

March 31, 1925.

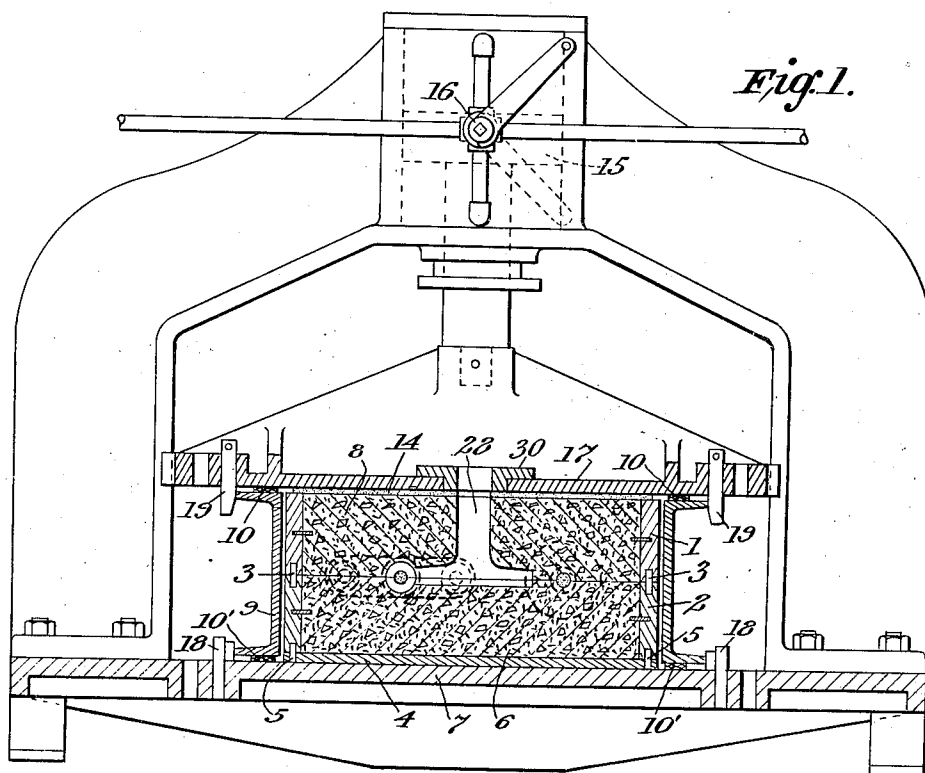
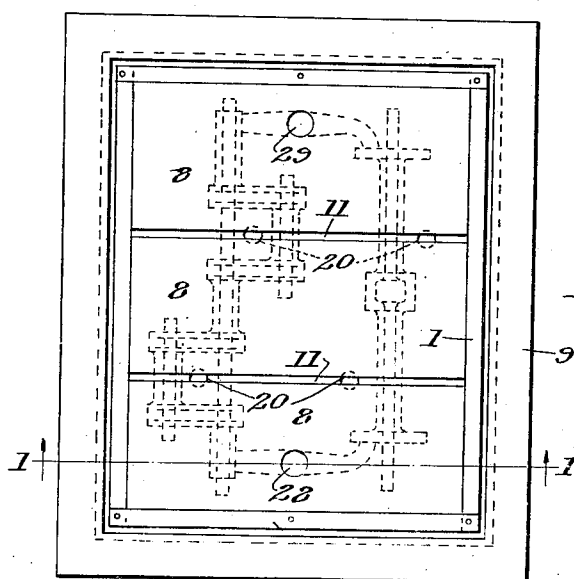
S. LAKE

1,531,445

MAKING METAL CASTINGS

Filed Jan. 13, 1920

3 Sheets-Sheet 1



INVENTOR.

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March 31, 1925.

