Dec. 14, 1948. T. C. KUHLMAN 2,456,067

CENTRIFUGAL CASTING MACHINE

Filed Aug. 23, 1943 2 Sheets-Sheet 1

Fig. 1.

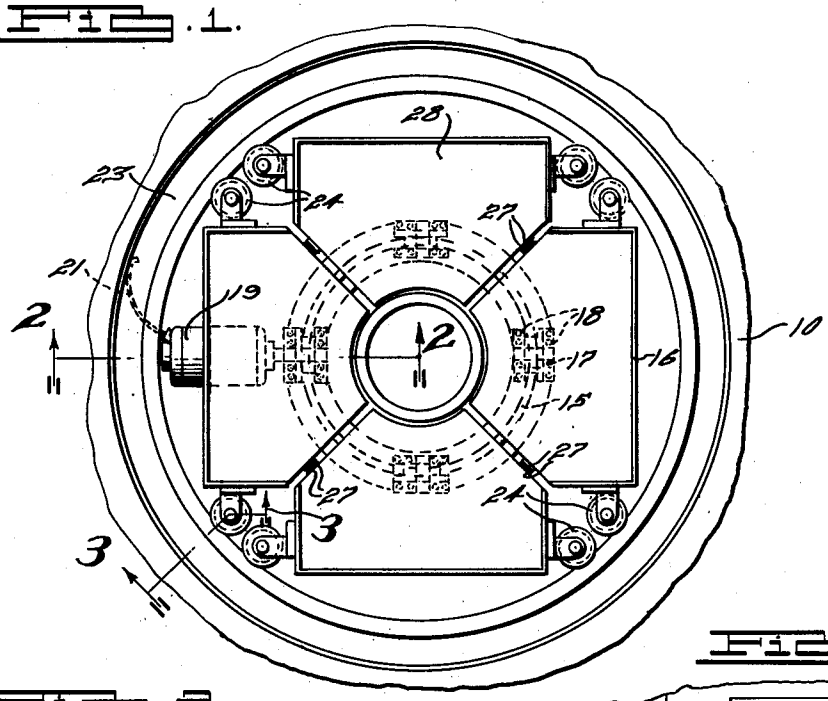


Fig. 3.

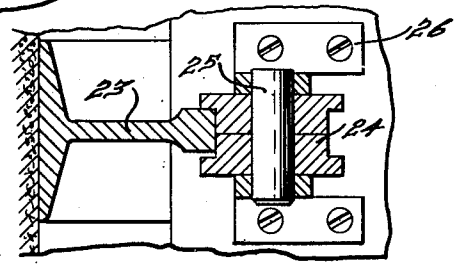
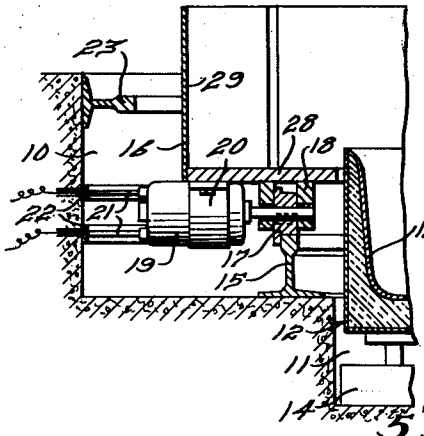


Fig. 2.



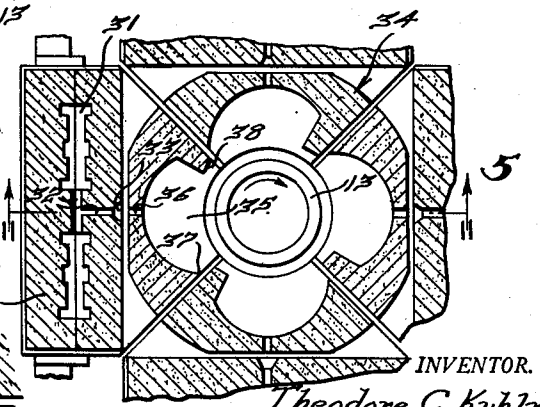


Fig. 4.

