July 26, 1960 A. R. MILLS 2,946,102

DIE CASTING MACHINES

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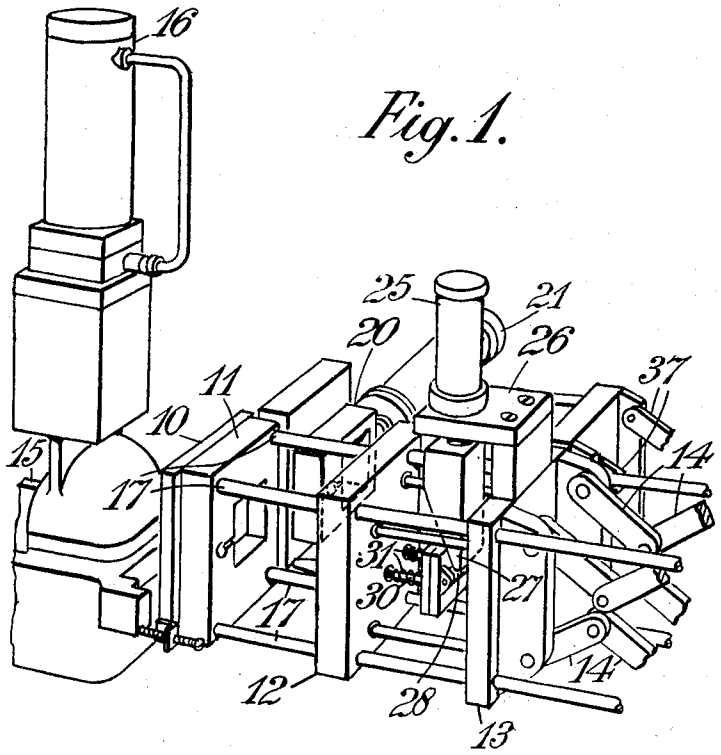


Fig. 1.

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Fig. 2.

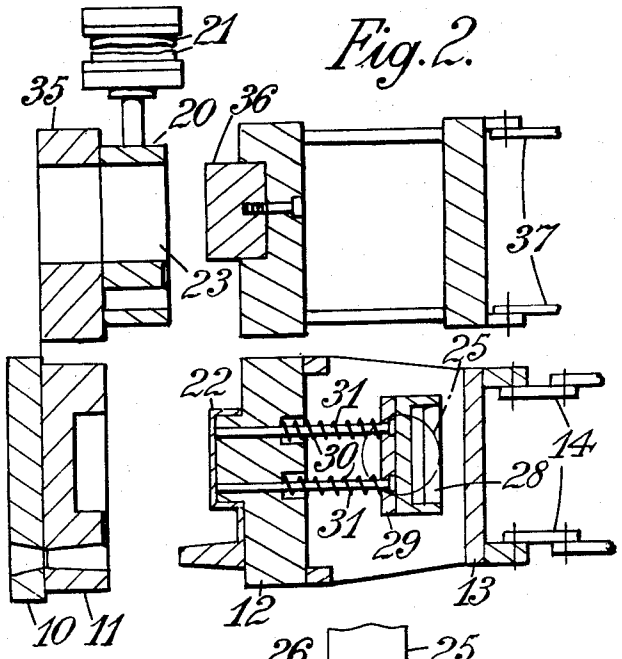
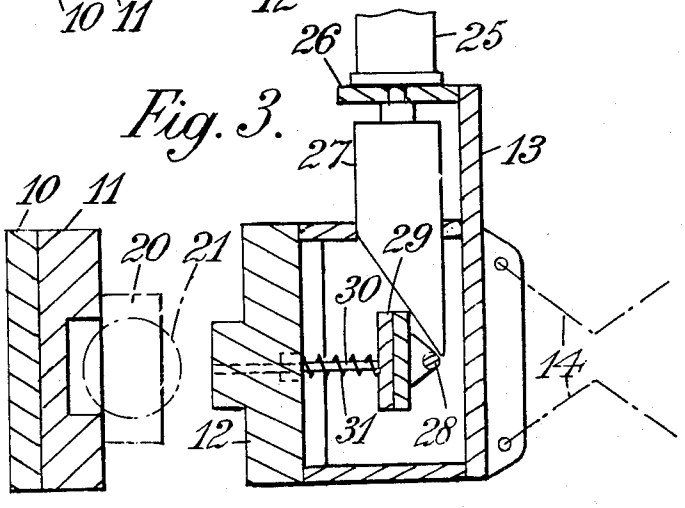


Fig. 3.