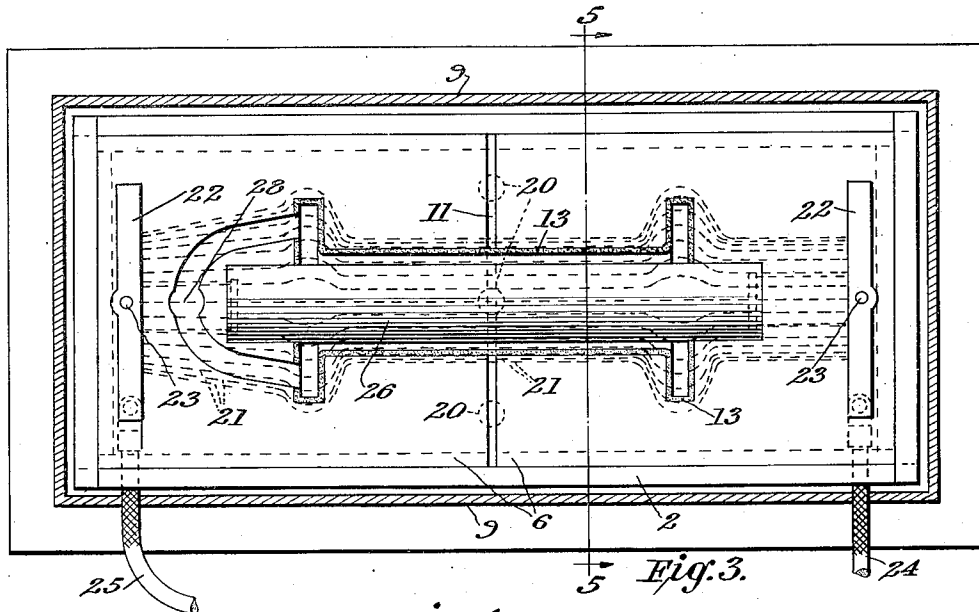
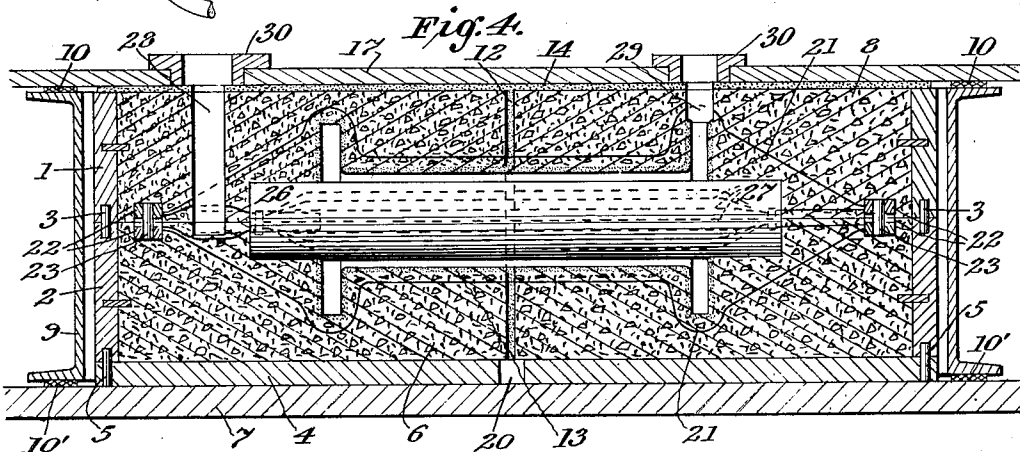
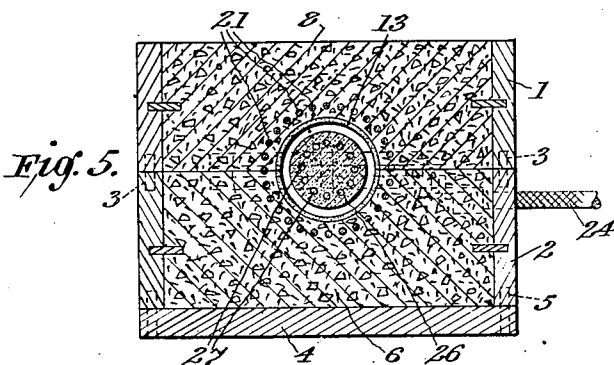
1,531,445