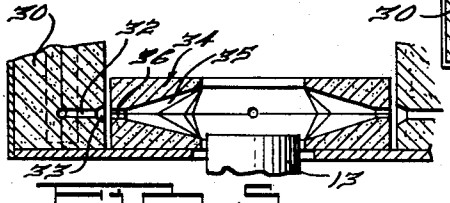


Fig. 5.

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FIG. 6.

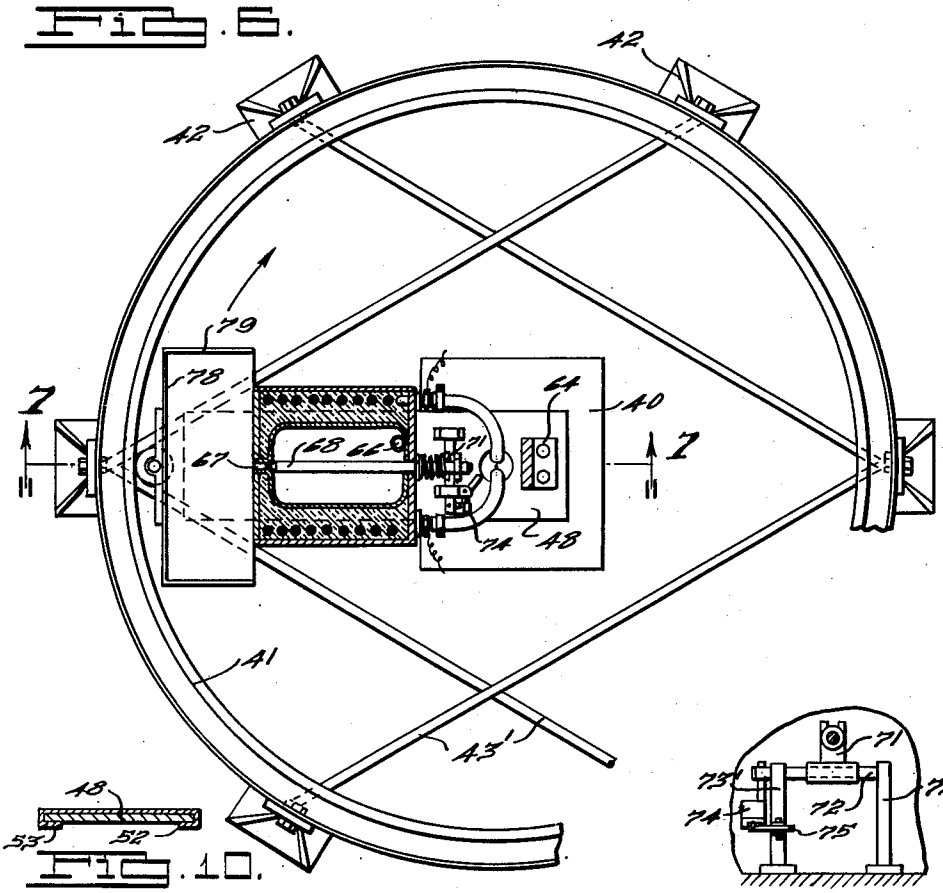


FIG. 10.

FIG. 9.

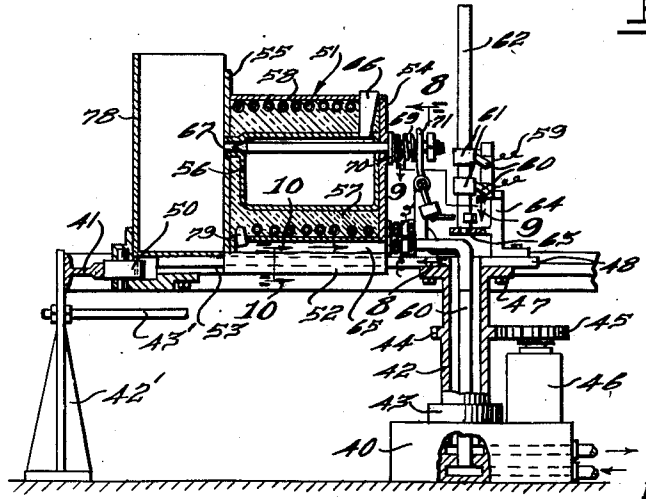


FIG. 7.

