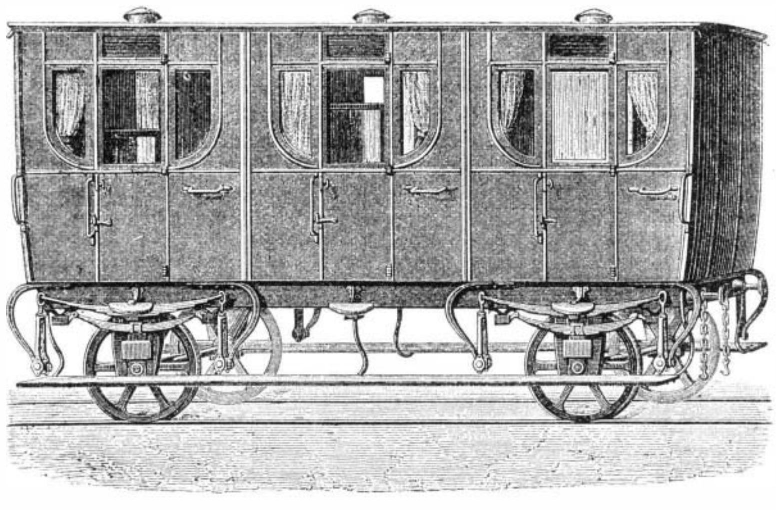
THE NEW GIFFARD RAILWAY CARRIAGES.

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.

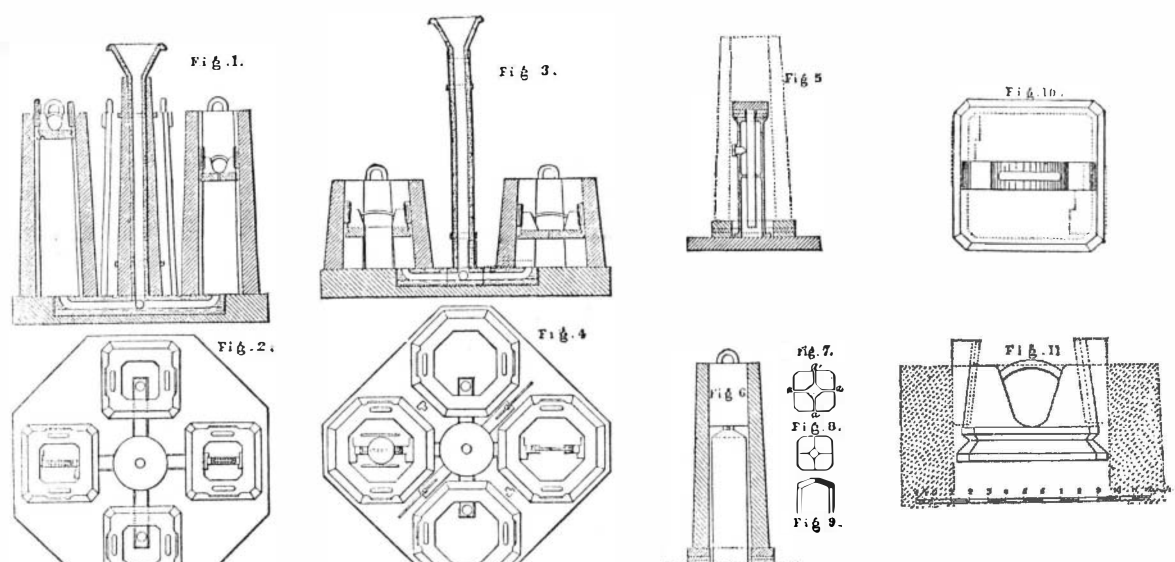
NEW METHOD OF CASTING STEEL INGOTS.

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 3¼ 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 7¼ x 1½ x ¾ 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 1⅛ x 6 inches long, and through the middle of the widest face make (lengthways) with a ¼ inch plow a groove about ¼ or ⅜ of an inch deep, and in another piece of wood, ⅜ x 1⅛ 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 ¼ 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 easi**ly, 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

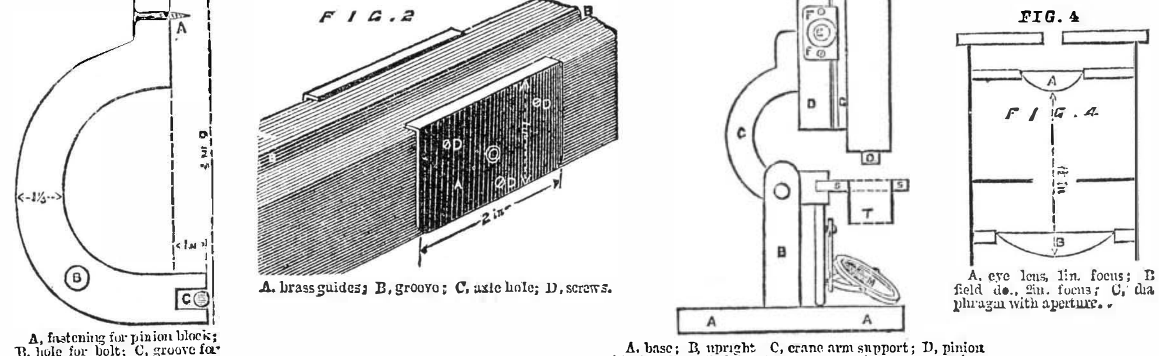


FIG. 1. A, fastening for pinion block; B, hole for bolt; C, groove for fixing stage.

FIG. 2. A, brass guides; B, groove; C, axle hole; D, screws.

FIG. 3. 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., 3in. focus; C, diaphragm with aperture.

A HOME-MADE MICROSCOPE.