Dec. 7, 1954 P. FOURON ET AL 2,696,031

AUTOMATIC MACHINE ADAPTED FOR THE CASTING OF PISTONS

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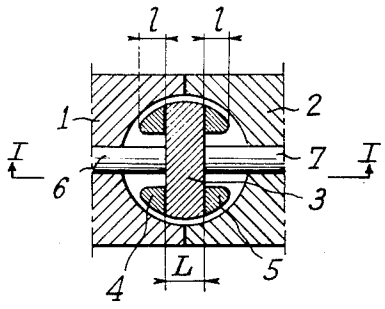


Fig. 1

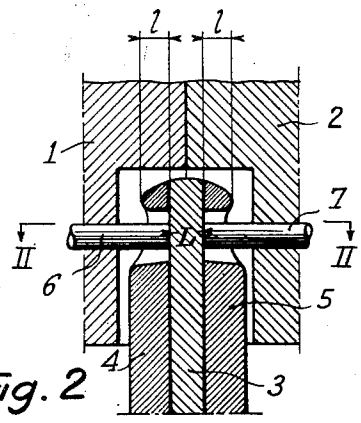


Fig. 2

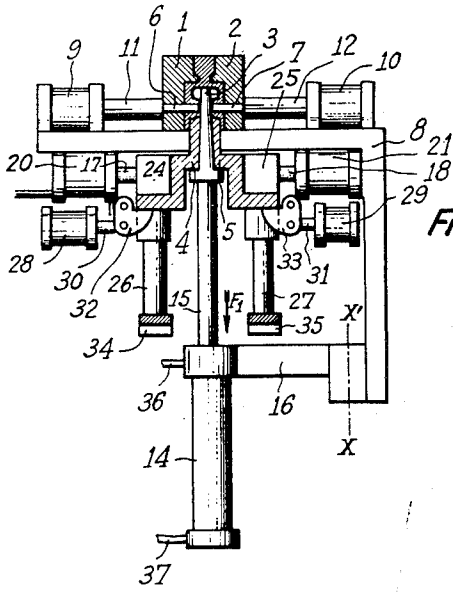


Fig. 3

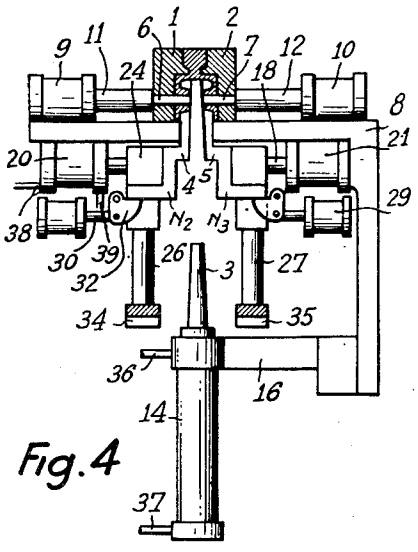


Fig. 4

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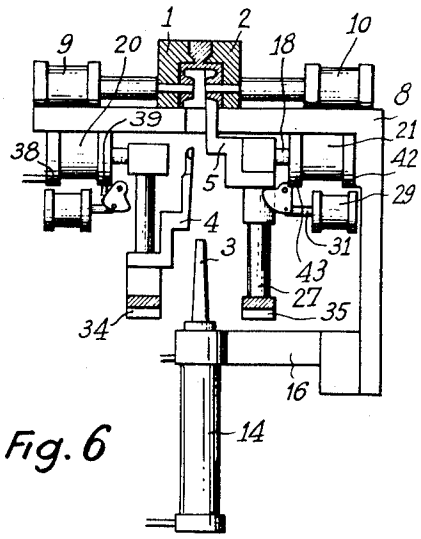