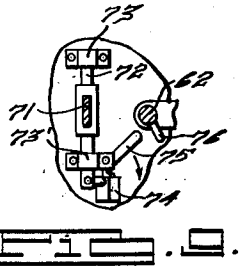


FIG. 8.

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Patented Dec. 14, 1948

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2,456,067

CENTRIFUGAL CASTING MACHINE

Theodore C. Kuhlman, Detroit, Mich.

Application August 23, 1943, Serial No. 499,619

2 Claims. (Cl. 22—65)

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This invention relates to machines for centrifugally casting metallic articles.

Difficulty has been experienced with centrifugal casting machines because of the necessity for maintaining the machine in balance. This difficulty has been especially pronounced in cases where the casting of relatively heavy parts was attempted. Although it is relatively easy to obtain balance in the machine when the molds are empty; as soon as the metal begins to flow, an unbalance is instantly set up. Because of this, centrifugal casting has been limited to the production of single pieces in a mold arranged concentrically about the axis of rotation, and where two or more molds have been used they have been identical and symmetrically arranged about said axis. Castings weighing from 500 to 1,000 pounds have not been produced centrifugally because of these limitations.

The principal object of my invention is to provide a machine for centrifugal casting which is free from the aforesaid difficulties and which is suitable for the production of heavy parts.

Another object is to provide a machine for making various castings at one time without regard for symmetrical spacing or counterbalancing. I accomplish this by having a track arranged peripherally about the machine such that it bears the radial load. Further, the platform on which the molds are carried is divided into sections which are not necessarily connected to the center shaft.

Other objects and advantages of the invention will become apparent from the following description.

In the drawings,

Fig. 1 is a plan view of the casting machine.

Fig. 2 is a sectional view along the line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail section taken along the line 3—3 of Fig. 1.

Fig. 4 is a partial plan view of the Fig. 1 apparatus with the sprue ring and molds in place.

Fig. 5 is a section along the line 5—5 of Fig. 4.

Fig. 6 is a plan view of a modified form of machine, parts being broken away to show sectional details thereof.

Fig. 7 is a partial elevation of the Fig. 6 structure.

Fig. 8 is an enlarged detail of the latch mechanism as indicated by the arrows 8—8 in Fig. 7, and

Fig. 9 is a similar view as indicated by the arrows 9—9 in Fig. 7 and

Fig. 10 is a section along line 10—10 of Fig. 7.

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Referring now to Fig. 1 and its associated figures, it will be seen that my improved centrifugal casting apparatus is mounted in a pit 10, preferably of concrete. This pit is of circular shape and has a circular depressed portion 11 at the center in which is disposed a crucible assembly 12.

The crucible assembly comprises a crucible 13 which is rotatably mounted on a base 14. The base 14 contains suitable driving means (not shown), such as an electric motor and gear box, for rotating the crucible about its central vertical axis at varying speeds. My copending application, Serial No. 493,495, filed July 5, 1943, now matured into Patent No. 2,450,832, dated October 5, 1948, shows in detail a crucible assembly which may be used with the apparatus being described if desired.

Surrounding the crucible assembly is an annular rail 15 which is adapted to support a number (in this case four) of sector shaped cars 16. These cars 16 comprise the casting platform which carries the mold flasks and sprue ring.

Each of the cars is provided with a rotatable flanged wheel 17 which bears on the rail 15. This wheel is mounted in a bracket 18 as illustrated. All of the wheels 17 may be driven, but in most installations satisfactory performance is obtained by driving one wheel only and such an arrangement is simple and economical. In the illustrated embodiment of the invention, one of the wheels 17 is directly connected to an electric motor 19 which is fastened to the corresponding car 16 by means of a bracket 20. The motor 19 is supplied with current through a pair of brushes 21 which engage slip ring contractors 22 mounted in the peripheral wall of the pit 10.

The cars 16 are further supported by an annular peripherally mounted rail 23 which also receives the horizontal thrust of the cars during rotation thereof. Double flanged wheels 24 (see Fig. 3) are carried by each of the cars, these wheels being mounted one at each side of the cars on axles 25. The axles are journaled in brackets 26 as shown.

It will be clear from the drawing that the wheels 24 in engagement with rail 23 together with the wheel 17 which rests on rail 15 provide a firm support for each of the cars. The latter are permitted individual movement during their travel about the central axis of the crucible, rubbing blocks 27 being provided to transmit driving thrust without transmitting twisting movement or vibration between cars.

