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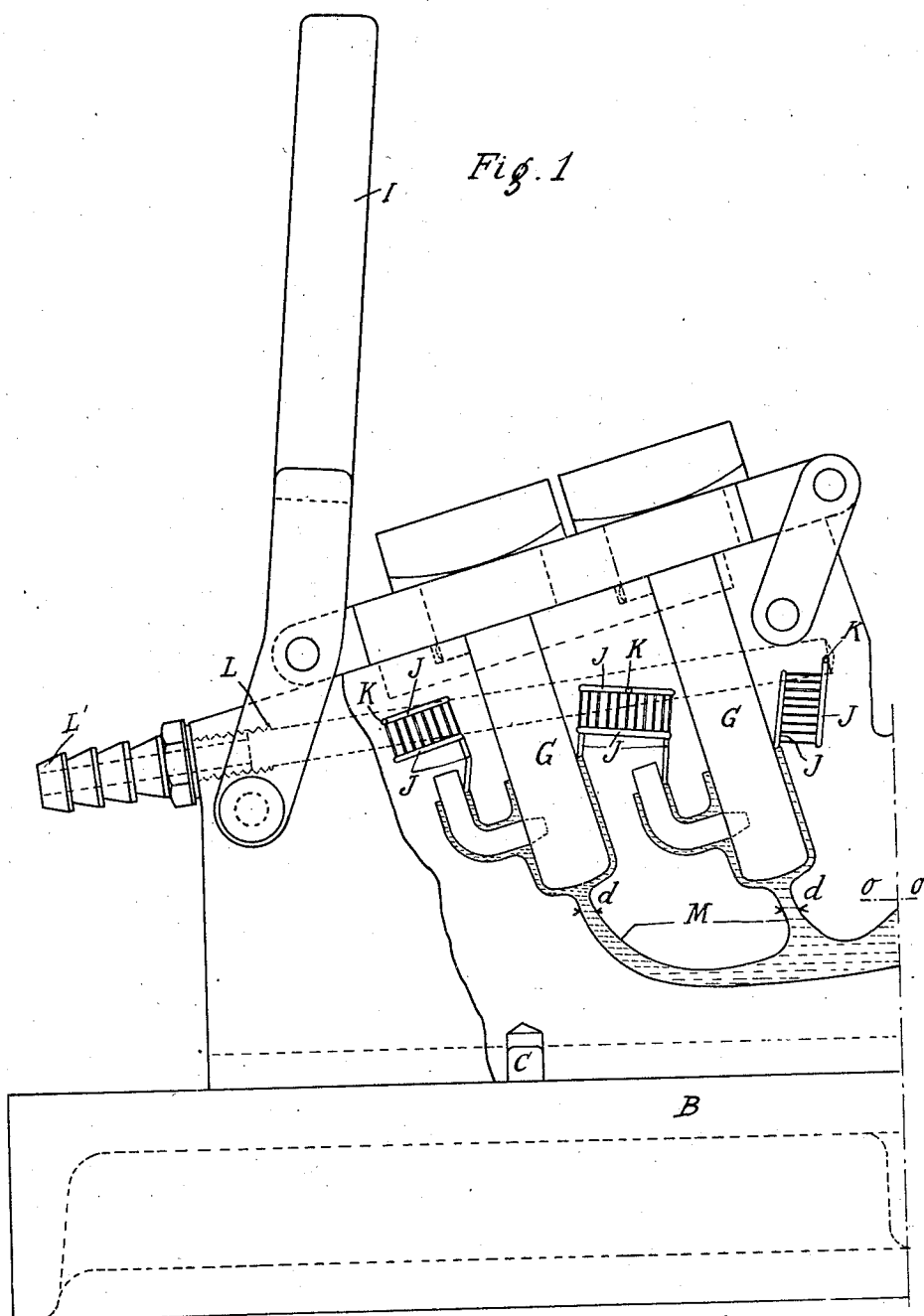
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E. BRUMM