Fig. 6

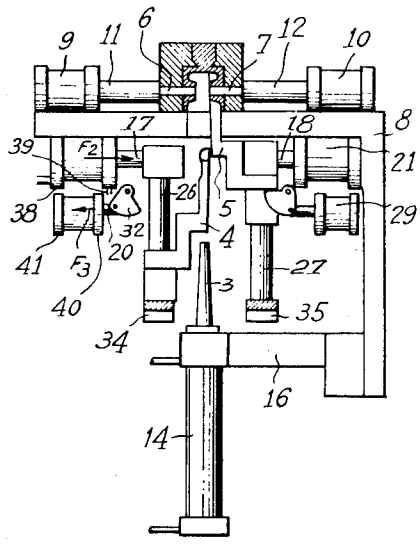


Fig. 5

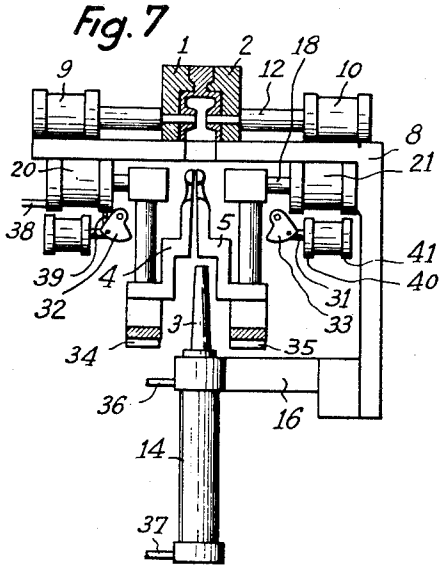


Fig. 7

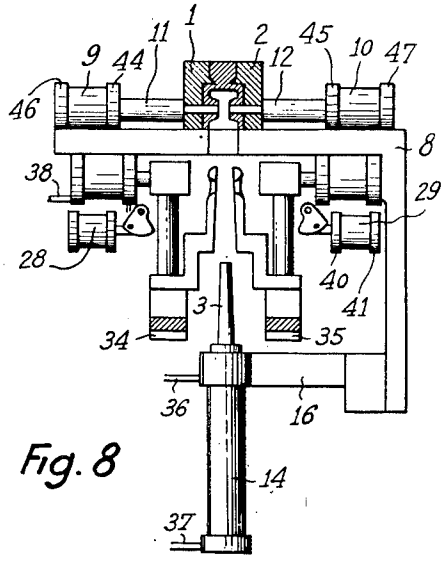


Fig. 8

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AUTOMATIC MACHINE ADAPTED FOR THE CASTING OF PISTONS

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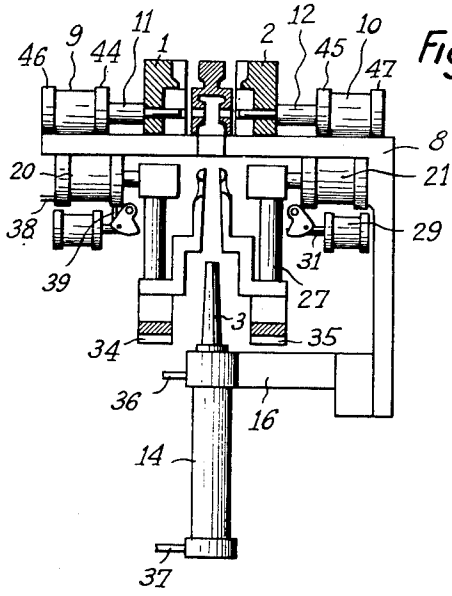


