July 28, 1959 G. NYSELIUS 2,896,279

MEANS FOR CONTROLLING THE OPERATION OF DIE CASTING APPARATUS AUTOMATICALLY AND IN TIMED RELATION

Filed July 6, 1956 4 Sheets-Sheet 1

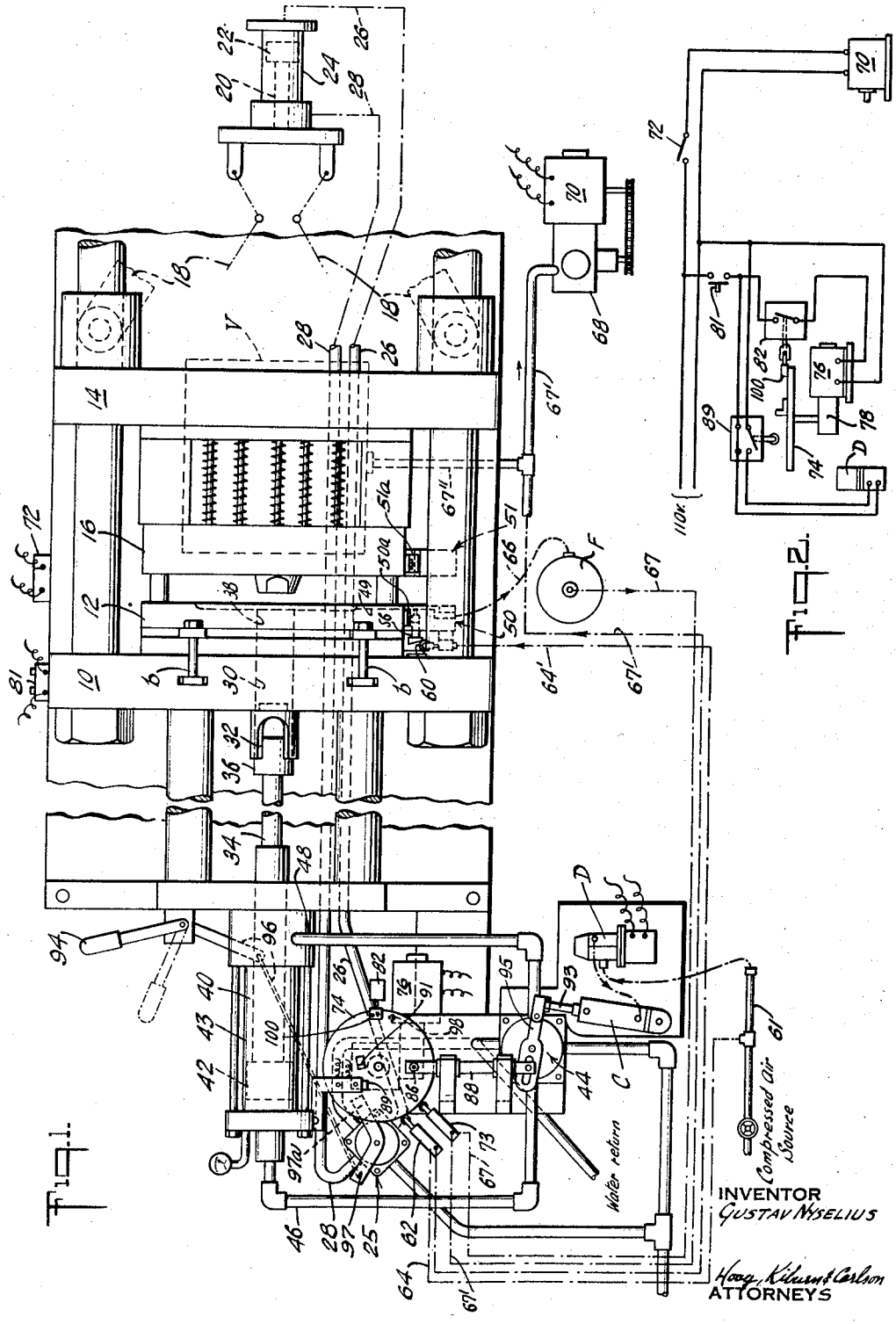


FIG. 1.