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Fig. 4.

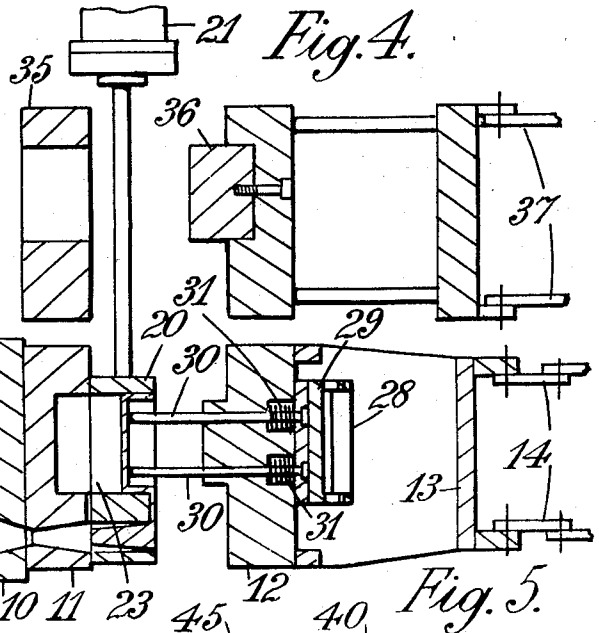
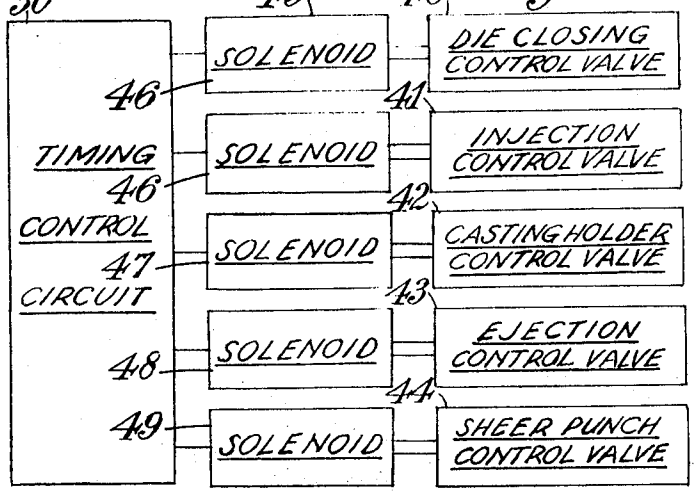


Fig. 5.



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DIE CASTING MACHINES

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6 Claims. (Cl. 22—94)

This invention relates to die casting machines.

When a die casting is produced by injecting molten metal into a mould formed by two dies, the casting after ejection from the dies has to be trimmed to remove the flash, sprue and runners and heretofore this has been done as an operation quite distinct from the production of the casting in the die casting machine, the casting being removed from the machine and subsequently trimmed, for example by a shear punch which is operated quite independently of the casting operation.

According to this invention, in a die casting machine having a fixed die and a movable die, a casting holder is provided adapted to be moved between a first position between the fixed and movable dies when the latter are apart, in which first position the casting holder can receive a casting ejected from the movable die, and a second position adjacent a punch tool arranged, on operation, to remove the flash from the casting in the casting holder. The die is preferably so arranged that the punch tool can remove not only the flash but also the sprue and runners from the casting in a single operation. Preferably means are provided for removing the casting holder automatically in synchronism with the cycle of movement of the dies. With this arrangement, the casting is conveyed by the casting holder from the dies to the punch tool and it is possible for the flash, sprue and runners to be removed whilst the casting is still warm. Provision is preferably made for returning the surplus metal thus removed directly to the melting pot for the die casting material whilst the metal removed from the casting is still hot, thereby effecting substantial economy in operation. It will be appreciated that metal die castings are often quite small and the surplus metal forming the necessary runner may constitute a large proportion of the actual metal required for each casting operation.

