarily end their lives. In youth men hang themselves, in the prime of life use firearms, and, when old, revert to hanging. Women usually prefer Ophelia's 'muddy death.' Poisoning is a method adopted by the very young of both sexes. We have the consoling reflection that, prevalent as brain disorder is in our country, at least eighty per cent of cases of insanity are curable if treated at an early stage; while it is to be noted that it is not pleasurable, productive brain work that does the mischief, but rather the mental strain which results from the high pressure of our artificial life."

Centennial Notes.

The Centennial Board of Finance have secured more than forty-six acres of fine level grain land at Schenck Station, on the Philadelphia and Trenton Railroad, three miles this side of Bristol, for the purpose of making it an international trial ground for reaping machines, steam plows, harrows, rollers, etc., at the Centennial Exposition. The necessary plowing has already been done under the superintendence of the Centennial Bureau of Agriculture.