FIG. 2.

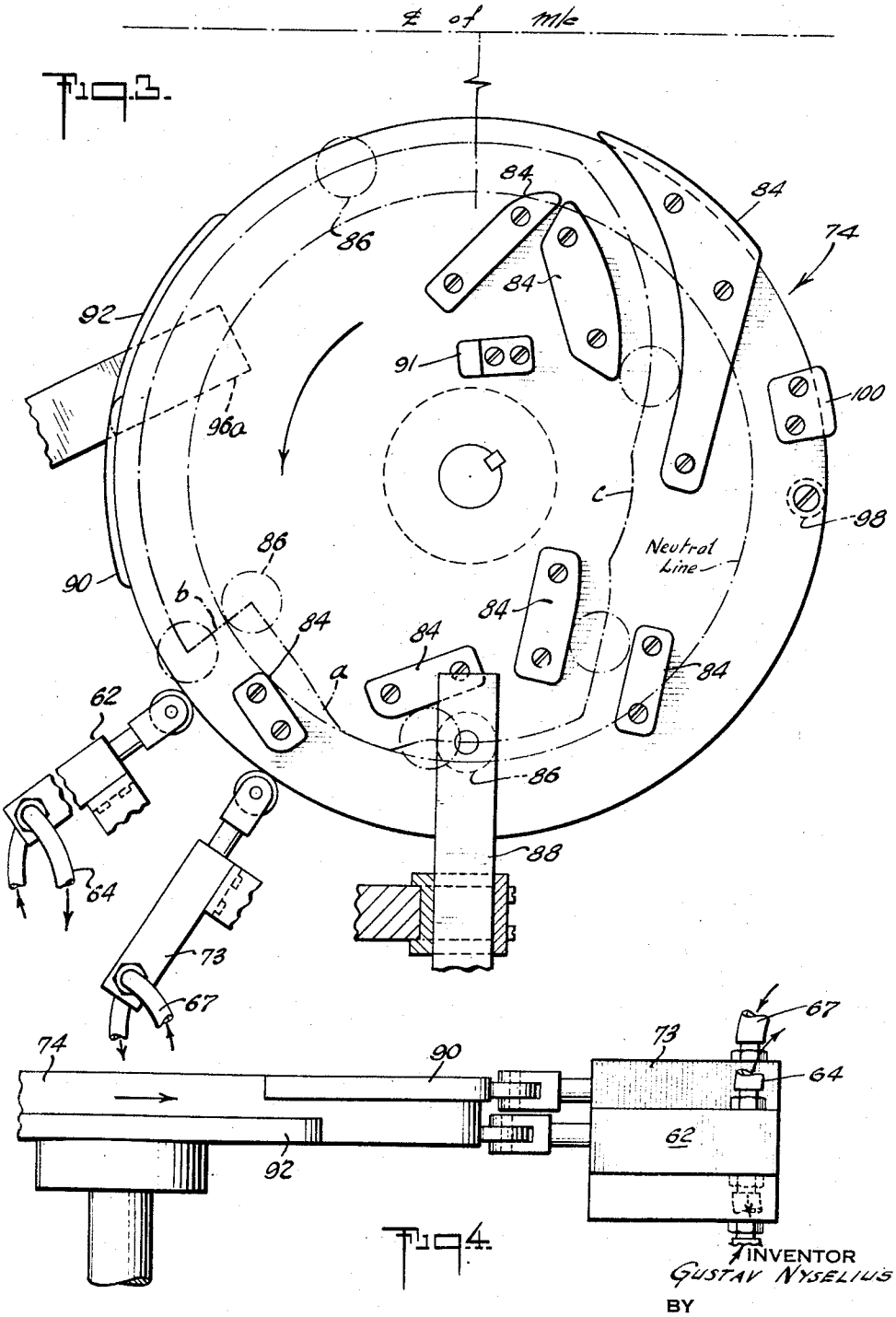
INVENTOR
GUSTAV NYSELIUS

Hoag, Kilburn & Carlson
ATTORNEYS

July 28, 1959 G. NYSELIUS 2,896,279

MEANS FOR CONTROLLING THE OPERATION OF DIE CASTING APPARATUS AUTOMATICALLY AND IN TIMED RELATION

Filed July 6, 1956 4 Sheets-Sheet 2



INVENTOR
GUSTAV NYSELIUS
BY
