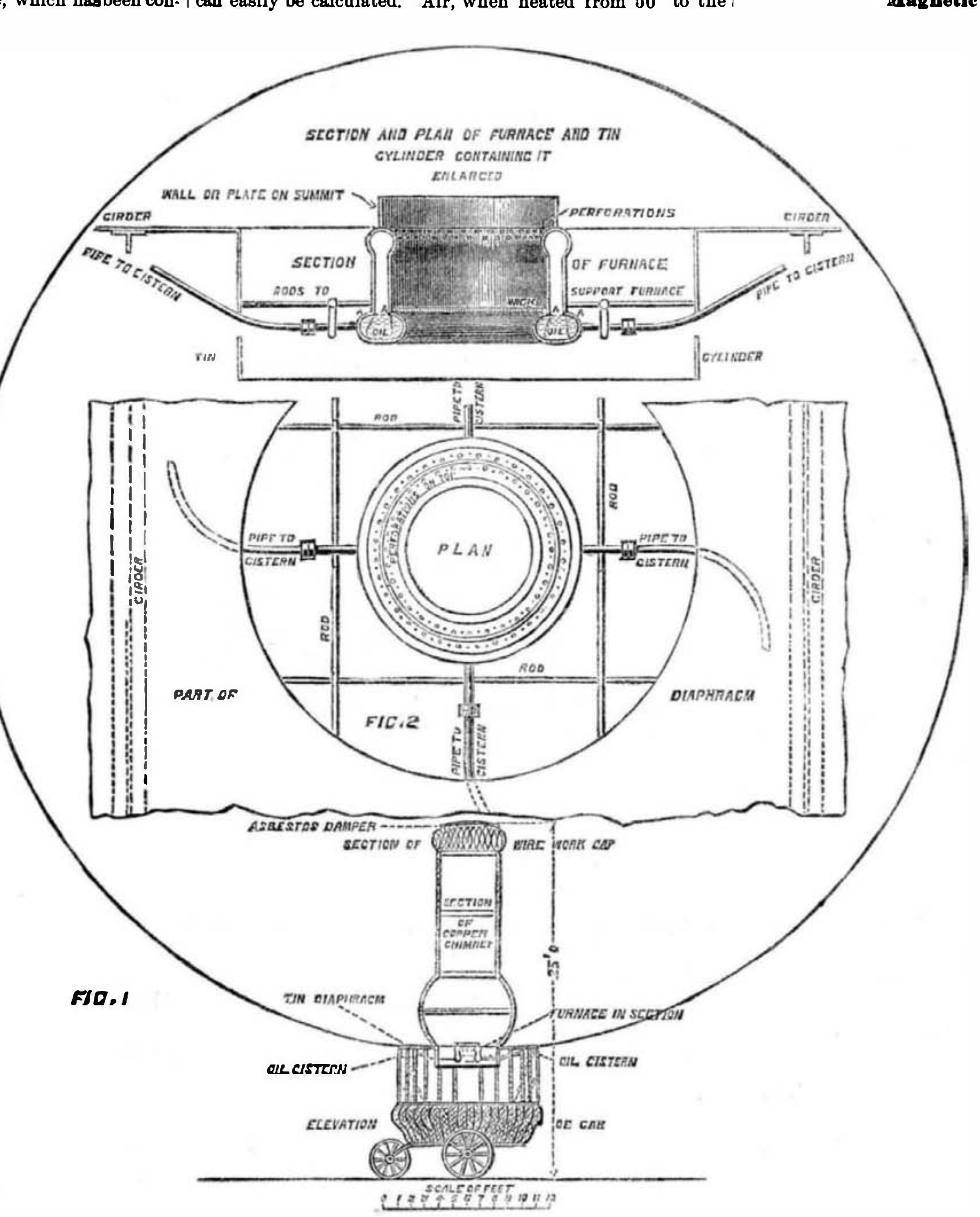
A NEW HOT AIR BALLOON.

The possibility of ascending in a balloon filled with hot air was long since demonstrated, but the death of one of the earliest experimenters, followed by the manufacture of coal gas, led to the abandonment of the system. A Frenchman named Ménier has recently revived the idea, and has made experiments on a scale of considerable extent. His scheme is to employ a balloon filled with hot air, in a captive condition only, as a means for obtaining observations from a considerable altitude for an army upon the line of march; and experiments have been instituted at the Woolwich Arsenal, England, with a balloon of gigantic size, which has been constructed under the supervision of the well known aeronaut, Mr. Simmons, for this purpose, a paraffin lamp being used for heating, which is the invention of M. Ménier.