Fig. 9

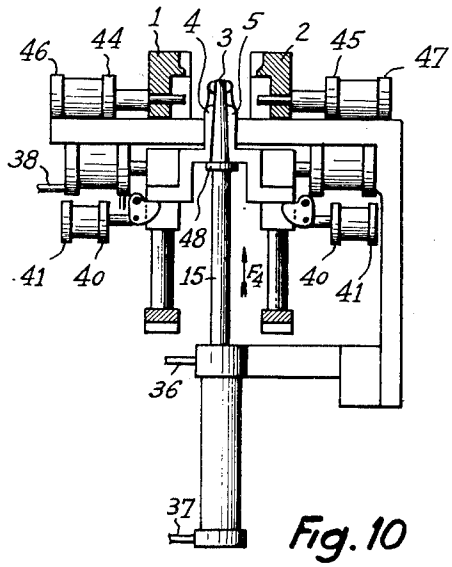


Fig. 10

Fig. 11

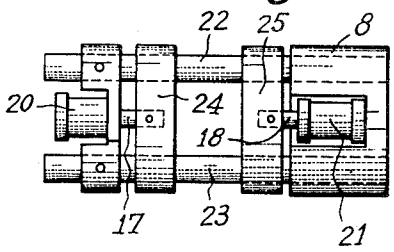
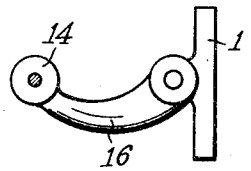


Fig. 12



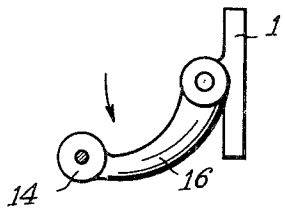


Fig. 13

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AUTOMATIC MACHINE ADAPTED FOR THE CASTING OF PISTONS

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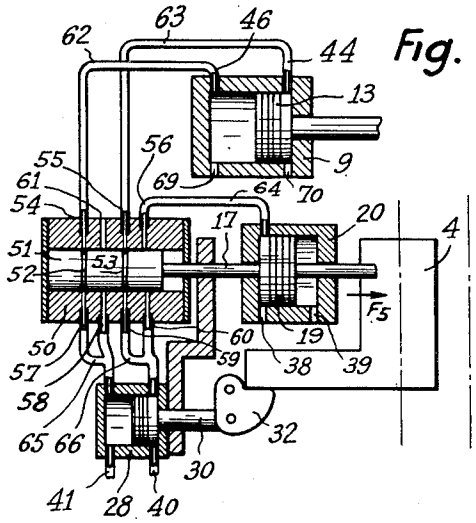


Fig. 14

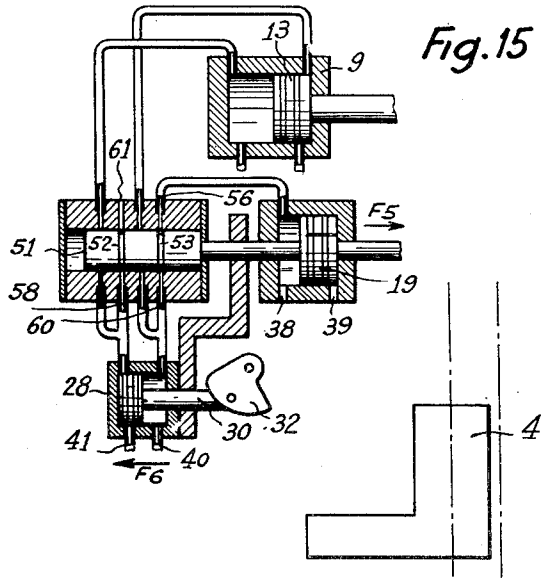


Fig. 15

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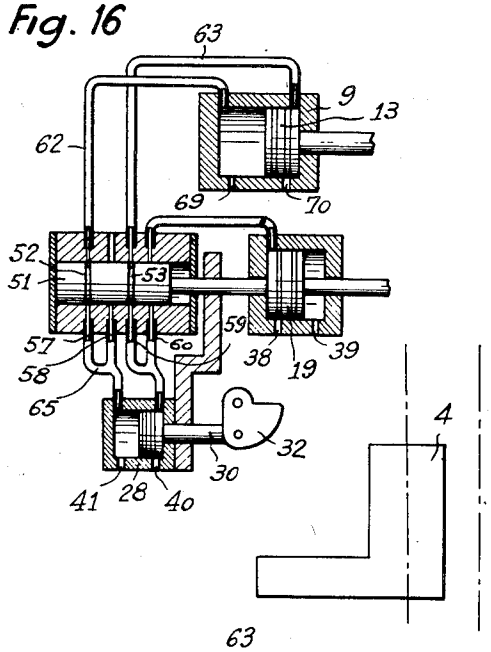
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Fig. 16