Hoag, Fillburn & Carlson
ATTORNEYS

July 28, 1959 G. NYSELIUS 2,896,279

MEANS FOR CONTROLLING THE OPERATION OF DIE CASTING APPARATUS AUTOMATICALLY AND IN TIMED RELATION

Filed July 6, 1956 4 Sheets-Sheet 3

Fig. 5.

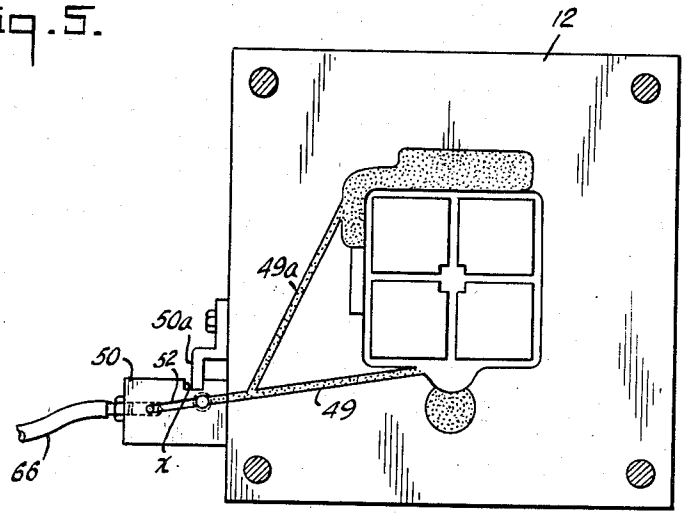
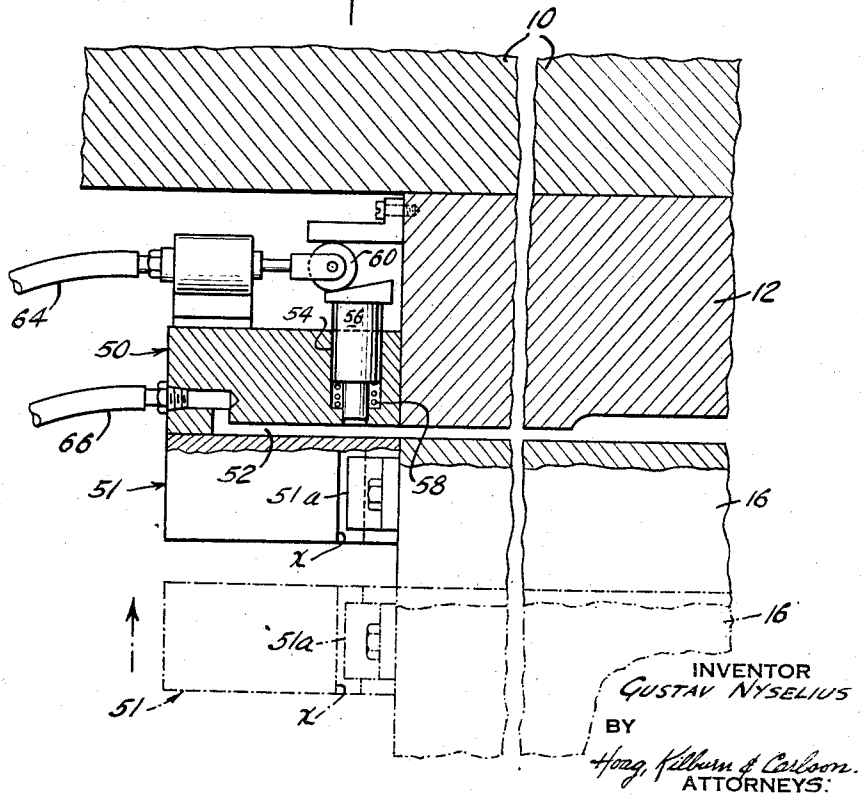


Fig. 6.