Each of the cars 16 has a bottom floor 28 of relatively heavy section and walls 29 of lighter section. The latter extend along the back of each car part way along each side as shown and are adapted to retain in place the mold of the part or parts to be cast. This mold may be of sand, plaster, or other suitable material. In Fig. 4 a sand mold 30 is shown in place on each of the cars. The mold has a pattern cavity 31 with runners 32 leading therefrom to a pouring mouth 33.

The molten metal is conducted from the crucible 13 to the pouring mouths 33 of the molds by means of a sprue ring 34. This ring consists of four segmental sections respectively carried by the four cars and is of suitable refractory material. Each section is formed with a cavity 35 which has a passage 36 connecting the cavity with the mouth 33 of the mold. The direction of rotation of the crucible and of the platform is clockwise as indicated by the arrow on Fig. 4 and each of the cavities 35 of the segmental section of the sprue ring is formed with a relatively high leading edge 37 and a relatively low trailing edge 38. This arrangement of edges is important in that it prevents the molten metal from flying out through the spaces between the sprue ring sections. The metal which hits the higher edge portions 38 will, because of its tangential velocity flow into the next cavity at the lower edge portion thereof.

In operation the crucible 13 contains the metal to be cast. This metal may be melted in the crucible or it may be melted somewhere else and transferred to the crucible in molten state. When a cast is desired to be made, the molds and sprue ring are placed on the machine, the crucible is charged and the cars 16 are started to revolve in clockwise direction. After the speed of the platform has reached a satisfactory value, the crucible is started and the speed of the crucible increased to cause the molten metal to be discharged therefrom. The speed of each is determined by the size and shape of the articles to be cast and by the characteristics of the alloy being cast. The speed of the crucible is usually higher than the speed of the platform (in revolutions per minute).

The speed at which the crucible will discharge is a critical one and depends on the shape of the crucible, the weight of metal, etc., but when this speed is reached the metal flows rapidly and smoothly over the lips of the crucible (which is raised above the platform floor as shown in Fig. 2) and into the cavities 35 thence through the passages 36 and 32 into the mold cavities.

If desired, the mold may be preheated before the cast is made.

Figs. 6 to 9 inc. illustrate a modification of my invention which differs from that just described in several respects, chiefly in that the crucible itself revolves with the mold platform.

The apparatus of Figs. 6–9 may be mounted in a concrete pit if desired, but as illustrated a main central support 40 is provided and the horizontal thrust is taken by a circular rail 41 which is supported on uprights 42' suitably tied together by rods 43'.

The central support 40 mounts a vertical hollow shaft 42 in a thrust bearing 43. The shaft 42 is of heavy construction and carries gear teeth 44 which are in mesh with a pinion 45, the latter being mounted on the driving shaft of an electric motor 46.

Bolted at 47 to the top flange of the shaft 42 is a platform 48 on which the crucible assembly and mold flask assembly are adapted to slide by means of the gibs 52, 53. At the outer end of the mold flask assembly, a wheel 50 is journaled for rotation about a vertical axis. This wheel engages the track rail 41 and thus transmits the radial thrust to the rail.

The crucible assembly 51 is mounted on the platform 48 by means of the gibs 52, 53. The assembly has end walls 54, 55, between which is mounted a lining 56 of refractory material or of graphite compound depending upon the character of the metal to be melted. The lining is surrounded by insulating material 57 in which is embedded a water cooled induction coil 58. The latter is electrically connected to a transformer by any suitable means such as wires 59 and contacts 60, the latter being adapted to slide on the rings 61 which may be connected to the source by wires carried in the conduit 62. The latter is bearinged at 63 in a bracket 64 carried on the revolvable platform.

The crucible has a water cooled base 65 which prevents overheating of the platform, the coil 58 being connected therewith as indicated at 79. Water connections 66 are centered in the shaft 42 and turn with the assembly, suitable water tight connections of any desired design being provided at the bottom of base 48.

The crucible has a charging spout 66 and a discharge mouth 67. The latter is closed when the apparatus is stationary by a rod 68. The latter is preferably made of refractory material and has a conical end portion adapted to fit and close off the mouth 67. A spring 69 carried by the rod bears against a shoulder 70 and a lever 71. The lever 71 (Figs. 8 and 9) is rigidly carried on a rod 72 journaled in the uprights 73, 73', which are in turn carried by the platform.