The accompanying plan engraving will give the reader an idea of the proportions of this balloon, and of the apparatus employed for heating it. The balloon is nearly circular, 70 feet in diameter, the aperture at the neck being almost closed by a tin diaphragm which separates the balloon from the car, suspended 4 feet beneath by cords surrounding the balloon. A manhole is contrived in the diaphragm, so that observations can be taken of the interior of the balloon during an ascent. The car is of wirework, with a wooden hoop round the top and bottom, and runs upon three light carriage wheels, by means of which it can be transported from one place to another, with the whole of the balloon and its attendant gear packed upon the top. The wheels remain attached to the car during an ascent. The heating apparatus, which consists of a huge paraffin lamp with a copper chimney, the whole being 25 feet high from the ground, rests upon the tin diaphragm, being supported by light girders of wrought T iron, crossing the ring round the diaphragm (see the section, at the upper part of the illustration, for the girders). The furnace for the lamp, the details of which will be described presently, rests within a tin cylinder projecting beneath the diaphragm, being supported by bent rods of iron crossing the cylinder. It has four feed pipes, leading into it and communicating with two oil cisterns suspended from the diaphragm ring, two to each cistern. The cisterns are filled from cans of oil, by means of small force pumps and a supply pipe—a waste pipe being also attached to each, leading away into an empty can. The furnace is immediately beneath the chimney, which is constructed of thin sheet copper, having a bulb at the bottom 6 feet in diameter. The chimney is divided into several portions, as may be seen in the engraving, which take to pieces, and are capable of packing into a small space for easy transit. At the top is a head of open wirework, crowned with an asbestos mat or damper, to prevent the heat striking directly upwards and burning the roof of the balloon. The substance of the balloon is French cambric, an excessively fine fabric, with a double crossed woof, so as to be impervious to the air. It is slightly heavier than the silk usually employed for balloons, but requires no preparation or dressing of any kind to render it airtight. The furnace or burner is of annular character, constructed of copper, hollow, with a bulge all round at the bottom, to contain the oil. At the junction of the bulge and the walls of the furnace, on both sides, is a ring of wick (see AA.) At the summit of the burner or furnace are numbers of perforations piercing into its interior. A wall or ring of metal is erected on the top to direct the flame upwards. The action of the apparatus is as follows: Upon filling the bulge with oil and lighting the wicks, the walls of the furnace are quickly heated, the surface of the oil inside being rapidly converted into inflammable gas as its body becomes hot. The gas escapes at the perforations before alluded to, and very shortly ignites outside the burner with a loud roar, continuing to burn fiercely until the cisterns are exhausted. These are of course replenished from the tin cans carried in the car, as previously explained. The average heat generated throughout the balloon is about 100° above the surrounding atmosphere, a higher temperature than that being considered dangerous for the fabric of the balloon. It has been found, however, experimentally, that a temperature of 22° above the surrounding atmosphere will actually lift the balloon off the ground.

The actual lifting power of M. Ménier's hot air balloon, says the *Engineer*, from whose pages we select the engraving, can easily be calculated. Air, when heated from 50° to the boiling point, 212°, expands to the extent of 33 per cent beyond its original bulk. Assuming then the average temperature of the surrounding atmosphere up to a short distance from the earth's surface, say 300 yards, to be 50°, we should expel from the balloon, by heating it to 150° of heat, about 20 per cent. of its original contents. Now a globe of air 1 foot in diameter weighs as nearly as possible $\frac{1}{25}$th of a pound; and as Ménier's balloon is very nearly spherical, its contents would weigh, in pounds, $70 \times 70 \times 70 \times \frac{1}{25}$, or 13,720 lbs., because the contents of spheres are directly proportional to the cubes of their diameters. Hence, by the above process we should reduce this weight by 13,720 divided by 5, or 2,744 lbs. This, then, would be the total lifting power of the balloon, or exactly 23½ cwt.; and deducting 13 cwt. for the weight of the entire apparatus, we find that 10½ cwt. is the excess of lifting power arrived at. Occupants, freight and ballast to that extent could therefore be carried in M. Ménier's balloon.