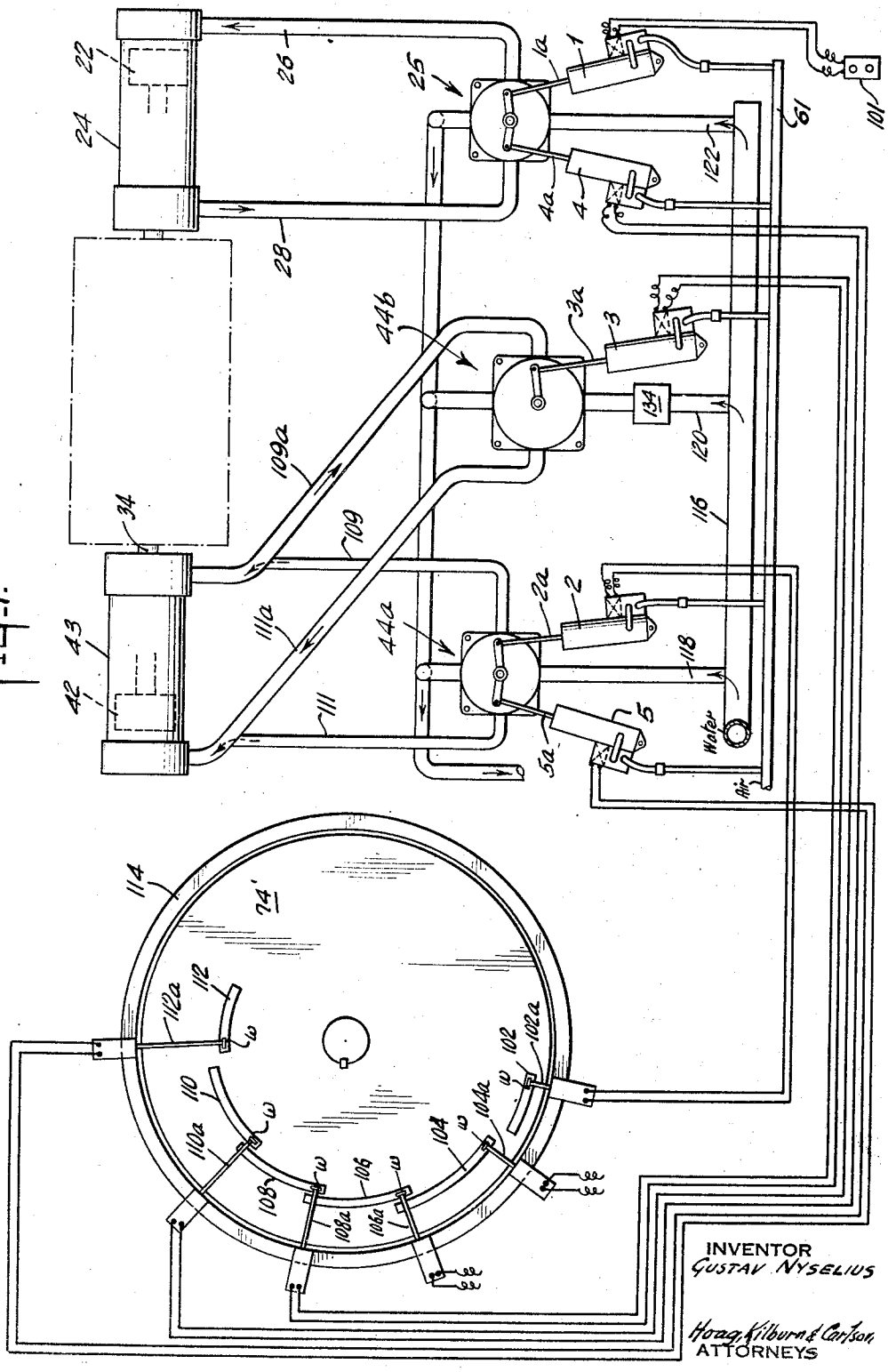
INVENTOR
GUSTAV NYSELIUS
BY
Hoag, Kilburn & Carlson.
ATTORNEYS.