On one end of the rod 72 a weight 74 is carried as shown in Fig. 8. The upright 73' has a lever 75 pivoted thereon. The lever 75 is adapted to be positioned so that it holds the weight 74 in such position that the spring 69 is compressed thereby causing the rod 68 to seat firmly in the crucible mouth. A trip arm 76 carried by the conduit 62 is disposed such that it will disengage the lever 75 from weight 74 during the last portion of the first revolution of the platform.

Disengagement of the lever 75 will permit the weight 74 to swing sharply outwardly under the combined influence of centrifugal force and spring 69. This will cause the bifurcated upper end portion of lever 71 to deal a hammer blow on the shoulder 77 of rod 68 thereby pulling the rod radially inward and opening the mouth of the crucible.

The means for disengaging the rod 68 from the crucible mouth by means of a hammer blow is an important feature of my invention. It frequently happens that accumulation of slag, metal, etc., at the mouth of the crucible will tend to cement the rod in place and a sharp blow is necessary to dislodge it. While the specific means described may be varied to suit different conditions, some means for dealing the rod 68 a blow of considerable weight is necessary.

The outer end of the platform 48 is adapted to carry the mold which is capable of movement independently of the platform. The mold is retained by the end and side walls 78, 79 and may be provided with suitable runners and sprues connecting with the crucible mouth.

When a casting is to be made the crucible 56

is suitably charged through the spout 66 and current is introduced into the soil 58 until the charge is molten. A mold of the article to be cast is placed on the outer end of the platform 48 within the walls 78, 79 and rotation of the assembly is started by suitably controlling the motor 46.

With the arrangement shown as the apparatus nears the end of the first revolution lever 75 will engage the trip lever 76 and weight 74 will be free to swing radially outwardly to thereby inflict a hammer blow on the shoulder 77 of rod 68. The outer end of the rod will thus be disengaged from the crucible mouth 67 and the rod 68 will be moved radially inwardly by spring 69 to thereby permit the molten charge to be discharged through mouth 67 into the mold.

If desired, the crucible mouth 67 may be kept covered until the apparatus has gained speed through several revolutions in which case suitable means may be provided to deal the rod shoulder 77 a hammer blow and open the crucible at any desired time. An electrical solenoid or other suitable control means may be provided for this purpose.

The apparatus just described is suitable for casting very heavy objects, particularly of alloys where the cast must be made at a critical temperature. It frequently happens that the temperature range at which the cast must be made is very narrow in order that the metal will not be scorched or burned, yet be fluid enough for casting. With the arrangement just described the crucible may be kept closed for any suitable period of time to prevent oxidation of the molten metal and then opened suddenly so that the cast may be made with extreme rapidity and with minimum exposure of the molten metal to the atmosphere before solidification thereof.

The rod 68 is preferably of ceramic material and the crucible lining 56 may be of refractory material or of a graphite compound depending on the alloy to be cast as aforesaid.

If desired the shoulders 76, 77 on the rod 68 may be made adjustably by means of set screws

or other retaining means so that the rod may be adjusted radially outwardly as the tip wears off.

Having thus described two preferred embodiments of my invention, I wish it to be clearly understood that this has been done for the purpose of illustrating the principles thereof and is not to be considered as limiting except as defined in the claims appended below.

I claim:

1. In a casting machine having a revolvable furnace, an outlet in said furnace for discharging molten metal in a mold by centrifugal pressure; a refractory rod for normally closing said outlet, means for retaining said rod in closing position, and means for moving said rod to opening position including means for inflicting a hammer blow on said rod to break it loose from said outlet, said last means being operable automatically in response to revolution of said furnace.

2. In a casting machine, a revolvable furnace having an outlet for discharging molten metal by centrifugal pressure, a refractory rod having an end engaging said outlet for closing the same; latch means for yieldably holding said rod in closing position; a swingable lever disposed in operable relation with said rod; a weight on said lever, and means for suddenly releasing said lever when the machine is in operation such that the centrifugal force acting on said weight will cause said lever to inflict a hammer blow on said rod thereby to release it from said outlet.

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