CASTING A FIVE HUNDRED TUN ANVIL.

At Perm, a town situated on the banks of the river Rama, in the northeastern part of Russia, there is a gun factory, belonging to the Russian government and erected for the purpose of manufacturing cast steel guns of large caliber. Owing to the increasing requirements of the work carried on, it was found necessary to substitute for the 15 tun hammer ordinarily employed, a large double-acting 50 tun machine, calculated, when using top steam, to be equal in effect to a single-acting 100 tun hammer. To form the anvil block, the molding of a solid mass of iron, 500 tuns in weight, was necessitated, and the annexed engravings and following description, condensed from *Engineering*, explains how the operation was performed.

The geological characteristics of the ground selected for the erection of the hammer were first examined, and after passing through various strata of clay, sand, and boulders, a dense slate, capable of resisting a pressure of 680 lbs. to the inch, was reached. This was selected as a foundation, and the excavation was performed by the aid of a watertight caisson and compressed air. After the slate had been penetrated to a depth of 7 feet, two cross layers of heavy larch beams were laid and covered with tar and felt. Then came three courses of sandstone masonry laid in cement, *n n*, Fig. 1, each block weighing from 16 to 19 tuns. This change of wood and masonry was repeated twice, and the whole ultimately covered with a double course of larch beams, upon which the anvil block was to be placed. The construction of the hammer building (a tower-like edifice, consisting of an iron roof supported by four iron pillars) and of the adjoining structures was next finished, and the preparation for the casting of the great block were begun.

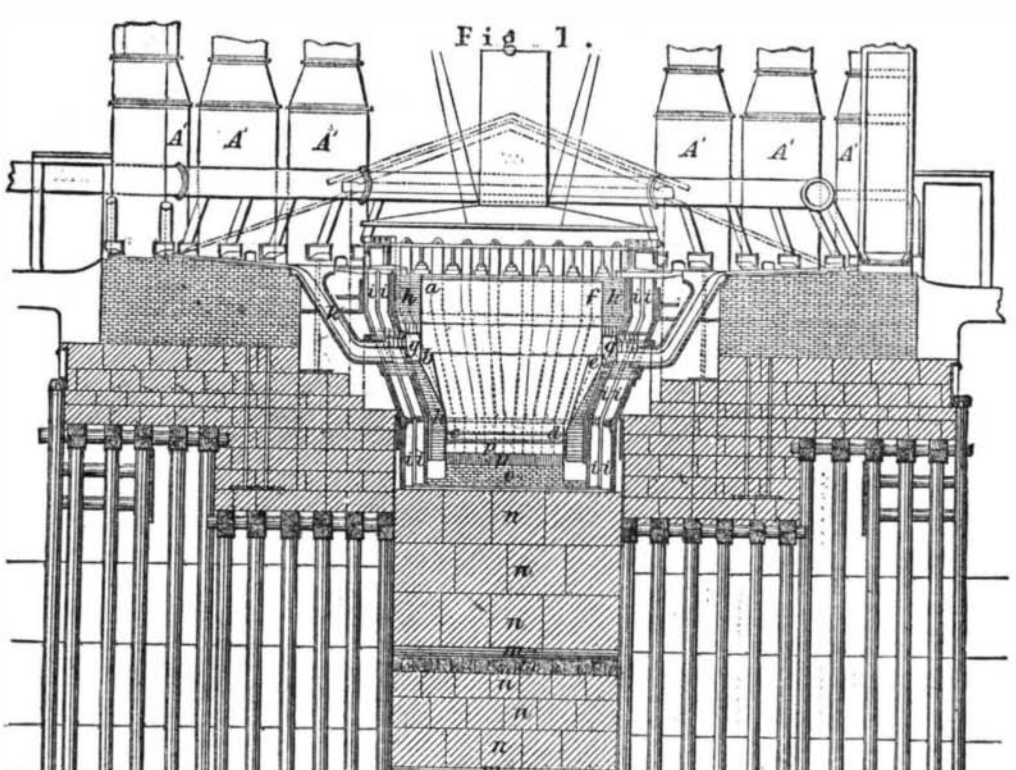
The latter has the form of a prism with a base 16½ feet square and 5 feet high, joining a pyramid 9 feet high, with a top 9 feet 8 inches square. The cubical contents of the mass are, therefore, 2,700 feet. To compress the iron on the top of the anvil block, it was decided to cast the same upside down, and hence two trunnions, *g g*, were provided, upon which it could be turned to its proper place after having cooled, and which also served as inlets for the molten iron. The block was cast on the top of its definitive foundation; and after the casting pit had been well dried and warmed, the molding itself commenced. First a framework, *i i*, of vertical cast iron beams covered with iron plates, and strongly braced, was erected at the sides of the pit. The hollow space in this structure was filled with molding sand. Four layers of common brick, provided with flues for the escape of gases, were placed at the bottom of the mold, then four courses of fire brick, *p*, the three upper layers forming an inverted arch. A mixture of fire clay and quartz served as filling material. Lastly came three more courses of large fire brick, the space between the latter and the iron framing being rammed with molder's sand. The pinions and channels for the liquid iron were similarly molded.

While this operation was progressing, fourteen Mackenzie cupolas, A′, were erected around the mold and to supply them with the necessary blast of 4,000 cubic feet of air per minute, anthracite coal being mainly used, three blowing engines were used, of different construction, having, however, cylinders respectively 6½ feet, 6 feet, and 7½ feet in diameter, and making from 21 to 28 revolutions per minute; and 255,360 lbs. of fuel and 1,786,400 lbs. of pig iron were prepared. Within an hour after the cupolas were lighted, the three blasts being turned on during that period successively, the iron began to melt, and the first tapping took place. The work began at 3:45 A. M., and by 3 P. M. 880,000 lbs. of iron had entered the mold, reaching a hight of 10 feet from the bottom. By 7:21 in the morning of the following day, the whole operation was over, the cupolas having been cleansed and filled three times, and only ten of them being used toward the end.