July 28, 1959 G. NYSELIUS 2,896,279

MEANS FOR CONTROLLING THE OPERATION OF DIE CASTING APPARATUS AUTOMATICALLY AND IN TIMED RELATION

Filed July 6, 1956 4 Sheets-Sheet 4

Fig-7.



INVENTOR
GUSTAV NYSELIUS

Hoag, Kilburn & Carlson
ATTORNEYS

United States Patent Office

2,896,279

Patented July 28, 1959

2,896,279

MEANS FOR CONTROLLING THE OPERATION OF DIE CASTING APPARATUS AUTOMATICALLY AND IN TIMED RELATION

Gustav Nyselius, Stamford, Conn.

Application July 6, 1956, Serial No. 596,364

2 Claims. (Cl. 22—68)

This application relates to die casting apparatus and more particularly to means for controlling the operations of such apparatus automatically and in timed-relation.

An object of the invention is to provide means for rendering more automatic the operation of die casting apparatus of the kind disclosed herein.

Another object of the invention is to provide improved control means which is compact and may readily be added to previously manufactured die casting machines.

Another object of the invention is to provide a detachable sub-assembly facilitating exhausting air from the mold of apparatus of the kind described herein in timed relation to feeding molded metal into the mold, which may be readily transferred from one machine to another.

Another object of the invention is to provide apparatus by the use of which castings of improved quality may be obtained.

Other objects will be apparent from reading the following description and claims.

The invention will best be understood if the following description is read in connection with the drawings in which,

Figure 1 is a side elevation of a known die casting machine with my improved control means attached to it.

Figure 2 is a diagrammatic view of electrical circuits, comprising the said control means.

Figure 3 is a top plan view of part of the said control means.

Figure 4 is a diagrammatic side elevation of Fig. 3 showing the turntable and air and vacuum control valves.

Figure 5 is a side elevation of mold plate **12** and attached control member **50**.

Figure 6 is a detail view showing the position of complementary member **50** and **51** when mold members **12** and **16** are closed together, and

Figure 7 is a view similar to Figure 1 but showing a modification of the control means.

Apart from the control means the die casting machine described herein is of known kind. It comprises a stationary frame member **10** to which a mold plate **12** may be demountably attached, as by bolts *b*, and a movable frame member **14** which carries the mold plate **16** which coacts with plate **12** to provide a mold closure. The movable frame member **14** is connected to toggle means **18** which is actuated by movements of piston rod **20** and the piston **22** which is responsive to fluid pressure exerted on it in one direction or the other within cylinder **24**. A source of fluid pressure is connected through two-position 4-way valve **25** and conduits **26** and **28** leading to said cylinder on opposite sides respectively of piston **22** therein, the position of valve **25** determining the direction of movement of the piston.

Projecting from the outer face of member **10** and communicating through a bore **30** in member **10** with which it is aligned is a tubular receptacle **32** for molten metal, which is cut away at the top for convenience in charging the receptacle by means of a ladle. Aligned with the

axis of the receptacle **32** and bore **30** is a reciprocable plunger **34** having an enlarged head portion **36** suitable for pushing a molten metal charge from said receptacle **32** through the bore **30** in member **10** and through the bore **38** in mold plate **12** which is aligned with bore **30** and communicates between it and the mold cavity.

Plunger **34** is actuated by movements of piston rod **40** and the piston **42** which is responsive to fluid pressure exerted on it in one direction or the other within cylinder **43**. A source of fluid pressure is connected through two-position, 4-way valve **44** and conduits **46** and **48** leading to said cylinder on opposite sides respectively of piston **42** therein, the position of valve **44** determining the direction of movement of the piston. Valve **44** is opened twice to provide two forward movements of piston **40**, the first for advancing the plunger **34** into the bore **30** in member **10** and close said bore behind it, and the second to charge the metal into the mold after the mold has been evacuated.