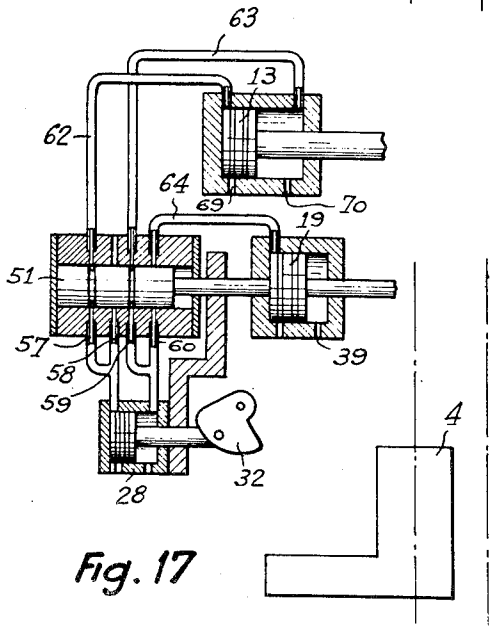


Fig. 17

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United States Patent Office 2,696,031 Patented Dec. 7, 1954

2,696,031

AUTOMATIC MACHINE ADAPTED FOR THE CASTING OF PISTONS

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Application December 24, 1951, Serial No. 263,068

Claims priority, application France December 23, 1950

4 Claims. (Cl. 22—93)

The invention relates to casting and stripping machines and particularly to such machines adapted for the casting and stripping of heat engines pistons of the type comprising an internal pin about which swings the small end of the connecting rod. It has for its principal object to provide such a machine in which the various displacements of the moving parts, whether mould parts or core parts, necessary for continuous casting and stripping operations are performed automatically by servo-motors controlled by a distributor.

It is usual, in machines performing the continuous casting and stripping of pistons of the type mentioned above, to use two separable chilled half moulds in combination with a core comprising a central core-member disposed diametrally between two identical lateral core-pieces which impart the required shape to the bearings of the pin of the piston, the co-axial core-pins forming the bores of these bearings fixed internally of the said half-moulds. The usual practice is, after the piston is cast, to first disengage the central core-member, to bring together the two lateral core-pieces in the space left vacant by the withdrawal of the said central core-member and to withdraw them, using the passage left free by the said withdrawal of the central core-member.

In order to be able to do this, however, it is necessary that the thickness l of each of the two lateral core-pieces be less than half the thickness L of the central core-member, so that the thickness $2l$ of the two juxtaposed lateral core-pieces be less than the thickness L of the central core-member.

Another object of the invention is to provide a machine by means of which it is possible to carry out the casting and stripping of pistons of the type referred to in the case when $2l$ is greater than L, provided, of course, that l is smaller than L, by disengaging one at a time successively the lateral core-pieces through the passage left free by the removal of the central core-member.

Another object of the invention is to provide locking means adapted to perform the locking in position and, inversely, the release of the supports of the lateral core-pieces, as and when required by the successive stages of operation of the machine.

Yet another object of the invention is to provide a system of control of the servo-motors performing the displacements of the mould and core parts and other auxiliary operations, so that these are achieved in the correct sequence, by using fluid under pressure as the motive agent of the servo-motors, under the control of a central distributing device.

Referring to the accompanying drawings, which illustrate a preferred embodiment of the invention, in the way of example only:

Fig. 1 is a sectional view taken along the line II—II of Fig. 2 through the external and internal mould parts used to form the piston,

Fig. 2 is a sectional view along the line I—I of Fig. 1 showing the mould parts in elevation,

Figs. 3 to 10 inclusive are elevational views partly in section showing the parts in various positions during successive stages in the operation of the presently disclosed device,

Fig. 11 is a plan view of certain supporting elements,

Figs. 12 and 13 are diagrammatic views in different positions, of one of the parts of the machine, namely, a bracket carrying the central core member and its servo-motor, and

Figs. 14 to 17 inclusive are sectional views through the operating means for the servo-motors showing the various position of parts during successive stages in the operation of the machine.