A fluid-operated ram, e.g. a pneumatic or hydraulic ram, may be provided for ejecting the casting out of the movable die into the casting holder. Conveniently the casting holder is arranged to constitute a shearing die and said punch tool is arranged to force the casting through the casting holder. Conveniently also, the casting holder is moved in a direction at right angles at the run of movement of the dies and the punch tool is arranged to move in a direction parallel to the line of movement of the dies.

The following is a description of one embodiment of the invention, reference being made to the accompanying drawings of which:

Figure 1 is a perspective view illustrating part of a die casting machine,

Figures 2 and 3 are, respectively, a diagrammatic plan view partly in section and an elevation of the machine showing only the essential features for explaining the present invention,

Figure 4 is a view similar to Figure 2 but showing the casting holder in a different position, and

Figure 5 is a block diagram illustrating a control system.

Referring to Figure 1, there is illustrated a die casting machine comprising a fixed platen **10** to which is attached a fixed die **11** and a movable die **12** which is mounted rigidly on a movable platen **13**. This movable platen **13** is movable towards and away from the fixed die **11** by means of a toggle linkage indicated at **14** which may be actuated by means of a pneumatic ram in the known manner. When the die plates are closed together molten metal from a suitably heated bath **15** is injected into the die cavity formed by two die plates by means of a plunger (not shown) operated by means of a compressed air piston and cylinder assembly **16**. The movable die plate **12** is slidable on four guide bars **17** arranged at the four corners of the die plates.

The apparatus thus far described may be of known construction. For the purpose of the present invention there is provided a movable casting holder **20** which is moved transversely of the line of movement of the movable die plates **12** by means of a piston and cylinder assembly **21** forming a pneumatic ram. This casting holder **20** is illustrated more clearly in Figures 2 and 4 in which there is shown diagrammatically, as an example, a casting **22** which might be considered typical of the type of casting made in this form of machine. The casting holder **20** is made to receive the particular shape of casting being produced and has an aperture **23** exactly corresponding to the plan view of the required finished casting looking in the direction of movement of the movable die **12**. This casting holder **20** thus constitutes a shearing die for shearing off the flash which has formed round the edge of the casting at the junction of the two die plates by forcing the casting through the aperture **23**. The die plates are formed so that the runners enter along the dividing surface of the die plates so that the sprue and runners may be sheared off also by forcing the casting through the aperture **23**.

When the casting has been formed and the die plates opened into the position shown in Figure 3 the casting moves with the movable die plate and is thus withdrawn from the fixed die plate. As soon as the dies are open the piston and cylinder assembly **21** is operated to move the casting holder **20** into the position shown in Figure 4. The casting is then moved forwardly into the casting holder by means of a further compressed air piston and cylinder assembly **25** mounted on a bracket **26** secured on the moving platen **13**. This piston and cylinder assembly **25**, when operated, effects downward movement of a wedge **27** which engages a roller **28** on the back of an ejector plate **29** which, by means of ejector rods **30** axially movable through the movable die **12**, forces the casting **22** forwardly into the casting holder **20**. The piston and cylinder assembly **25** is operated so that the wedge **27** is moved downwards and immediately withdrawn. Spring means, illustrated as helical springs **31** round the ejector rods **30**, are provided for returning the ejector plate **29** to its original position as soon as the wedge **27** has been withdrawn. The casting holder **20** is then traversed sideways by the cylinder **21** to the position shown in Figure 2. In this position the casting holder **20** lies closely adjacent a fixed abutment **35**. On the opposite side of the casting holder **20** is a shear punch **36** which is actuated by a further piston and cylinder assembly through a toggle linkage **37**. The shear punch actuating mechanism conveniently is made constructionally similar to the die closing mechanism. This shear punch is shaped to correspond to the aperture **23** in the casting holder **20** and is driven into this aperture to force the casting through the aperture. As previously explained, the apertured casting holder **20** con-

stitutes a shearing die and thus the flash, sprue and runners are removed from the casting. The casting is ejected through the casting holder 20 and through an aperture in the fixed abutment 35.