After a lapse of two days, a thin crust appeared on the surface, and the iron underneath was found to be under a state of compression by the contraction of the cooling surface, so that, instead of forming the well known phenomena of hollows, the iron came bubbling up through the pierced holes. After the lapse of two months, the mass was cool enough not to affect zinc, while it melted lead inserted in drilled holes. According to trials of temperature, it was found that the heat diminished at the rate of 72° Fah. per day at the outset, then at the rate of 54°, and, toward the end of the cooling, at the rate of 32° per day.

The entire work cost about $48,400, or some $96 per tun.

The difficult operation of turning the anvil block was successfully accomplished in the month of October last by Mr. Woronzow, the engineer in charge of the factory. The great mass was revolved on its journals, by two steam engines, within two hours and a half.



THE GREAT ANVIL AT PERM, RUSSIA—PLAN AND SECTION.

To Make Paper Transparent.

The best kind of paper is the class known as wove, not laid, paper. A varnish formed of Canadian balsam dissolved in turpentine supplies an excellent means of making paper transparent. The mode by which we succeeded best was to apply a pretty thin coating of this varnish to the paper, so as to permeate it thoroughly, and then give it a good coating on both sides with a much thicker sample. Keep the paper warm by performing the operation before a hot fire, and apply a third or even a fourth coating until the texture of the paper is seen to merge into a homogeneous translucency. Paper prepared in this way has come nearer than any other to our ideal of perfection in transparent paper.—*British Journal of Photography.*

THE SOLAR COUNTER.

A curious invention, the device of Abbé Allegret, has recently been introduced in the *Jardin d'Acclimation*, in Paris. It is an instrument which indicates how long the sun shines (months, days, hours, or minutes), during any given period. The machinery operates only when the sun is visible, and transmits its movement to three dials which, connected together in a simple manner, show months, days, hours, and fractions of the latter.

The essential part of the apparatus is two balls, one of which is black and the other yellow, fastened on opposite arms of a lever, which is sustained by a central pivot. When the sun shines the black ball absorbs more heat than the yellow one, and hence the vapor of the liquid contained in the former is elevated to a higher temperature than that in the latter; consequently the fluid travels through the lever from the first ball to the second, which, becoming heavier, overbalances the equilibrium, and in so doing sets free a weight attached to clockwork mechanism connected with a pendulum. When the sun is obscured, the liquid resumes its normal position, and the arms of the lever once more balance, arresting the fall of the weight.

In addition to the three dials above noted, there is a fourth, which is combined with mechanism which shows how many clouds pass before the sun, how frequently, and the exact time they take in making the transit. This consists of a narrow band of paper extended on a light circular frame established around the face of a clock. The latter is actuated by the ordinary machinery. Its single hour hand carries a pencil. When the sun shines, the paper, on its movable frame, is carried up to the pencil through mechanism connecting with the motor already described. The leaden point then traces a portion of the circumference corresponding to the divisions on the face of the clock passed over by the hand. If, however, a cloud passes before the sun, the movement of the lever, regaining its balance, withdraws the paper circle from the pencil, leaving a blank, the length of which shows the time during which the sun was screened. A single band of paper will last for a month or more, as the hour hand is made in two parts, screwed together, and so combined that, at every revolution, the outer portion passes under a fixed rack so that the screw head is slightly turned, thus elongating the arm and causing the pencil to begin its mark on a fresh portion of the paper.

In connection with the apparatus the inventor has established a sun dial which strikes the hours, a paradoxical operation accomplished as follows: At every hour mark on the dial plate is fixed one of the ball and lever mechanisms that we have above described. When the shadow of the style arrives at any hour, one ball is shaded, the lever tilts, and clockwork mechanism, of simple construction, strikes the hour on a gong.

We should imagine that the solar counter might be of considerable use in extended meteorological observations. A large superficies of territory, for instance, might be provided with a number of these instruments distributed at equal distances apart, from which telegraphic communication might be established to a central station, and thus, say every twenty-four hours, the period of sunshine, for all the points of observation, might be known. From this could be ascertained the course of the atmospheric currents; and further, by noting the amount that the sun has warmed the soil and atmosphere of countries more or less temperate than our own, we might be able to predict either milder or colder weather, through the effect of the condensation or dilatation of the atmosphere in such regions, and the consequent effect of such upon that of our immediate territory. The knowledge of the direction and number of clouds (which exercise a notable influence upon the temperature), coupled with that of the direction of the wind currents, would also offer new elements of observation of considerable practical value. Finally, as the autumn is warmer in proportion as the sun has shone more or less during the summer, transmitting more or less heat to the soil, the solar counter would serve to indicate approximately the yield of fruit and other crops to be expected.

An Hotel on Wheels.

The American carriage and wagon builders have a world-wide reputation for light work, says the *Carriage Monthly*; and as our cousins across the water have repeatedly stated that we carry this idea of lightness to extremes, we are now prepared to inform them that we can build also an occasional heavy vehicle. To Philadelphia, justly celebrated for light work, please remember to give the credit for building the heaviest heavy carriage on record. The following dimensions will be sufficiently startling, but we can vouch for their correctness, inasmuch as we have seen the drawing and copied the sizes.

DIMENSIONS OF BODY.—Length: 50 feet; width: 20 feet; hight: 16 feet. The carriage body is two stories high. The first story is 8 feet in the clear, and the second story 7 feet exclusive of the arch of the roof, which at the center gives 8 feet head room. Entrance is provided for at the front and back ends. The roof has ventilators similar to a street car. There