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W. G. NEWTON ET AL
MANUFACTURE OF CASTING DIES

2,023,645

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Fig. 1.

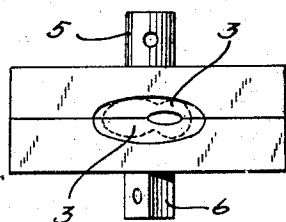
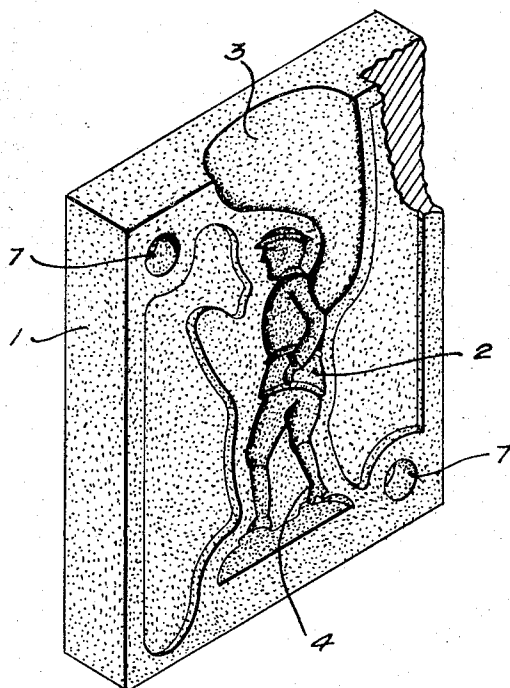


Fig. 2.



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MANUFACTURE OF CASTING DIES

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Application May 25, 1932, Serial No. 613,372

4 Claims. (Cl. 22—192)

This invention relates to the manufacture of casting dies, and particularly to such dies made by a die-casting process, for use in making castings of low melting point metal.

5 The principal object of the invention is to enable dies for the casting of low melting point metals to be made cheaply and accurately, and at the same time to provide dies which are durable and in which the metal will flow freely so as to make a sharp impression. A further object of the invention is to provide casting dies made by a die-casting process out of a metal of higher melting point than the metal which is to be cast in them. A further object of the invention is to provide casting dies suitable for making castings of a low melting point metal containing lead, the dies being die cast from an alloy characterized by substantially complete absence of any lead or tin, so as to eliminate possible blistering of the dies or alloying of the metal to be cast with such metals in the die. A further object of the invention is to provide a coating for such dies which acts as a heat insulator to prevent too rapid cooling of the metal to be cast in the dies, so as to prevent premature solidification of such metal in the gates or narrow passages of the die, and so as to insure that it will fill every part of the die and form a sharp impression. A further object of the invention is to provide a coating which will prevent corrosion of the die and possible alloying therewith of the low melting point metal to be cast.

In the drawing which illustrates a typical pair of dies embodying the invention,

25 Figure 1 is a plan view of the dies in position for pouring; and

Figure 2 is a perspective view of one of the dies.

Referring to the drawing in detail, each die comprises a body 1 having a mold recess 2 and a half-gate passage 3 adapted to match with the corresponding half-gate passage in the companion die. In some instances, depending upon the character of the casting to be made, portions of the mold recess may present narrow passages through which the molten metal must flow, as illustrated, for example at 4. The dies may be provided with suitable means for mounting them in the die-casting machine such, for instance, as the lugs 5 and 6 which may, if desired, be of different shapes so as to insure the mounting of the proper die member in the proper position in the die-casting machine. The dies are also preferably provided with means for insuring registration, for instance, dowels (not shown) on one of the die

members adapted to fit in recesses 7 in the companion die member.

The dies of the present invention are more particularly adapted for use in casting machines using low pressure upon the metal to be cast or in which the metal flows into the die by gravity. For instance, the dies may be used in connection with the toy casting machine described in the application of William G. Newton, Serial No. 449,169, filed May 2, 1930. The dies may, however, be used in any other suitable manner.

In ordinary die-casting processes, steel dies are used which are individually cut and finished by hand and which are accordingly very expensive. In accordance with this invention, master dies are made in this manner in reverse of the form desired for the cast dies, and from them are cast the dies of the present invention, utilizing metal of sufficiently high melting point so that these die-cast dies will be capable of withstanding a substantial amount of service when used to cast metal of a lower melting point. It is thus possible to produce a great number of duplicates from the original master dies. These duplicate dies can be readily made to accurately conform to the intended design and to be sharp and perfect in detail without any hand work at all being performed upon them. This is very necessary if cheap dies are to be produced, available for the purpose, for instance, of toy dies to be widely distributed for use in connection with a toy casting machine such as set forth in the application for patent referred to above.