APPARATUS FOR THE CASTING OF MELTED METALS UNDER PRESSURE

Filed Oct. 10, 1924

5 Sheets-Sheet 1



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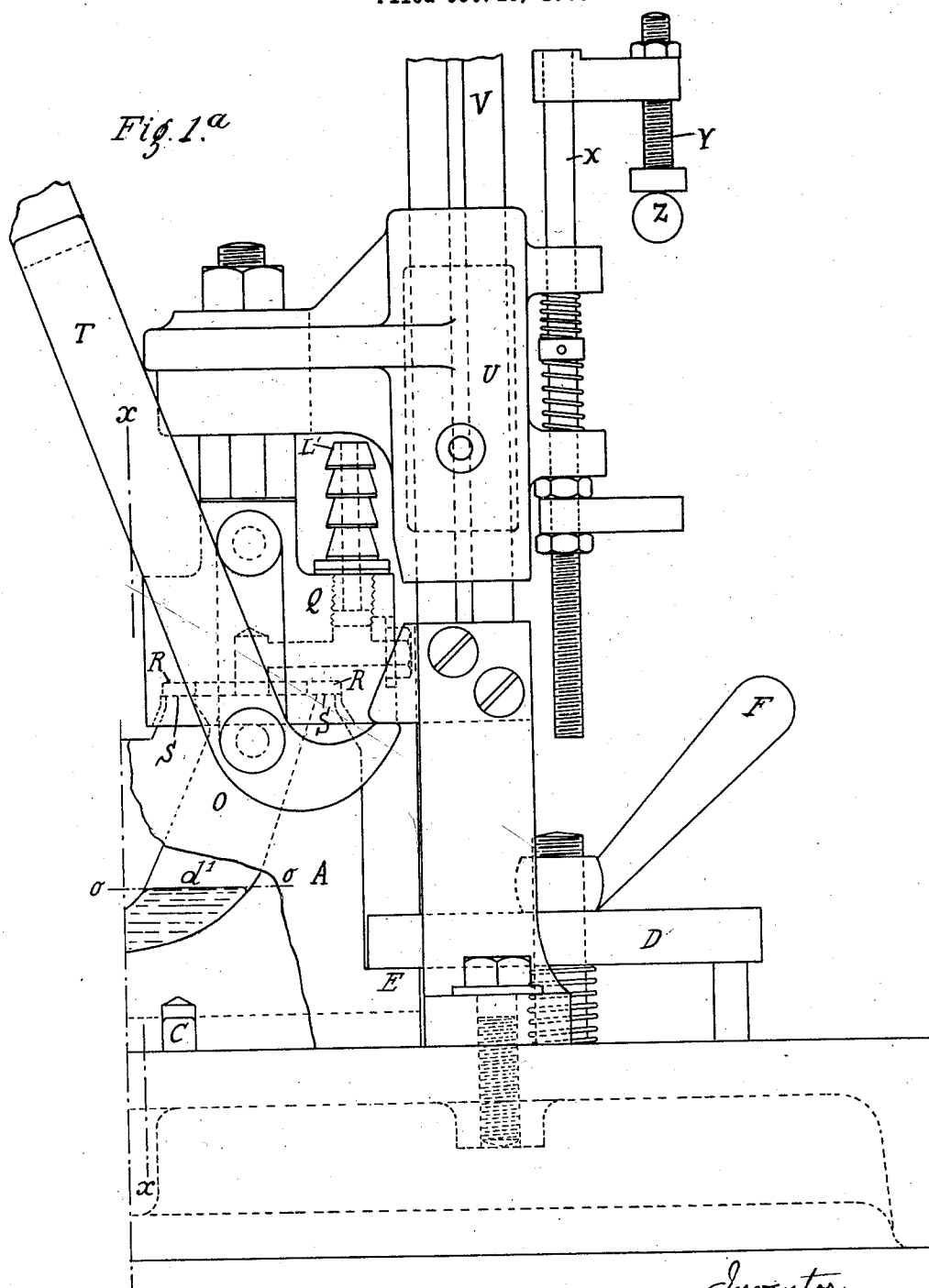
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Filed Oct. 10, 1924