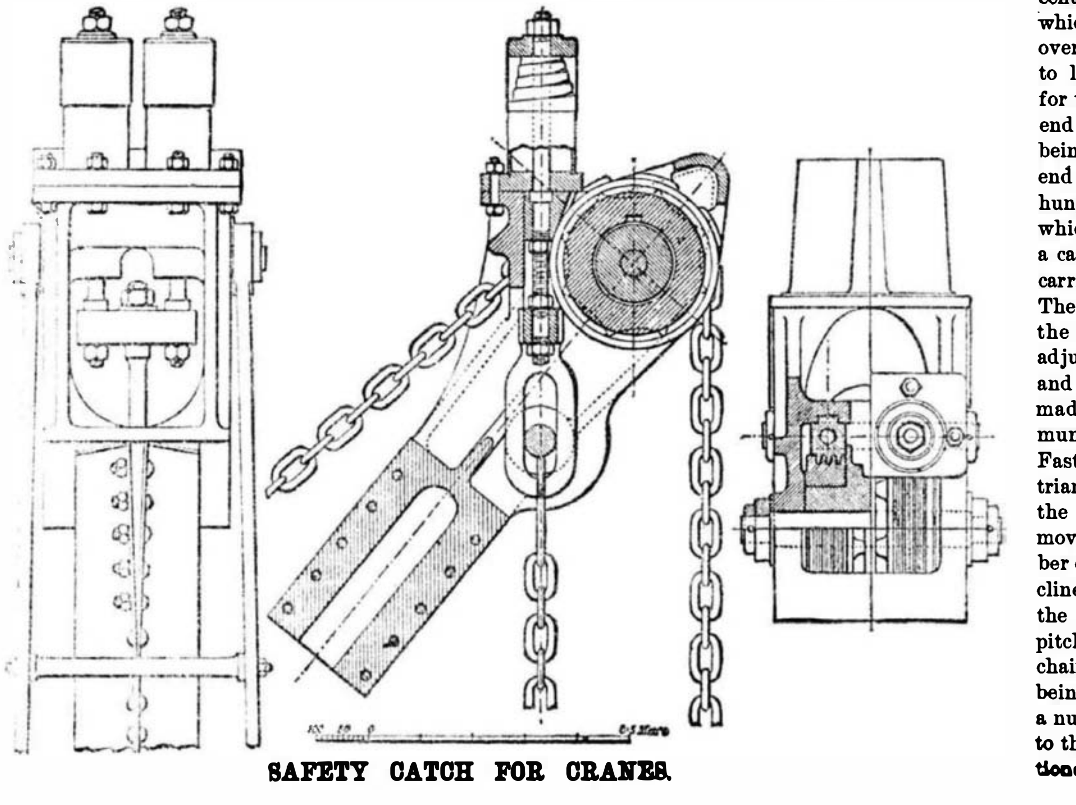
MENIER'S HOT AIR BALLOON.

Magnetic Condensation.

It is well known that a bar of soft iron, surrounded by an induction coil of wire, becomes magnetized on the passage of a current through the latter. Large magnets are frequently thus constructed; and in one capable of sustaining 330 lbs., M. Lallemand has noticed a curious condition. He states that, after allowing the above weight to be supported by the magnet, he removed all but 110 lbs., and then interrupted the current. The weight, however, remained supported, as it appeared, by residual magnetism in the iron. On removing the armature and weight, and then trying to replace the armature, it was found that the magnetism in the bar had disappeared and that there was not sufficient to hold the armature alone. *La Nature* mentions this as a new discovery, and suggests experimenting them. In this view our cotemporary is at fault, as a well known electrical expert informs us that, in using large magnets, he has repeatedly remarked the same phenomenon, and is, besides, under the impression that even a greater proportion than one third the weight can be sustained by the residual magnetism left in the bar. The explanation is doubtless to be found in the re-arrangement of the atoms of the iron under the influence of the current, a condition which, though of course not visible, can nevertheless be made to demonstrate its presence, as Professor Tyndall has shown, by a click at the establishment and interruption of the electric flow. The magnet and its armature and weight thus form a circuit, which may be likened to a band of steel held in annular form. The atoms retain their altered places even after the stoppage of the current; but the instant the continuity of the ring is broken, they return to their normal position, just as do the particles of steel when strain is removed.

SAFETY CATCH FOR CRANES.

Accidents from overloading cranes frequently take place, as the weight of heavy masses is not always known; and men are adt to risk a catastrophe rather than stop work or wait for assistance. The Northwestern Railway of Austria has recently brought into use an appliance which prevents the machine being overtaxed, and makes it impossible to lift a weight heavier than that for which the crane is designed. The end of the lifting chain, instead of being fastened to a fixed link at the end of the jib, is attached to a link hung to a crossbar, at each end of which is a vertical bolt rising through a casting in the head of the jib, and carried by a pair of volute springs. The arrangement is clearly shown in the engraving. These bolts can be adjusted with the greatest nicety, and the strength of the spring is made to correspond with the maximum load that the crane is to lift. Fastened to each of the bolts is a triangular block, with a feather at the back, serving as a guide, and moving in a groove, and with a number of V grooves in the front or inclined side. The sheave, over which the chain passes, is indented to a pitch corresponding to that of the chain itself, and on either side, and being a part of it, it is formed with a number of V grooves corresponding to those in the blocks above mentioned. So long, therefore, as the



SAFETY CATCH FOR CRANES.

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