The dies may be made from any suitable metal capable of being die cast, having a sufficiently high melting point to withstand the heat of the metal to be cast in them, and of such composition as not to be adversely affected by chemical action or alloying with the metal to be cast in them. The invention is especially applicable to the making of toys of cheap though low melting point metals, which metals necessarily are largely composed of lead. It is important therefore to use an alloy for manufacturing the dies which contains practically no lead or tin, as the presence of even minute quantities of such metals would tend to cause the surfaces of the dies to blister, and alloying of the casting metal with the lead and tin in the die with subsequent pitting and erosion of the die will gradually take place. As an example of an alloy which may be advantageously utilized for the dies, a zinc base alloy may be cited comprising zinc of a high degree of purity combined with a small percentage of aluminum, and either with or without the

addition of copper. It is necessary to use a highly refined zinc, substantially free from lead or tin. A specific example of an alloy which may be employed satisfactorily is the following:

	Percent
Zinc (99.99% pure) -----	90-92
Aluminum -----	4- 5
Copper -----	3- 4
Magnesium -----	.02-.10

Another suitable alloy is the following:

	Percent
Zinc (99.99% pure) -----	95-96
Aluminum -----	4- 5
Magnesium -----	.02-.10

It is also possible to make satisfactory dies from alloys consisting principally of aluminum, provided such alloys are practically free from lead or tin.

An important feature of the invention consists in the treatment of the die-cast dies to provide a proper surface finish for them which will act as a heat insulator to a sufficient extent to insure the flowing of the metal through the gate and through any narrow passages forming a part of the design before solidification takes place, so as to insure the complete filling of the die and the formation of a sharp impression. The coating also serves to protect the die from corrosion and possible alloying therewith of the metal being cast in the die, although if a proper alloy has been used for the die as above described no alloying should take place. Any suitable method of coating which gives these results may be utilized, but I preferably provide such a coating by oxidizing or otherwise chemically treating the surface of the die, as the coating thus formed adheres closely and firmly, does not come off with use, and protects the surface of the metal from corrosion and alloying. Such a coating may be made of sufficient thickness to provide the desired insulating action but is not so thick as to delay the ultimate solidification of the casting to any appreciable extent.

The procedure preferably followed in producing the desired coating on zinc base alloy dies of the character referred to above is as follows: The zinc base alloy die after casting is first thoroughly cleaned, preferably by dipping in an alkaline cleanser of usual composition, with which may be mixed a solution of whale oil soap. After cleaning in this manner the die is rinsed with cold water and then with boiling water. The die, while still hot from the boiling water, is then dipped in a nitric acid solution of suitable strength, for instance 25% nitric acid and 75% water, which forms a coating of oxide thereon. The die is then rinsed again in cold water and in boiling water. The die is then preferably dipped in a bath containing, for instance, six ounces to the gallon of caustic soda and one-half ounce to the gallon of antimony oxide. The temperature of the bath is preferably maintained at approximately 95° C. and the bath should be stirred sufficiently to keep the antimony oxide in suspension. The antimony oxide appears to have the effect of hardening the deposit on the dies and of increasing its durability. The caustic

soda cleans off any loose dirt and grease. After treatment in this bath the castings are removed and rinsed in cold water and then in boiling water. After treatment the castings should appear substantially black. If the castings present a mottled or discolored appearance, it indicates improper rinsing, and if there are white spots on the castings it is usually due to imperfect cleaning of the castings before treatment. The coating is, of course, only required on the working faces of the dies, but it is usually easier to treat the dies by dipping, in which case the coating will cover the dies all over.

In the case of dies made of aluminum or an aluminum base alloy, a suitable coating for the purposes described may be produced by anodic oxidation.

The exact chemical nature of the coating produced by the process described cannot be stated at this time, but for the purpose of convenience, it will be referred to as "oxide". This term as utilized in the claims is intended to cover any kind of a firm and adherent coating produced by chemical action on the surface of the metal itself.

It will be evident that various alloys may be used for making the dies and that variations in the specific treatment employed for producing the desired coating of the dies may be resorted to without departing from the invention.

I claim:

1. A zinc base alloy die having a coating on the face thereof resulting from treating the face of the die with nitric acid followed by treating with a solution of caustic soda and antimony oxide, the coating being characterized by a blackish color.

2. The method of finishing zinc base alloy dies for casting low melting point metal which consists in cleaning the dies then dipping them in a nitric acid solution, then rinsing the dies, then treating them with a bath containing a solution of caustic soda and antimony oxide and finally again rinsing the dies.

3. The method of finishing zinc base alloy dies for casting low melting point metal which consists in cleaning the dies then dipping them in a solution of approximately from 15% to 30% nitric acid and from 85% to 70% water, then rinsing the dies, then treating them with a bath containing a solution of caustic soda and antimony oxide and finally again rinsing the dies.

4. The method of finishing zinc base alloy dies for casting low melting point metal which consists in thoroughly cleaning the dies by means of an alkaline cleanser, rinsing the dies with cold water and then with boiling water, immersing the dies while still hot in a solution of approximately 25% nitric acid and 75% water, again rinsing the dies in cold water and then in boiling water, then immersing the dies in a bath containing approximately six ounces to the gallon of caustic soda and one-half ounce to the gallon of antimony oxide, said bath being maintained at a temperature of between 90° and 100° C. and finally rinsing the dies in cold water and then in boiling water.

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to control the flow of electrical current through said resistance coil.