As it has been explained above, the machine, object of the invention, has for its purpose to allow the casting and the stripping of the pistons, the mould employed being constituted, on the one hand, by two halves of a chill-mould, which are separable, 1 and 2, and, on the other hand, in order to shape the internal wall of the piston, by a central diametral core-member 3 and by two lateral core-pieces 4 and 5, which shape the bearings of the pin of the piston and are traversed, respectively, by the co-axial core-pins 6 and 7 (Fig. 1), which are here secured to the two half-moulds, respectively. The purpose of the machine is to carry out automatically the various operations of putting in position or dismantling the parts already mentioned, so as to perform the assembling of these parts and, subsequently, the stripping of the cast piston. The machine is more particularly designed to meet the case when the thickness l of the lateral core-pieces 4 and 5 is greater than half the thickness L of the central core-member 3, that is to say, greater than half the space left vacant by the withdrawal of the latter to allow the removal of the said lateral core-pieces 4 and 5, but, of course, it can be operated when this thickness l is smaller than L.

The machine comprises a frame 8 supporting the mould and several servo-motors, each constituted by a cylinder in which reciprocates a plunger subjected to the pressure of a compressed fluid.

Two co-axial cylinders 9 and 10, disposed horizontally, are provided for ensuring the operations of the two halves 1 and 2 of the chill-mould, either in order to separate them or to bring them against each other, by means of the rods 11 and 12 of their respective pistons 13.

A vertical cylinder 14 is disposed axially of the machine, that is, in the plane of symmetry of the horizontal cylinders 9 and 10. Its purpose is to ensure the disengagement of the central core-member 3, which is carried by the rod 15 of the corresponding piston. This cylinder 14 is carried by a bracket 16 adapted to pivot about the axis XX (Figs. 3, 12 and 13) fixed with respect to the frame 8, so as to allow the central core-member 3 to be swung out of the way, either for cleaning or for disengaging entirely the other parts and allow free access to them (Fig. 11).

The lateral core-pieces 4 and 5 are adapted to be moved horizontally by the rods 17 and 18 of the pistons 19 of the cylinders 20 and 21 fixed on two horizontal parallel supports 22 and 23 secured to the frame 8 (Fig. 11).

The rods 17 and 18 of the pistons 19 are secured to the yokes 24 and 25, adapted to slide on the supports 22 and 23, which act as guides. These yokes 24 and 25 each carry a vertical guiding rod, 26 and 27, along which the supports of the lateral core-pieces 4 and 5, can slide downwards.

On the yokes 24 and 25 are also mounted two cylinders 28 and 29, the piston rods 30 and 31 of which are adapted to perform the locking and the unlocking of the supports of these lateral core-pieces 4 and 5 on to these yokes 24 and 25 by means of cams 32 and 33 (Figs. 14 to 17).

On the lower portions of the vertical guide rods 26 and 27 (Figs. 3 and 4) are fixed easily accessible nut-shaped knobs 34 and 35 which allow the rapid dismantling of the lateral core-pieces 4 and 5 after the disengagement of the central cylinder 14 by the angular displacement of its supporting arm 16 about the vertical axis XX (Figs. 12 and 13).

The operation of the machine is as follows:

The piston is cast with the various movable elements of the mould and of the core in the relative positions shown in the Figures 1, 2 and 3.

After the casting has solified, the compressed fluid which constitutes the motive agent for the operation of the servo-motors is admitted by the passage 36 into the cylinder 14, the opposite passage 37 being open to exhaust. This causes the lowering of the rod 15 in the direction of the arrow F1 and the disengagement of the central core-member 3 (Fig. 4).