S. LAKE

MAKING METAL CASTINGS

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3 Sheets-Sheet 2



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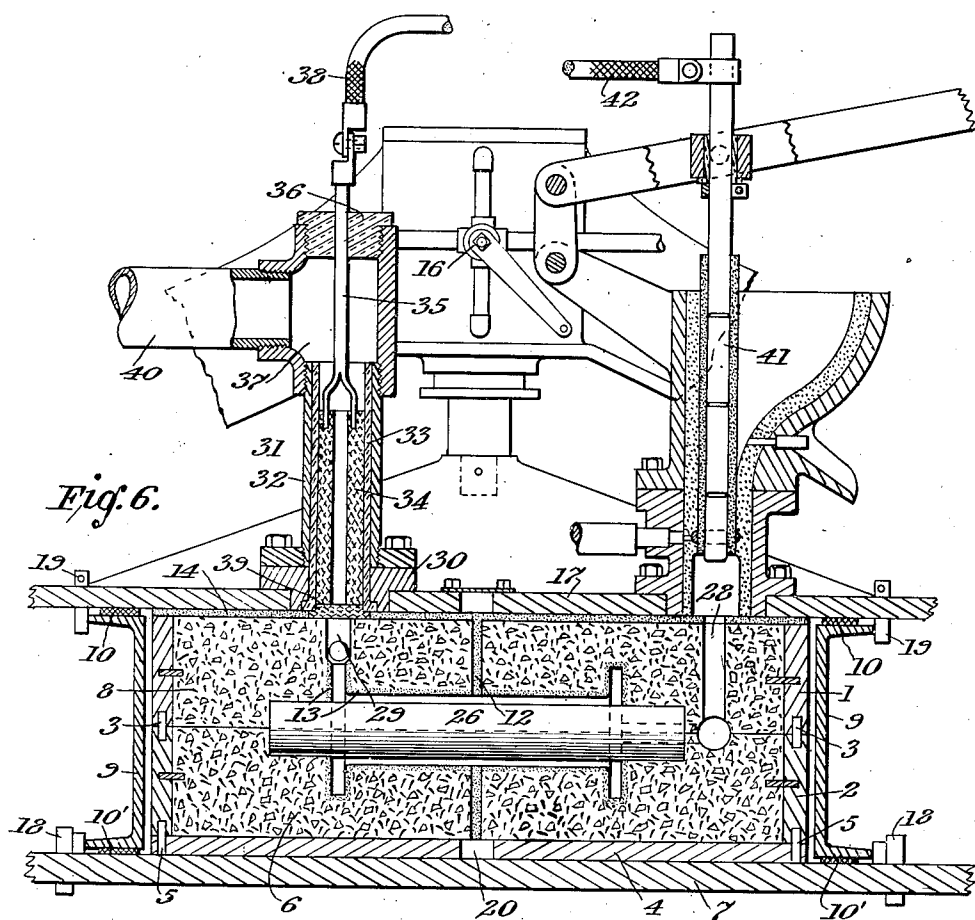
S. LAKE

1,531,445

MAKING METAL CASTINGS

Filed Jan. 13, 1920

3 Sheets-Sheet 3



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Patented Mar. 31, 1925.

1,531,445

UNITED STATES PATENT OFFICE.

SIMON LAKE, OF MILFORD, CONNECTICUT.

MAKING METAL CASTINGS.

Application filed January 13, 1920. Serial No. 351,097.

To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Milford, in the county of New Haven and State of Connecticut, have invented a certain new and useful Improvement in Making Metal Castings, of which the following is a full, clear, and exact description.

This invention relates to the art of making metal castings, and is in the nature of an improvement on the invention set forth in my Patent No. 1,272,062, dated July 9, 1918, for apparatus for making metal castings.

One object of the invention is to facilitate the casting of metals such, for example, as steel and aluminum which are subject to a marked degree to shrinkage when cooling, to the end that breaking of the casting is avoided.

Another object of the invention is to prevent uneven cooling or chilling of the casting in the mold, thus tending to produce a casting the metal of which is of a uniform texture throughout.

Still another object is to make possible case-hardening or annealing or other heat-treating of the casting while still in the mold, thus combining the operations of casting and heat-treating in a single apparatus.

A further object of the invention is to produce castings in such a manner as to reduce cooling shrinkage to a minimum, eliminate blow holes, and increase the tensile strength of the metal of the casting.

A still further object is the production of a flask the cope and drag of which are so held in proper relation to each other as to obviate the necessity for the usual attaching devices, the means for effecting this also providing for hermetically sealing the flask.

Other objects and advantages will appear as the description of the invention proceeds.

The invention consists in a method of and apparatus for producing metal castings in which the metal is cast under heat and pressure in a mold formed in sections to provide for shrinkage during cooling of the casting, and provided with means for heating it, to the end that a casting of uniform density and texture throughout may be obtained, all as I will proceed now to explain and finally claim.

In the accompanying drawings illustrating the invention, in the several figures of

which like parts are similarly designated, Figure 1 is a sectional elevation, taken in the plane of line 1—1 of Fig. 2. Fig. 2 is a plan view showing the flask and enclosing member. Fig. 3 is a transverse longitudinal sectional elevation, showing in plan the drag of the flask with a core in place, on a larger scale. Fig. 4 is an enlarged vertical longitudinal sectional view of the flask and associated parts. Fig. 5 is a section taken in the plane of line 5—5, Fig. 3, omitting the enclosing member. Fig. 6 shows a modified form of apparatus.