5. A carburetor, for an internal combustion engine, having spray nozzles therein, said nozzles having a passageway for liquid fuel therein, a heating element located in said passageway for heating the liquid fuel therein, a rheostat adapted to control the flow of electrical current to said heating element in said spray nozzles, said rheostat comprising a body, a resistance coil on said body, a shaft passing through said body, an arm fastened to said shaft having a stop on one side thereof, a second arm on said shaft that is freely rotatable thereon that is adapted to make contact with said resistance coil at one end thereof, a spring fastened to the other end of said last-named arm, said spring being adapted to cause said freely rotatable arm to normally engage the stop on said first named arm and move with said first named arm, a thermostat on the other end of said shaft, that is adapted to turn said shaft and the arms thereon to control the flow of electrical current through said resistance coil, means for operating said freely rotatable arm independently of said first named arm.

6. In an internal combustion engine, the combination of an exhaust manifold, a carburetor, a heating chamber on said exhaust manifold having an opening at one end thereof, a valve on said heating chamber for controlling the size of said opening, a fuel line, a part of said fuel line being located in said heating chamber whereby the fuel contained therein is heated as it passes to the carburetor.

7. A carburetor, for an internal combustion engine, having a spray nozzle therein, said nozzle consisting of a single tube through which the liquid fuel passes, a coil of resistance wire placed inside of said tube and submerged in the liquid fuel in the tube and making direct contact with and heating the fuel therein, insulation interposed between the outside of said coil of wire and the inside of said tube.

8. A carburetor, for an internal combustion engine, having a spray nozzle therein, said nozzle consisting of a single tube through which the liquid fuel passes, a coil of resistance wire placed inside of said tube and submerged in the liquid fuel in the tube and making direct contact with and heating the fuel therein, insulation interposed between the outside of said coil of wire and the inside of said tube, means for controlling the supply of electric current to said coil of wire.

9. A carburetor, for an internal combustion engine, having an electrically heated spray nozzle therein, a rheostat adapted to control the flow of electrical current to said electrically heated spray nozzle, said rheostat comprising a body, a resistance coil on said body, an arm on said body adapted to engage said resistance coil, a link connected to the other end of said arm, a rod engaging said link, said rod being adapted to move said link to cause said arm to rock and vary the flow of electrical current through said resistance coil.

10. A carburetor, for an internal combustion engine, having an electrically heated spray nozzle therein, a rheostat adapted to control the flow of electrical current to said electrically heated spray nozzle, said rheostat comprising a body, a resistance coil on said body, an arm on said body adapted to engage said resistance coil, a pin on said body, a spring for normally causing said arm to engage said pin, a link connected

to the other end of said arm, said link having an eye at the other end thereof, a rod passing through said eye, a collar on said rod, said collar being adjustable up and down on said rod, said collar being adapted to move said link at a predetermined time upon the downward movement of said rod, causing said arm to rock away from said pin and vary the flow of electrical current through said resistance coil.

11. A carburetor, for an internal combustion engine, having an electrically heated spray nozzle therein, a rheostat adapted to control the flow of electrical current to said electrically heated spray nozzle, said rheostat comprising a body, a resistance coil on said body, a shaft passing through said body, an arm on said shaft making contact with said resistance coil, a thermostat at the other end of said shaft adapted to turn said shaft and said arm to vary the flow of electrical current through said resistance coil, means for manually operating said arm independently of said thermostat.

12. A carburetor, for an internal combustion engine, having an electrically heated spray nozzle therein, a rheostat adapted to control the flow of electrical current to said electrically heated spray nozzle, said rheostat comprising a body, a resistance coil on said body, a shaft passing through said body, an arm passing through said shaft having a stop on one side thereof, a second arm on said shaft freely rotatable thereon making contact with said resistance coil at one end thereof, a spring fastened to the other end of said second named arm, said spring causing said freely rotatable arm to normally engage the stop on said first named arm and move with said first named arm, a thermostat on the other end of said shaft adapted to turn said shaft and the arms thereon to control the flow of electrical current through said resistance coil, a link on said second named arm, a rod engaging said link, said rod being adapted to move said link to cause said second named arm to rock and control the flow of electrical current through said resistance coil independently of the operation of said thermostat.

13. A carburetor, for an internal combustion engine, having an electrically heated spray nozzle therein, a rheostat adapted to control the flow of electrical current to said electrically heated spray nozzle, said rheostat comprising a body, a resistance coil on said body, a shaft passing through said body, an arm passing through said shaft having a stop on one side thereof, a second arm on said shaft freely rotatable thereon making contact with said resistance coil at one end thereof, a spring fastened to the other end of said second named arm, said spring causing said freely rotatable arm to normally engage the stop on said first named arm and move with said first named arm, a thermostat on the other end of said shaft adapted to turn said shaft and the arms thereon to control the flow of electrical current through said resistance coil, a link on said second named arm, said link having an eye at the other end thereof, a rod passing through said eye, a collar on said rod, said collar being adjustable up and down on said rod, said collar being adapted to move said link at a predetermined time upon the downward movement of said rod, causing said second named arm to rock and vary the flow of electrical current through said resistance coil independently of the operation of said thermostat.