The compressed fluid is then sent in the cylinder **20** by the passage **38**, the passage **39** being open to exhaust (Fig. 14). This causes the rod **17** of the plunger reciprocating in this cylinder to displace the element **4** horizontally in the direction of the arrow F2 (Fig. 5). When this movement is completed, the compressed fluid is admitted into the cylinder **28** by the passage **40**, the passage **41** being open to exhaust, thereby causing the rod **30** to operate the cam **32** by moving in the direction F3, unlocking the support of the lateral core-piece **4** which falls under the action of its own weight along the guiding rod **26** (Fig. 5). The length of the rod **26** is such that the lateral core-piece **4** is entirely disengaged from the mould and is lowered on the lower portion of the frame **8**.

The compressed fluid is then admitted into the cylinder **20** by the passage **39**, the passage **38** being open to exhaust; this brings the lateral core-piece **4** back in the same vertical plane as that it did occupy in the position shown in Fig. 3 (Fig. 6).

The compressed fluid is then admitted into the cylinder **21** by the passage **42**, the passage **43** being open to exhaust, this compelling the lateral core-piece **5** to perform the movement corresponding to that of the core-piece **4**, preparatory to falling along the guiding rod **27** when its support is released by the cam **33** being brought to the unlocking position by compressed fluid being admitted in the cylinder **29** by the passage **41**, the passage **40** being open to exhaust, so as to push out the rod **31**.

It will be seen that both the lateral core-pieces **4** and **5** have been brought in succession nearer to the axis of the mould and then have performed similar vertical downward displacements. Admission of the compressed fluid in the cylinder **21** by the passage **43**, the passage **42** being open to exhaust, will bring the core-piece back in the same vertical plane as that it did occupy at the beginning. The constitutive elements of the core, **3**, **4** and **5** are therefore, at this moment, entirely disengaged from the cast piston and from the frame **8**, as shown in Fig. 8.

The compressed fluid is then admitted into the cylinders **9** and **10** by the passages **44** and **45**, respectively, the passages **46** and **47** being open to exhaust, and the half moulds **1** and **2** are brought apart from each other by the piston rods **11** and **12**, leaving the casting simply standing on the upper surface of the frame **8** (Fig. 9).

After having removed this casting, the compressed fluid is admitted into the vertical cylinder **14** by the passage **37**, the passage **36** being open to exhaust, the central core-member rises as shown by the arrow F4 (Fig. 10), a collar **48** on the piston rod **15** taking along with it, in its ascending movement, the supports of the lateral core-pieces **4** and **5**; the constitutive elements of the core of the mould are in this manner brought back in the initial position which they occupied before the casting, as shown in Fig. 3.

The compressed fluid being now admitted in the cylinders **9** and **10** by the passages **46** and **47**, the passages **44** and **45** being open to exhaust, the piston rods **11** and **12** bring the half-moulds back against each other and they take back their initial position shown in Fig. 3.

The cycle is completed and the casting of another piston is proceeded with.

It has been mentioned above that the locking of the core-pieces **4** and **5** in their casting position was brought about by the cams **32** and **33** operated by the rods **30** and **31** of the pistons in the cylinders **28** and **29** (Fig. 3). The manner in which this locking is performed, also by the action of the compressed fluid remains to be explained.

The rod **30** of the piston of the cylinder **28**, driving the cam **32**, is actuated by the compressed fluid through a distributor **50** (Fig. 14); this distributor consists in a cylindrical slide valve **51** adapted to reciprocate in the body of the distributor and provided with two annular grooves **52** and **53**. The body of the distributor is provided with orifices **54**, **55**, **56**, **57**, **58**, **59**, **60** and **61**, some of which may be put in communication with each other by means of the circular grooves **52** and **53**.