The apparatus shown in Figs. 1 to 5 comprises a flask composed of a cope 1 and drag 2, suitable dowels 3 being provided to hold these parts in proper relation. The drag 2 has a bottom 4 also held in position by dowels 5. In use the drag, containing its half 6 of the mold, is placed upon the base 7 of a hydraulic or other suitable press, and the cope 1 with its half 8 of the mold is properly positioned upon it by means of the dowels 3. The flask is then enclosed as to its sides and ends by means of a frame or casing 9 here shown as composed of channel members, and this frame is provided at top and bottom with compressible strips or gaskets 10 and 10' of rubber or other suitable material as shown.

The mold which I have devised, for the purpose of preventing fracture of the casting during cooling, and split laterally into halves 6 and 8, is formed of some permanent material such as cement combined with broken fire-brick, whereby a mold of the requisite porosity and strength to stand up through successive casting operations is provided, and this mold is also formed in sections as clearly shown in Fig. 2, with spaces 11 left between them whereby when the casting contracts while cooling the sections may be capable of relative movement to accommodate this contraction or shrinkage. Although I have shown the mold as divided into sections laterally only and in only two places, it is obvious that it might be parted in as many planes and at as many points as the nature and shape of the casting to be formed would require.

When the mold is being set up the spaces 11 are filled with fine sand 12 while the pattern is in place and when the pattern is removed, the interior of the mold may be painted or otherwise covered with a coating 13 of graphite, bone black, potash, lime or

the like, or other coatings which under sustained heat will act upon the metal of the casting to anneal or harden it as desired. This coating 13 will also help to maintain the sand in the openings 11 in position.

After the flask is positioned upon the base of the press as described, a layer 14 of fine sand is sprinkled over its upper face and then the piston 15 of the press is operated in the usual manner, as by the four-way valve 16 to lower the head 17 over the flask and into contact with the packing strip or gasket 10 and sufficient pressure may be applied to compress this strip 10 and consequently also the strip 10' and the layer of sand 14 to thereby hermetically seal the flask and its mold within the frame 9 and the base 7 and head 17 of the press, and by compressing the layer of sand, the mold is effectively protected against fracture and its halves against separation when pressure is applied to its interior as will be later described. Keys 18 and wedges 19 are used to hold the frame 9 in proper relation to the base and head of the press, and in addition to this method of mounting the flask in the press furnishing a hermetic seal it does away with the multiplicity of fastening devices commonly used to hold the cope and drag together.

The bottom plate 4 of the drag is provided with holes 20 in line with the openings 11 so that when the flask is removed from the press, the sand may run out of the openings 11 and thus admit of the sections of the mold having relative movement to accommodate the shrinkage of the casting.

Each half of the mold is provided with wires 21 electrically connected at their ends with bars 22 provided with dowels 23 which in addition to acting as alining means for the mold halves, act as electrical conductors between the two.

To the bar 22 at one end of the mold is connected a cable 24 running to one terminal of a source of electrical energy, and to the bar 22 at the other end of the mold is connected another cable 25 running to the opposite terminal of the source of electrical energy, so that when current is turned on, the wires 21 through their connection with the bars 22, will be energized and the resistance set up in them will heat the mold.

If the mold is of a character that requires coring, as that shown in the drawings, the core 26 also may be provided with heating wires 27 so arranged that the core may be removed from the mold without destroying the electrical equipment thereof.

The head of the press is provided with openings 28 and 29 having bolt flanges 30, and these openings provide pouring and exhausting communication respectively with the interior of the mold, and the flanges 30 are adapted to receive the pouring and pres-

sure-applying mechanism, and the exhausting mechanism, shown and described in my patent above mentioned, or they may receive the modified forms of these devices shown in Fig. 6 and hereinafter explained.

It will of course be understood that a number of flasks may be mounted in the same press for pouring at the same time, but for convenience of illustration, and in the interest of clearness, only one is so shown in the drawings.