5 Sheets-Sheet 2



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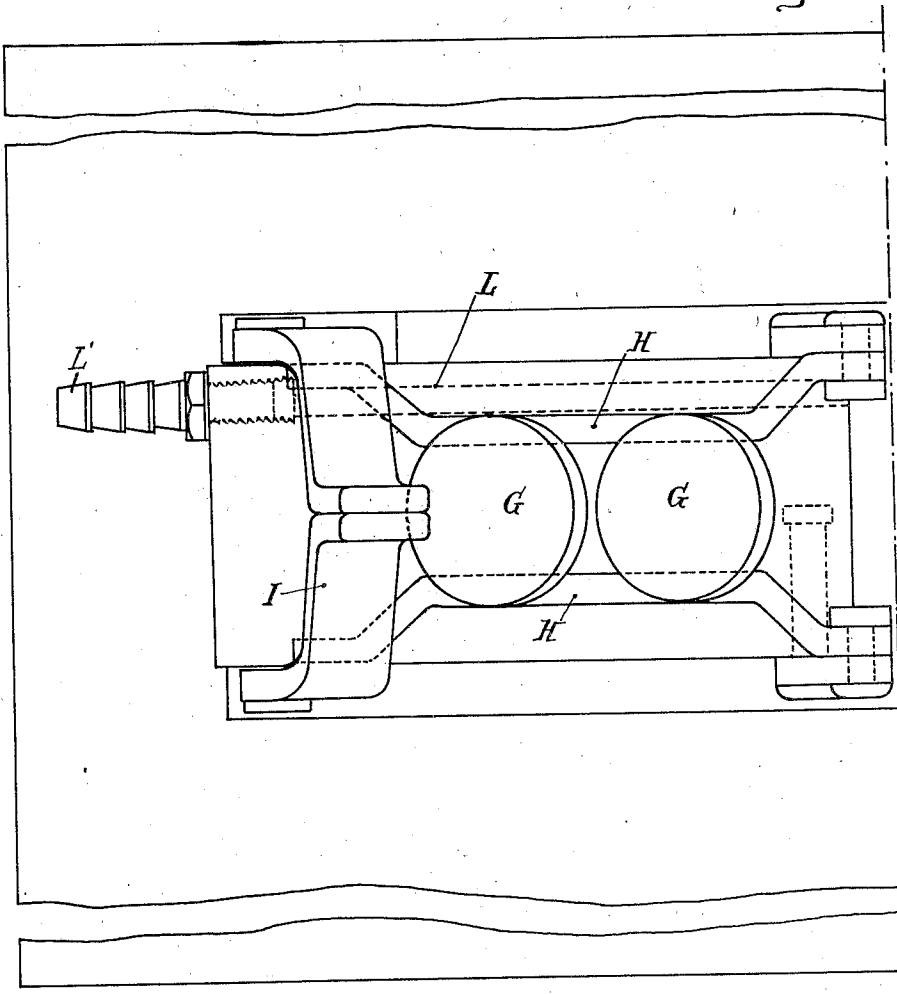
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Fig. 2.



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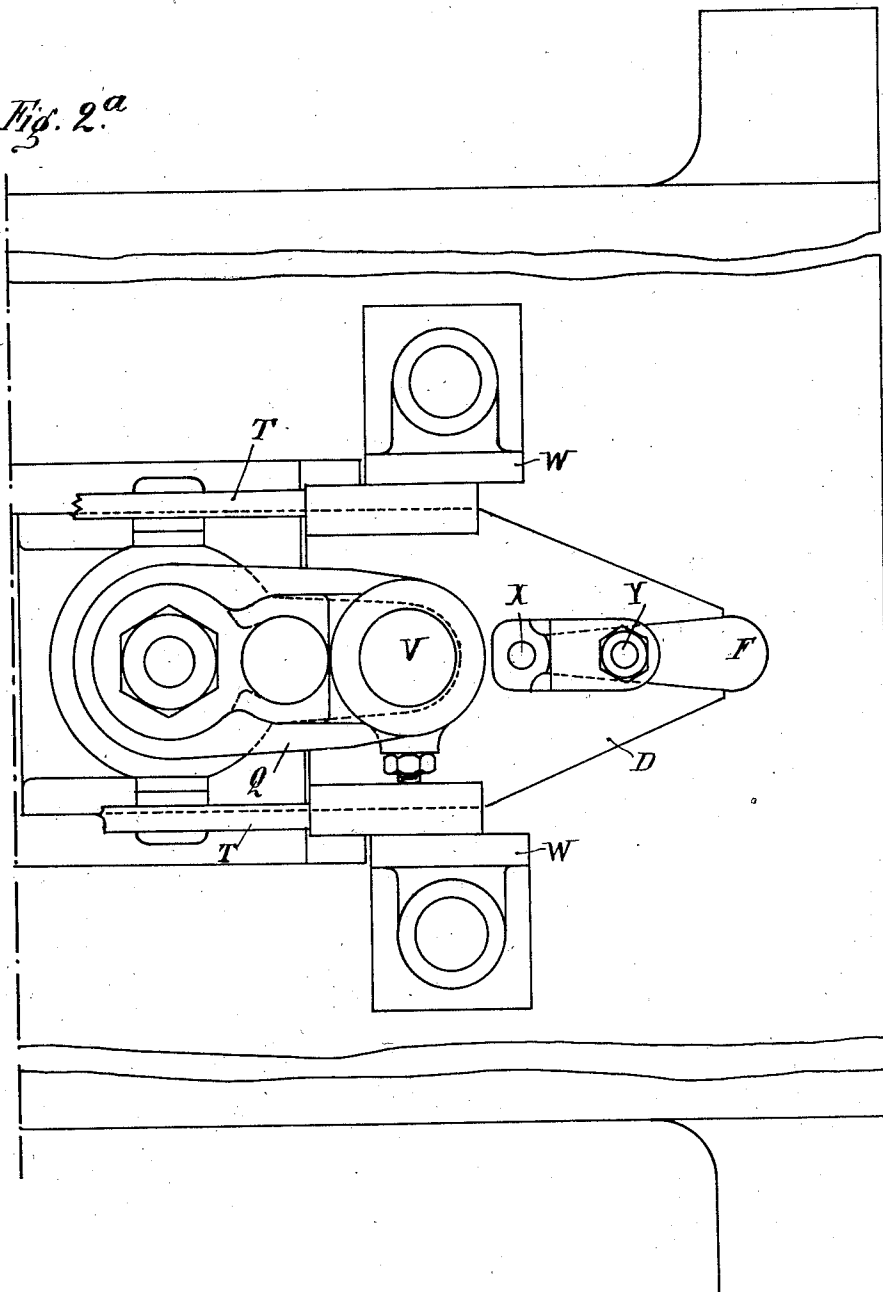
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Fig. 2^a