The orifices **54** and **55** are connected by the pipes **62** and **63** with the passages **46** and **44**, respectively, of the cylinder **9** actuating the half-mould **1**. The orifice **56** is connected by the pipe **64** to one end of the cylinder **20** actuating the lateral core-piece **4**. The orifices **57** and **58** are connected by the pipe **65** to one end of the cylinder **28** actuating the cam **32**; the orifices **59** and **60** communicate with the other end of this cylinder by the pipe **66**. The orifice **61** is permanently open to exhaust.

The slide valve of the distributor is solid with the piston rod **17** of the piston **19** of the cylinder **20**.

The cylinder **28**, actuating the cam **32**, is secured to the support **24** and consequently partakes of all the movements of the latter support.

The operation of the servo-motors takes place as follows:

1st stage.—The lateral core pieces **4** and **5** having been brought in the position shown in Fig. 4 and the half-mould **1** having been brought by the piston rod **11** in position for casting, the cylinder **9** is filled with compressed fluid, the pressure of which is transmitted by the passage **46**, the pipe **62**, the orifice **54** of the distributor, the circular groove **52** of the slide valve, the orifice **57** and the pipe **65**, to the cylinder **28**, which actuates the cam **32**, thereby locking the support of the lateral core-piece **4** in position, as shown in Fig. 14.

The operation of the left half of the machine only is described, the servo-cylinders on the other (symmetrical) half being communicating with the corresponding cylinders of the left half, so that they act simultaneously, as described for the latter half, in an exactly similar manner.

2nd stage.—The compressed fluid is brought by the passage **38** into the cylinder **20** by a distributor (not shown), the passage **39** being open to exhaust, causing the rod **17** to move in the direction of the arrow F5 (Fig. 15) together with the slide valve **51** of the distributor **50**, which is brought in the position shown in Fig. 15. The groove **53** puts in communication the orifices **56** and **60**, while the groove **52** puts in communication the orifices **58** and **61**; the compressed fluid arrives on the other face of the piston in the cylinder **28** and actuates the rod **30** in the direction of the arrow F6, thereby causing the unlocking of the support of the lateral core-piece **4**, which falls owing to its own weight, guided by the rod **26** (Fig. 5).

3rd stage.—The compressed fluid is introduced into the cylinder **20** by the passage **39**, the passage **38** being open to exhaust, thereby actuating the support of the lateral core-piece **5** in exactly the same manner as has just been described for the core-piece **4**. It will be understood from the description of the disengagement of these two core-pieces that their operation cannot take place simultaneously. Both of the locking arrangements are now in the released position shown in Fig. 15.

4th stage.—The fluid is admitted in the cylinder **9** by the passage **70**, the passage **69** being open to exhaust, therefore the half-mould **1** is separated from the casting. The same action takes place with respect to the half-mould **2**, at the same time, so that the mould is now open (Fig. 9), owing to the cylinders **9** and **10** being coupled, so that they are operated simultaneously.

The ascending of the three elements constituting the core, under the action of the cylinder **14**, completes the cycle of operations. A new cycle begins with the simultaneous actuating of cylinders **9** and **10** for closing the mould and cylinders **28** and **29** for locking the core in position.

What we claim is:

1. In a machine for automatically casting and stripping pistons in a chill mould wherein the mould comprises two exterior parts and a core structure having a central part and two lateral pieces, the combination of a support, means mounted on said support for moving the exterior mould parts horizontally between open and closed positions, an arm pivotally mounted on said support for pivotal movement on a vertical axis, means mounted on said arm for moving the central core part vertically to and from a position within the exterior mould parts, means mounted on said support for moving the lateral core pieces horizontally, said last-named means including guide rods mounting the lateral core pieces for vertical movement to and from a position within the exterior mould parts, and an abutment carried by said central core supporting means for engaging the lateral core pieces for simultaneously moving the central and lateral core parts vertically.

2. A machine as recited in claim 1, including cam means fixedly interconnected with said guide rods for retaining the lateral core pieces within the exterior mould parts.

3. A machine as recited in claim 2, including a distributor for pneumatically operating said cam means.

4. A machine as recited in claim 1, including pneumatically operated means for locking the lateral core pieces within the exterior mould parts.

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