The interior surface of mold plate **12** is provided with the small grooves or gates **49** and **49***a*. Connected to mold member **12**, preferably detachable for transfer from one machine to another, is a member **50** which has the surface groove or gate **52** aligned with groove **49**. Connected to mold member **16** is a member **51** which has a surface adapted to fit tightly against the grooved surface of member **50**. Blocks **50** and **51** are detachably connected to mold members **12** and **16** respectively by Z-shaped clamps **50***a* and **51***a* which extend into transverse slots X in said blocks respectively. When mold plate **16** has been closed against mold plate **12** member **51** covers the semicircular groove or gate **52** and converts it into a conduit through which air may be exhausted from the mold.

Communicating with passage **52** is a bore **54** in block **50** in which is a reciprocable member **56** biased away from passage **52** by spring **58** but which when forced into passage **52** closes it preventing molten metal from advancing into said passage beyond this point. As shown the outer face of member **56** is inclined, and riding on said face is a projectable member **60** which moves member **56** into passage **52** against the action of spring **58** as it advances over said inclined face of member **56**. Member **60** is controlled by compressed air supplied from a suitable source **61** through valve **62** and conduit **64** and **64'** when said valve is opened. Inserted in the outer end of passage **52** is a flexible conduit **66** which is connected through filter F, conduit **67**, air valve **73** and conduit **67'** to vacuum pump **68** which is actuated by motor **70** connected in an electric circuit which may be completed by closing of switch **72**. Conduit **67'** is connected by conduit **67''** to vacuum tank V. Valves **62** and **73** are positioned adjacent the turntable **74**.

Turntable **74** may be rotated by any suitable means. As shown herein it is actuated electrically by motor **76** through the gear reduction unit **78**. Connected in circuit with said motor is a push button switch **81**, by the operation of which rotation of the turntable may be started, and a limit switch **82** positioned close to said turntable.

Carried by the turntable are a number of cam members. As shown the cams **84** on top of the turntable serve to guide a cam follower **86** on one end of arm **88**, the other end of which is connected to said valve **44**. The initial and final or return movements of valve **44** are actuated by movements of said arm **88** derived from the contact of cams **84** on said cam follower **86**. As will be noted the second movement of valve **44** depends on air cylinder C actuated as will be described by an electric circuit including switch **89**. In Figure 1 the moving turntable **74** is a first source of power acting on arm **88** which is a first link to valve **44**, and the cylinder C is a second source of power acting on valve **44** through link-

age which includes the plunger **93** of cylinder C and link **95**. As will be noted from Figure 3 cams **84** cause said cam follower to move both outwardly and inwardly of a circular path concentric with the axis of said turntable, which for convenience is referred to herein as "the neutral line." When rotation of the turntable is started cams **84** move said cam follower out and back from "the neutral line" through a gradual curve *a* and this movement of cam follower **86** and arm **88** turns valve **44** to supply fluid briefly through conduit **46** causing piston **42** to move in a direction which advances plunger **34** only sufficiently to push a charge of molten metal from receptacle **32** into bore **30** and to close said bore behind the molten metal therein, after which valve **44** is returned to neutral position and the plunger again is stationary until air has been exhausted from the mold. Exhausting of the mold is accomplished by cam **90**, shown on the periphery of the turntable, contacting valve **73**. The evacuating step is terminated by cam **92** on the turntable contacting valve **62** thereby causing member **60** to be projected against member **56** thus advancing member **56** and closing the passage **52** and preventing molten metal from being drawn through passage **52** upon being pushed into the mold by plunger **34** which is now advanced for this purpose.

Plunger **34** is advanced sharply to charge the mold by cams **84** moving cam follower **86** outwardly from its "neutral line" in the straight line *b* which causes arm **88** to turn valve **44** to supply fluid pressure to the cylinder **43** on the side of piston **42** which causes plunger **34** to move toward said mold. This action of arm **88** is caused by force of compressed air from cylinder C the valve D of which is actuated by an electric circuit including switch **89** which is closed by contact with projection member **91** on turntable **74**. The plunger **93** of the compressed air cylinder C is attached to the stem of valve **44** by link **95**.