It will be appreciated that the piston and cylinder assemblies 16, 21 and 25 and the piston and cylinder for operating the toggle linkages 11 and 37 moving the die plate and shear punch can be controlled manually, e.g., there might be provided a single control lever which is movable in steps so as to operate the various cylinders in the sequence required, that is to say, the die closing cylinder is operated to close the die plates, the injection cylinder 16 is operated to inject material into the die cavity, the die closing cylinder is operated to open the die plates, the cylinder 21 is operated to move the casting holder into the position shown in Figure 5, the cylinder 25 is operated and released to eject the casting, the cylinder 21 is operated to return the casting holder to the position shown in Figure 3 and the shear punch cylinder is then operated and released to shear the flash, sprue and runners from the casting. Most conveniently, however, the various cylinders are operated automatically in synchronism and for this purpose the various cylinders might have solenoid operated control valves as indicated diagrammatically in Figure 5 in which there are shown five valves 40—44 operated respectively by solenoids 45—49. The valves 40—44 are reversing valves controlling the admission of air pressure to the various cylinders, the valve 40 controlling the die closing cylinder, the valve 41 controlling the injection cylinder 16, the valve 42 controlling the casting holder operating cylinder 21, the valve 43 controlling the ejection cylinder 25, and the valve 44 controlling the shear punch operating cylinder. The various solenoids 45—49 are arranged to operate in the appropriate sequence by means of an electronic timing circuit indicated diagrammatically at 50. To guard against any mis-operation, micro-switches are provided which are operated by the movable die plate 12 and the casting holder 20 so as to ensure that the die plates cannot be closed when the casting holder is between them, to ensure that injection can only take place when the die plates are closed, to ensure that neither the casting holder nor the ejection mechanism can be operated unless the die plates are fully open and to ensure that the shear punch can only be operated when the casting holder is in the appropriate position.

After the shear punch has operated, the flash sprue and runners will fall out of the casting holder 20; the casting holder may be suitably shaped to ensure this by providing suitable grooves beneath the positions occupied by the sprue and runners.

Although in the embodiment described, a separate piston and cylinder assembly 37 is provided for operating the shear punch, the shear punch might instead be fixed to the movable die plate assembly so that the shearing is effected as the dies are closed by the die closing cylinder. Also it will be readily apparent that the use of the wedge 27 is merely illustrative of one form of ejection mechanism and that other mechanisms may obviously be employed.

It will also be understood that hydraulic operation may be employed for some or all of the cylinders instead of pneumation operation if desired.

I claim:

1. A die casting machine comprising a pair of relatively movable dies movable into engagement to complete a die cavity, said dies being separable and one die carrying the casting away from the other die upon separation of the dies; a casting holder movable laterally between the dies only when the latter are separated and having an opening to receive the casting; said casting holder being retractable from between the dies before the latter can be moved into engagement to complete the die cavity; ejector means associated with said one die to eject the casting into such opening; and a punch spaced laterally from said dies; said casting holder being movable laterally to align said punch with said opening, and said punch being movable into said opening to eject the casting therefrom.

2. A die casting machine comprising a pair of relatively movable dies movable into engagement to complete a die cavity, said dies being separable and one die carrying the casting away from the other die upon separation of the dies; a casting holder movable laterally between the dies only when the latter are separated and having an opening therethrough to receive the casting; said casting holder being retractable from between the dies before the latter can be moved into engagement to complete the die cavity; ejector means associated with said one die to eject the casting into such opening; and a punch spaced laterally from said dies; said casting holder being movable laterally to align said punch with said opening, and said punch being movable into said opening to eject the casting therefrom.

3. A die casting machine as claimed in claim 2 in which said opening conformingly receives the casting and said punch is shaped to conformingly fit said opening, whereby said punch and opening conjointly constitute a flash shearing die for the casting.

4. A die casting machine as claimed in claim 2 including mechanism operating said casting holder in synchronism with the closing and opening movements of said dies.

5. A die casting machine as claimed in claim 2 including mechanism operable to simultaneously close said dies and operate said punch.

6. A die casting machine as claimed in claim 2 in which one die is relatively fixed and the other die is relatively movable.

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