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May 8, 1928.

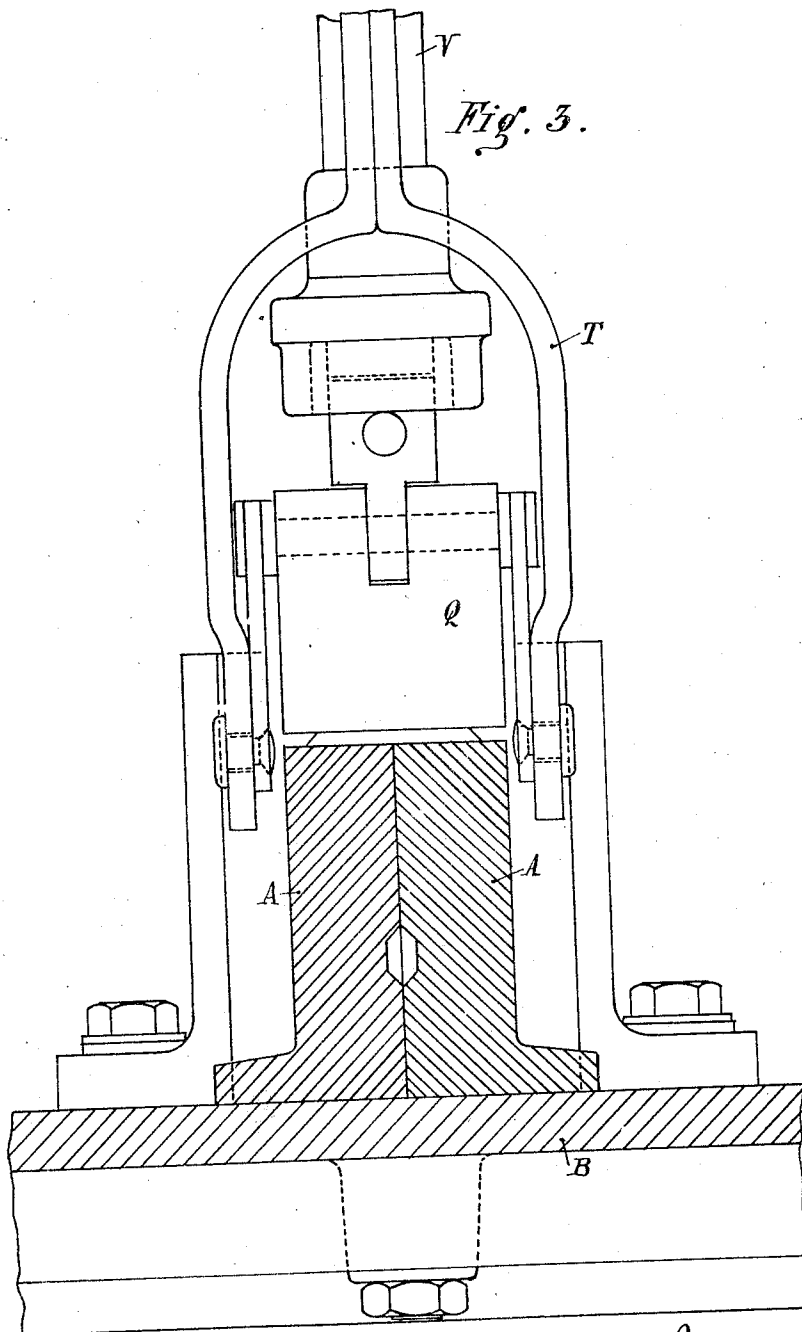
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APPARATUS FOR THE CASTING OF MELTED METALS UNDER PRESSURE