The machine is now opened and plunger **34** is now able to complete its inward or working stroke and in so doing helps to dislodge the metal casting from the front half of the mold. During the portion of a revolution of the turntable, from *b* to *c*, where cam follower **86** is moved in sharply by said cams **84**, cam follower **86** has been held at the same distance beyond its "neutral line." Its movement along the portion of its path indicated as *c* brings the follower inwardly across said "neutral line" and this movement of the follower and arm **88** turns valve **44** to supply fluid pressure to the other side of the piston in cylinder **43** thereby reversing the stroke of the plunger causing it to retract.

The machine may be both closed and opened automatically by cam means on said turntable. As a safety precaution however, the machine is closed by the hand lever **94** acting through link **96** and arm **97** which is connected to valve **25**, and is opened automatically and plunger **34** is retracted by the projection **98** on the turntable striking the extension **97***a* of arm **97** thus both restoring hand lever **94** to its initial position and turning valve **25** to supply fluid pressure to the side of the piston **22** in cylinder **24** to retract the toggle means **18** and thus open the mold by moving mold plate **16** away from mold plate **14**.

A projection **100** carried by the turntable now strikes limit switch **82** thus opening the circuit of motor **76** and stopping rotation of the turntable. This provides time for the next mold charge to be ladled into the receptacle **32** before starting the next cycle of operation by closing said switch **81**, but it will be understood that if the receptacle is filled automatically projection **100** may be omitted and the turntable permitted to revolve continuously to control a number of cycles of operation without a stop between cycles.

In Fig. 7 a modification of the control means is shown. Valve **25** is employed for closing the machine at the beginning of an operating cycle and for opening it near the end of the cycle. In place of valve **44** for operating metal charging plunger **34** two valves **44***a* and **44***b* are employed. Valve **44***a*, through conduits **109** and **111** to opposite sides of piston **42** in water cyclinder **43** controls the first forward movement of the piston **42** and metal feeding plunger **34**, which is the first operating step after the machine is closed, and the return of metal feeding plunger **34**, which is the last operating step in each cycle. Valve **44***b* controls the second forward movement of metal feeding plunger **34**.

The machine is closed by power supplied by air cylinder **1** the piston rod **1***–a* of which is connected to valve **25** on one side of its center and rotates it to permit fluid under pressure to flow into cylinder **24** through conduit **26** thereby actuating piston **22**, in water cylinder **24**, to close the machine. Air cylinder **1** is controlled by an electric circuit which I prefer to close manually by means of the push button switch **101**.

Also connected to water valve **25** is the air cylinder **4** the piston rod **4***a* of which is connected to valve **25** on the other side of its center from its connection to the piston rod **1***–a* of cylinder **1** and which serves to open the machine as will be described.

Air cylinders **2** and **5** are connected to valve **44***a*, on opposite sides of its center, by piston rods **2***a* and **5***a* respectively, and air cylinder **3** is connected to valve **44***b* by piston rod **3***a*. Cylinder **2** is a first source of power used for the first stage of the charging stroke. Cylinder **3** is a second source of power used for the second stage of the charging stroke.

On turntable **74′** are the six cams **102**, **104**, **106**, **108**, **110** and **112**, and mounted on the circular support **114** which surrounds turntable **74′** are the cam followers **102***a* and **104***a*, **106***a*, **110***a* and **112***a* which are of known kind. Each cam follower comprises a wheel *w* which is mounted on a vertically movable arm which when lifted by its cam closes an electric circuit or opens an air valve. When a cam follower moves off its cam the wheel *w* and its support arm drop down thus opening the electric circuit or closing the air valve as the case may be.

The circuit controlled by cam follower **102***a* is connected to cylinder **2** which is linked to water valve **44***a* and actuates the metal feeding plunger to move through the first part of its stroke, valve **44***a* being returned to neutral when the cam follower moves off its cam.