Assuming that the flask with its mold has been mounted and hermetically sealed, as described, and that the electrical connections have been made, and the exhausting and pouring and pressure-applying mechanisms are in place, the operation of forming a casting by my method is substantially as follows: The electric current is turned on and the mold and core are heated to a high temperature, then the exhausting apparatus is operated to exhaust all air from the mold cavity and to thereby produce a vacuum therein. At the same time the heat will have thoroughly dried the mold so that no moisture will be present to create vapor when the molten metal is introduced. The mold being dry and under a vacuum, the molten metal will be run in and pressure applied. The mold being highly heated there will be no cooling or chilling of the metal as it enters, and its flow will be free as distinguished from the sluggish flow common when casting by ordinary means. Moreover, this heating keeps the metal at a high temperature until the applied pressure forces into the mold cavity all the metal that it will contain, and densifies this metal, thus homogenizing its texture, eliminating blow-holes, and increasing its tensile strength, so that there is no hard outer crust on the casting where it comes in contact with the mold, and no inner soft spongy core, as is now the fault in so many castings, but the whole casting is of the same texture throughout.

As above stated, it is also possible with my heated mold, to heat treat the casting in the mold, to harden, anneal or otherwise affect it, depending upon the composition of the dope or paint of the coating 13 with which the interior of the mold may be provided.

When the casting operation is completed the electric current is cut off and the press head raised, whereupon the flask with its mold may be transferred to a cooling place. As before described, the sand in the openings 11 will run out and allow the sections of the mold to move relatively as the casting shrinks.

The great shrinkage of castings of steel and aluminum and other hard metals, is due to their very porous nature which is probably caused by the great heat at which they

must be poured and the consequent great reduction in heat and volume as they cool, but with my apparatus, the use of pressure in filling the mold so densifies the metal of the casting as to reduce the chance for shrinkage to a minimum.

In Fig. 6 I have shown a modification of my invention, in which the metal of the casting itself is used to conduct the electric current and is thereby consequently heated, thus obviating the necessity for the heating wires in the mold, although the latter is my preferred form of apparatus.

In this modified form I show an exhausting mechanism 31 bolted to the flange 30 of the opening 29, and comprising a tube 32 lined with a refractory non-conducting substance as at 33. In this tube is a hollow electrode 34, preferably of carbon, provided with a post 35 extending through a sealing plug 36 in a T 37, and to this post is connected an electrical conductor 38. The electrode 34 is slidable in the tube 32 and can be moved toward and away from a disk 39 of porous conducting material such as carbon capable of allowing air to be sucked through it by a suitable pump piped to the T 37 as at 40 but impervious so far as the molten metal in the mold is concerned.

The other terminal of the electric circuit is connected to the plug 41 by means of a conductor 42.

It will thus be seen that current can be passed through the molten metal trapped in the mold cavity by the disk 39 and plug 41, by means of the plug 41 and electrode 34.

It is to be understood that I do not consider my invention as limited to the exact details of construction and arrangement here shown, nor to the precise mode of carrying out the method of casting therewith, as various changes may be made without departing from the spirit of the invention or the scope of the claims following.

What I claim is:—

1. In an apparatus for making metal castings, a flask, a mold within said flask, a frame adapted to surround said flask and provided with sealing means adapted to be compressed to form a seal around said mold, means for creating a vacuum within said mold, and means embedded in said mold for heating it.

2. In an apparatus for making metal cast-

ings, a flask, a mold formed of a hard, porous material capable of resisting pressure, independent means for hermetically sealing said mold within its flask, means for producing a vacuum within said mold, means for introducing molten metal into said mold and for applying pressure thereto, and means embedded in said mold for heating it.

3. In an apparatus for making metal castings, a flask, a mold within said flask and composed of a permanent mold material, means surrounding said mold and flask and adapted to hermetically seal the mold, heating means in said mold, means for exhausting air and gases from said mold, and metal-introducing and pressure-applying devices connected with the mold.

4. In an apparatus for castings, a flask, a mold formed in sections and adapted to be arranged in said flask with its sections spaced apart, the spaces between said sections being filled with a pulverulent material, for the purpose specified.

5. In an apparatus for making castings, a mold formed in sections, said sections adapted to be spaced apart and the spaces filled with pulverulent material during the casting operation, and means for allowing the pulverulent material to run out of said spaces whereby the spaces may be open during the cooling of the casting.

6. In an apparatus for making metal castings, a flask having a cope and a drag, means for holding the same in alinement, a sectional mold in said flask, spaces between the sections of said mold, a bottom to said drag, filling material in said spaces, a covering of pulverulent material on the top of said mold, means for applying pressure to hermetically seal said mold within a sealing means and for compressing said covering to maintain said mold in pressure-resisting condition during the casting operation, and means in said bottom for permitting the escape of said filling material during the cooling of the casting.

In testimony whereof I have hereunto set my hand this 12th day of January, A. D. 1920.

SIMON LAKE.

Witnesses:

L. B. McLAUGHLIN,
ROBERT M. KEYS.