Filed Oct. 10, 1924

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE CASTING OF MELTED METALS UNDER PRESSURE.

Application filed October 10, 1924, Serial No. 742,843, and in France May 1, 1924.

The present invention relates to a casting device whereby metals in fusion can be cast in moulds of special composition, either metallic or variously constructed, in such manner that the metal is placed in a mould from which the air has been preliminarily exhausted, the hollow portions of the said mould being exactly filled with the metal so as to produce the desired castings, and that before the casting has become entirely solidified, the metal may be subjected to a suitable compression by means of a compressed gas, the latter being preferably neutral in order to obviate as far as possible the oxidation of the metal during the casting operation and to impart the maximum homogeneity to the metal.

The following description, with reference to the appended drawings, sets forth an embodiment of the invention.

Figs. 1 and 1^a are elevational views, with certain parts in section, of the casting device according to the invention, and Figs. 2 and 2^a are corresponding plan views. Fig. 3 is a section on the line X—X of Fig. 1^a.

The apparatus comprises a mould A consisting of two parts; each of the symmetrical parts of the mould comprises the reliefs corresponding to the shape of the objects to be cast; the same mould may comprise a plurality of reliefs of a given object or of different objects.

The two halves A of the said mould are well matched at the joints and are adjusted with great care in order to secure the maximum fluid tightness and to enable the production of a certain vacuum as well as the elimination of all leakage of the melted metal at the joints.

In order to provide for the accurate matching of the constituent parts of the mould, the lower surface of the said parts is made perfectly plane and is placed in contact with a well-surfaced plate B provided with a plurality of studs C, the various portions of the mould being thus centered on the middle plane; these latter portions comprise at the front part a projection E co-operating with the pressure plate D, the same being maintained by means of a

quick-acting handle F by which the said parts are pressed together. Suitable clamping straps, not shown, are disposed upon the several parts of the mould whereby the latter are pressed together in an efficient manner.

In order to obtain portions in hollow relief in the cast pieces, the apparatus comprises the cores G co-operating with suitable recesses which are formed in each part of the said mould; the said cores are supported by an extracting element H in such manner that when the cast piece has become solid, all the cores may be removed from the mould at the same time by simply operating the lever I.

Upon the middle face of the joint of one of the members constituting the mould A is provided a series of ducts J which communicate with the upper parts of the relief portions representing the casting; said ducts have a very small cross section, of about 0.1 mm.; and the series of ducts communicates with the apertures K which in turn communicate with an atmospheric outlet conduit which is shown in dotted lines at L, the latter having a connection L' which is connected to a vacuum pump and which—by means of a supply device operated at the proper time—permits of producing a vacuum in the said mould as soon as the metal begins to flow therein.

For the casting operation, one utilizes suitable filling ladles in order to employ only the exact amount of metal to completely fill the reliefs corresponding to the casting, as well as the supply conduits M and also a portion of the supply conduit O formed in the mould, as far as the level o o.

The orifice of the supply conduit M employed for the casting operation has a small diameter which is suitably calculated with reference to the large diameter of the main supply conduit O.

The upper part of the conduit O comprises a seating S co-operating with a member forming a fluidtight joint together with the packing R which consists of a semi-refractory substance (asbestos or the like), the same being controlled by the lever T which

effects the vertical motion of the slide U movable upon a vertical rod V which is slotted in order to hold the said slide against rotation when on the ascent or descent.