The cam follower **104***a* controls an air valve Fig. 7 in the negative pressure conduit **66** shown in Fig. 1.

The cam follower **106***a* controls an air valve Fig. 7 in the compressed air conduit **64** shown in Fig. 1.

The cam follower **108***a* controls the electric circuit leading to cylinder **3** connected to water valve **44***b* and actuates the metal feeding plunger to move through the second portion of its stroke, valve **44***b* being returned to neutral, i.e. closed position when this cam follower moves off its cam.

The cam follower **110***a* is connected to air cylinder **4** which turns valve **25** to open the machine.

The cam follower **112***a* is connected to air cylinder **5** which turns valve **44***a* to return the metal charging plunger **34** to its starting position. When follower **112***a* moves off its cam valve **44***a* is returned to neutral position, ending an operating cycle of the machine.

It will be noted that cam **104** overlaps cam **106**; that **106** overlaps **108**; and that **108** overlaps **110**. Cam **104** serves to start reduction of pressure in the mold immediately after the first movement of the metal feeding plunger **34**, and continues the reduced pressure until the vacuum line **49** is closed by the plug **54**, through means actuated by cam **106**. Cam **106** has enough length to keep the vacuum line plugged until after the casting is formed. Cam **106** thus overlaps the cam **108** which actuates the means by which valve **44***b* is turned to cause the metal feeding plunger **34** to be advanced through the second part of its stroke.

The air cylinders employed are of known kind in which

a piston is actuated by a solenoid connected in the circuits respectively.

Valves **25**, **44***a* and **44***b* are shown respectively connected to a main pressure line **116** through branch conduits **118**, **120** and **122**. If desired a known means for reducing the pressure of fluid delivered to said valves may be employed. Such a means is indicated by the numeral **134**, inserted in branch conduit **120**.

There has thus been provided an improvement in apparatus for automatic control of die casting machines in which the various objects set forth above are successfully achieved with many thoroughly practical advantages. It will be understood that the description and drawings are illustrative and not to be interpreted in a limiting sense.

What I claim is:

1. In a die casting machine having a mold and a reciprocable plunger to push molten metal into the mold, means for actuating the plunger in two charging steps and a return step, including, a fluid cylinder and piston means therein connected to said plunger, a source of fluid under pressure, a conduit interconnecting said source of fluid pressure and said fluid cylinder on opposite sides of the piston therein, a four-way valve in said conduit, two operating arms connected to said valve, a first source of power, and means connecting it to one of said operating arms, a second source of power and means connecting it to the other of said operating arms, said first named connecting means including a turntable, cam means thereon, a cam follower and link means connecting said cam follower to one of said operating arms for rotating said valve mechanically upon actuation of said cam follower by said cam means, said second named connecting means including an air cylinder, link means connecting said air cylinder to said second operating arm, and an electrical circuit for controlling said air cylinder, said circuit including a switch and means carried by said turntable for opening and closing said switch in timed relation to the actuation of said cam follower by said cam means.

2. The apparatus claimed in claim 1 including a vacuum line connected to said mold, means for exerting negative pressure on said vacuum line including air valve means, separate means for closing said vacuum line in timed relation to feeding molten metal into said mold, including a compressed air conduit, a source of compressed air, and valve means for controlling the supply of compressed air from said source into said conduit, means for opening the mold, and means on said turntable for actuating each of said aforementioned means in timed sequence.

References Cited in the file of this patent

UNITED STATES PATENTS

1,724,332	Will et al.	Aug. 13, 1929
1,974,822	Lannert	Sept. 25, 1934
1,989,812	Lester	Feb. 5, 1935
2,216,059	Vontobel et al.	Sept. 24, 1940
2,243,835	Brunner et al.	June 3, 1941
2,293,087	Tann	Aug. 18, 1942
2,581,550	Misfeldt	Jan. 8, 1952
2,668,985	Babbitt	Feb. 16, 1954
2,774,122	Hodler	Dec. 18, 1956