5 The lever T is pivoted to a horizontal axis secured to the device Q, so that when the said lever attains the lower end of the stroke and the packing member R is brought upon the seating S of the mould, a projection
10 upon the lever T will be engaged below the toe of a member W which is secured to the base B; by a continued effort upon the said lever, the device Q is caused to bear in a fluidtight manner upon the seating S of the
15 mould A.

In these conditions, the device Q comprises internal conduits which are connected by flexible hose with a conduit for the supply of a compressed neutral gas. The slide
20 U is provided with a spring-mounted device X which at the end of the stroke is caused to bear, by an adjustable arm Y, upon the handle Z of a supply device which opens the conduit of the said compressed
25 gas.

The said arrangement provides for the casting of metal objects under pressure and in a neutral atmosphere, the operation being performed as follows:

30 The metal is rapidly poured into the orifice of the conduit O (the device U being removed) and as soon as the metal begins to fill the bottom of the conduit O, the operator opens the vacuum supply pipe, and
35 under the sole action of the atmospheric pressure and of the vacuum in the mould, the melted metal will fill up the relief parts of the mould in a satisfactory manner. After this operation is performed, one instantly lowers the slide U which as soon as
40 it is applied upon the seating S will provide for the admission of the compressed gas upon the surface of the still liquid metal occupying the lower part of the conduit O.

45 But inasmuch as these several operations are performed within a very short time, the metal already begins to solidify in the mould, but in the first place upon the outer portions of the latter; at the same time,
50 under the effect of the vacuum, the metal fills, to a greater or less extent, the set of small ducts J, and in virtue of the extremely small section of the said ducts, the metal is at once solidified, thus closing the outlet
55 of the vacuum and preventing all discharge of the metal from this portion of the mould.

The metal also becomes solidified, as above stated, upon the outer surface of the supply conduits M of each object to be obtained,
60 so that during the first period of the casting which is of a very short duration, there will be formed an outer shell representing the surface portion of the cast object and of the supply ducts M.

65 At this time the pressure of the neutral

gas is applied upon the surface of the metal which has remained in the liquid state at the lower part of the conduit O by reason of the considerable mass of metal therein.

In virtue of the differential nature of the
70 cross sections of the conduits M (sections d) and the cross section of the lower part of the conduit O (section d^1) there will be produced at this time an effect comparable to what takes place in a hydraulic press, thus
75 producing within the already solidified metal shell in the conduits and the mould, a pressure which is amplified with respect to the pressure of said neutral gas at the inlet O, in the inverse ratio to the cross sections
80 d and d^1 . So that the said pressure will be transmitted in a uniform manner, since the transmitting element is a liquid mass (melted metal) and it forces the still malleable metal shell of the solidified metal into
85 exact contact with the walls of the mould, by this action which resembles that of forging.

The solidification of the supply ducts and of the small feeding head in the conduit O
90 will rapidly follow the solidification which produced the said shell. At this moment, the slide U is raised at the same time that the cores G are removed from the mould by
95 means of the device H.

By operating the handle F the mould is disengaged from the pressure plate D, and the two portions of the mould can be separated after releasing the devices employed
100 for clamping the joints, should such be provided. After the various parts of the mould have been opened, the castings may be removed, and the operations are recommenced.

Obviously, the said mould may be made of any suitable metal or other substance capable
105 of withstanding the temperature of the metal employed.

What I claim is:

1. A casting machine of the type described, comprising a separable metallic
110 mold, a plurality of cores projecting into said mold, means to remove said cores simultaneously from said mold, a vacuum pipe, a plurality of ducts connecting said vacuum pipe with the interior of said mold, a gas
115 inlet pipe for said mold and means for supplying said inlet pipe with an inert gas under pressure.

2. A casting machine of the type described, comprising a separable metallic
120 mold, a plurality of cores projecting into said mold, means to remove said cores simultaneously from said mold, a vacuum pipe, a plurality of ducts connecting said vacuum pipe with the interior of said mold, a gas
125 inlet pipe for said mold, means for supplying said inlet pipe with an inert gas under pressure and means including a slidable element for closing the inlet to said mold.

3. A casting machine of the type de- 130

scribed, comprising a separable metallic mold having a molding cavity, ducts connected to said cavity to rapidly freeze metal entering them and close the ducts, means to exhaust the ducts and therethrough the cavity and means to apply auxiliary gas pressure to the casting metal after the ducts have been closed by the entrance and freezing of the metal therein.

In testimony that I claim the foregoing as my invention, I have signed my name hereto. 10

EMILE BRUMM.