Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 1

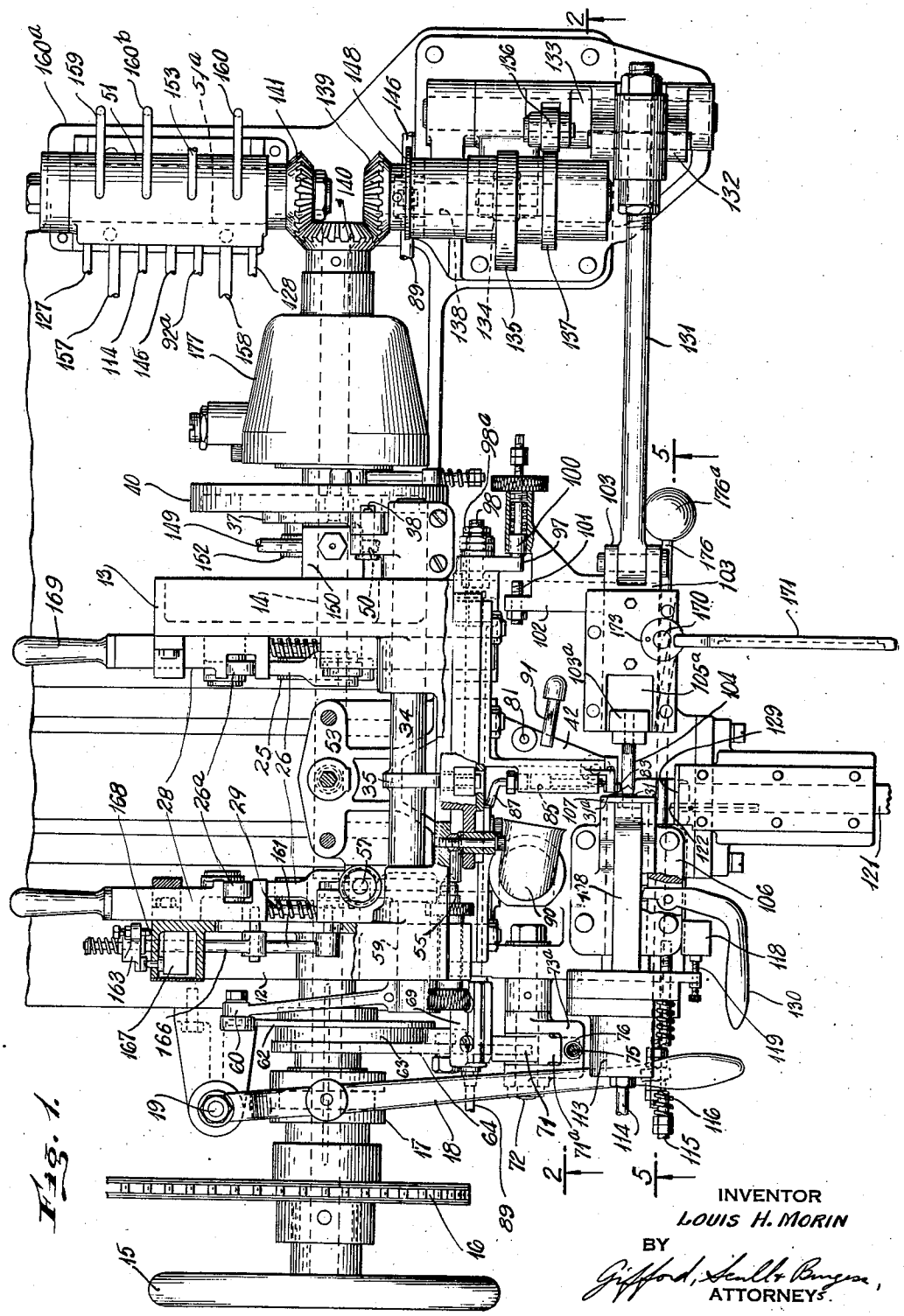


Fig. 1.

INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess,
ATTORNEYS.

Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 2

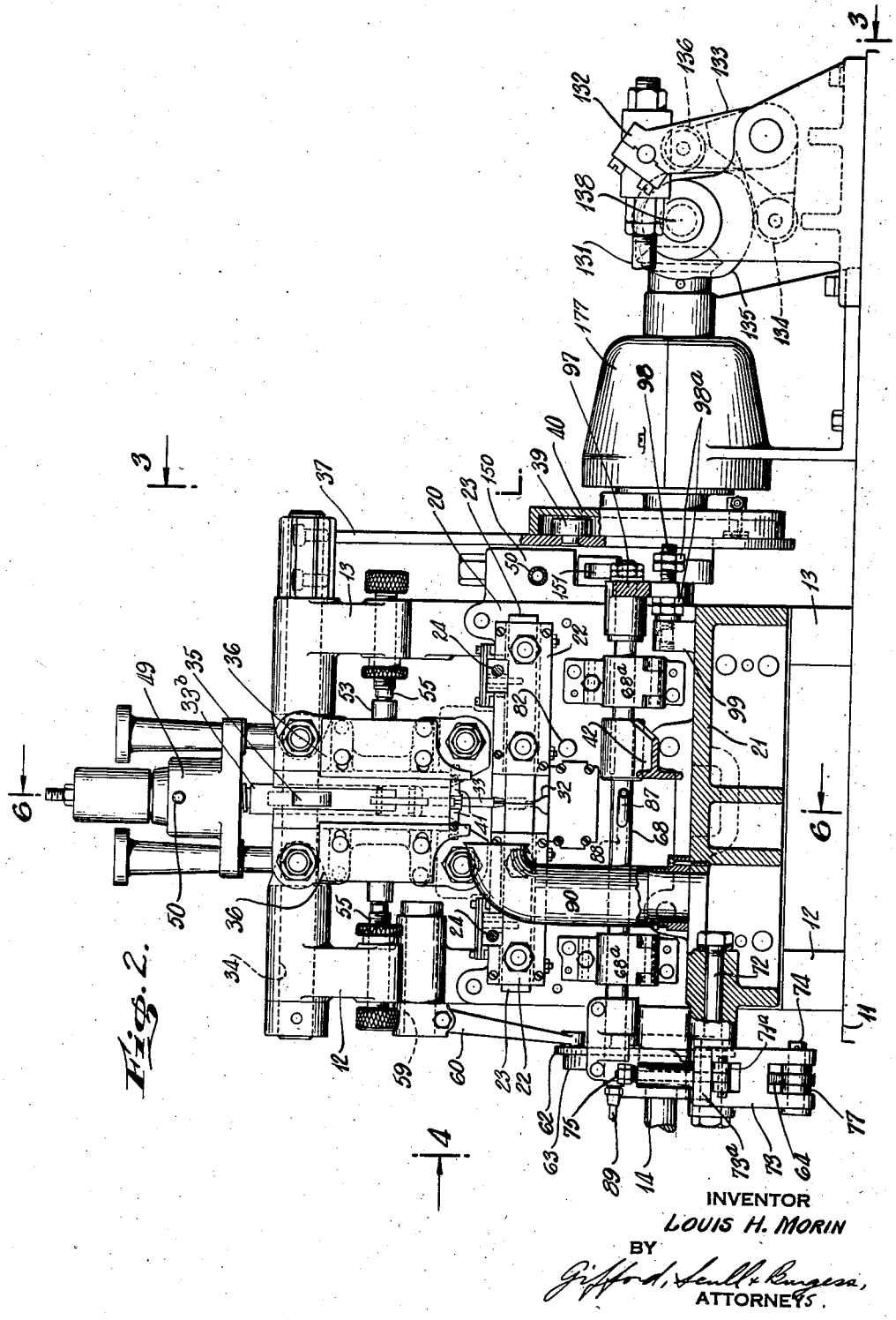


Fig. 2.

INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess,
ATTORNEYS.

Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 3

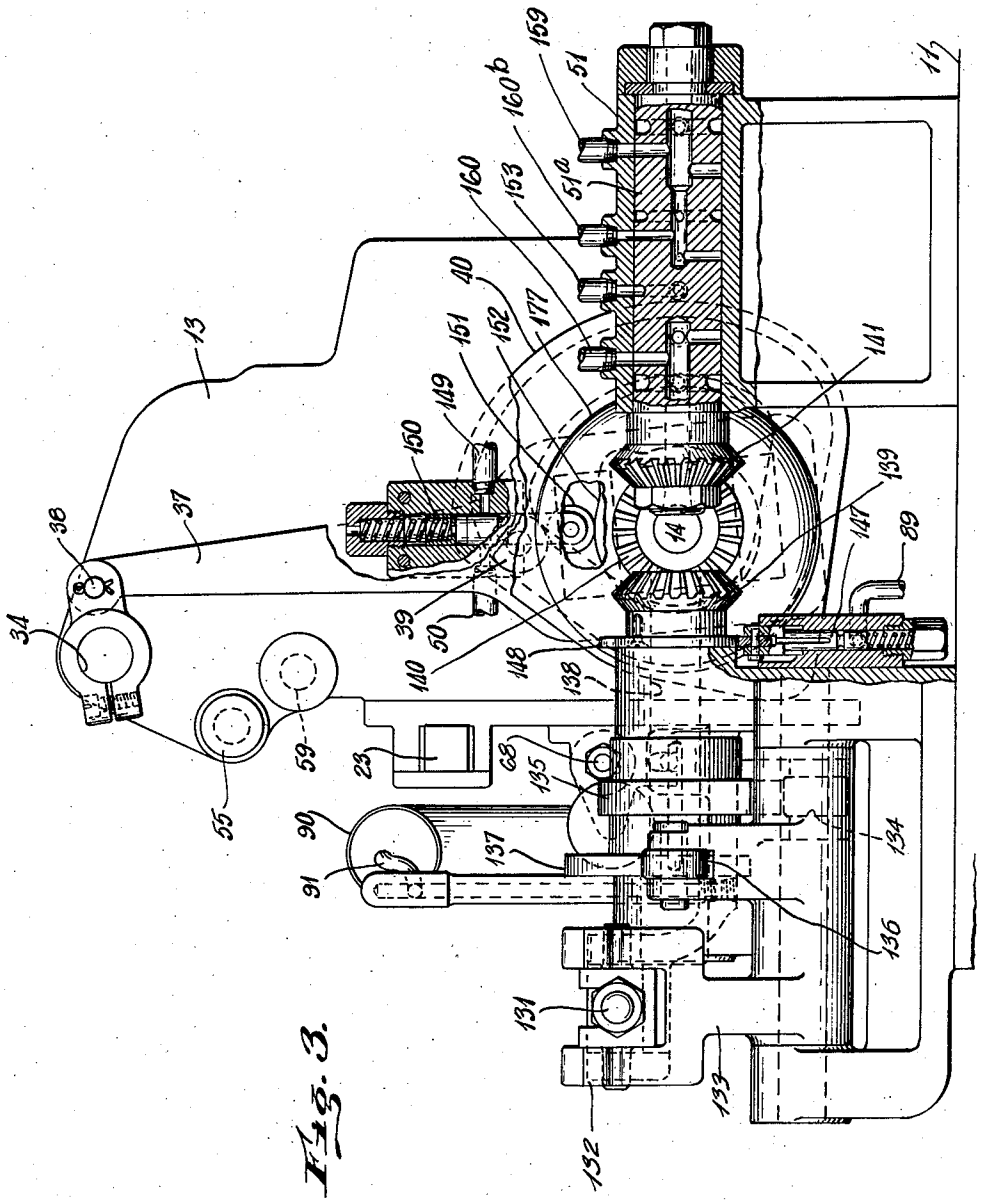


Fig. 3.

INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess
ATTORNEYS

Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 4

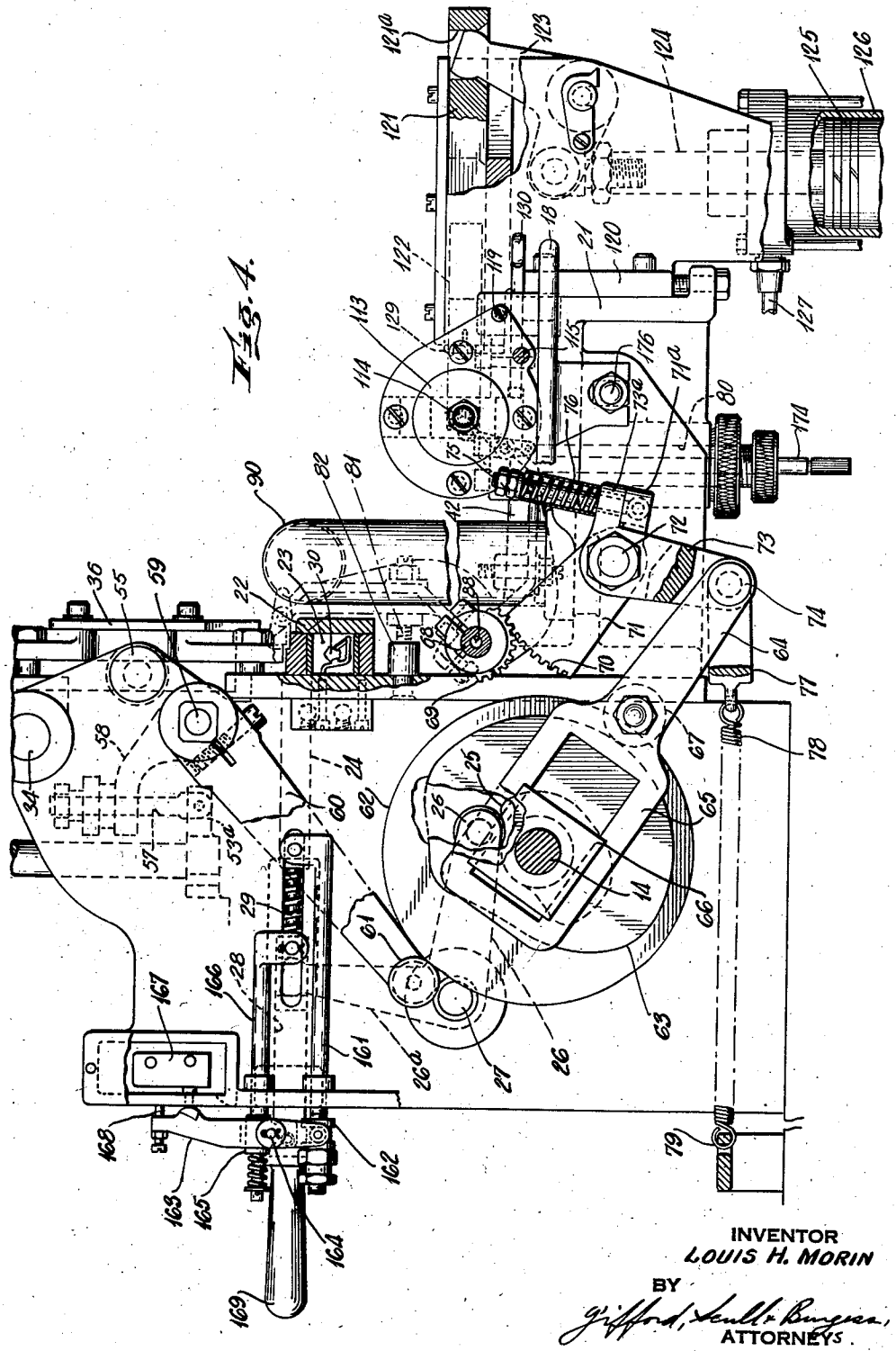


Fig. 4.

INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess,
ATTORNEYS.

Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 5

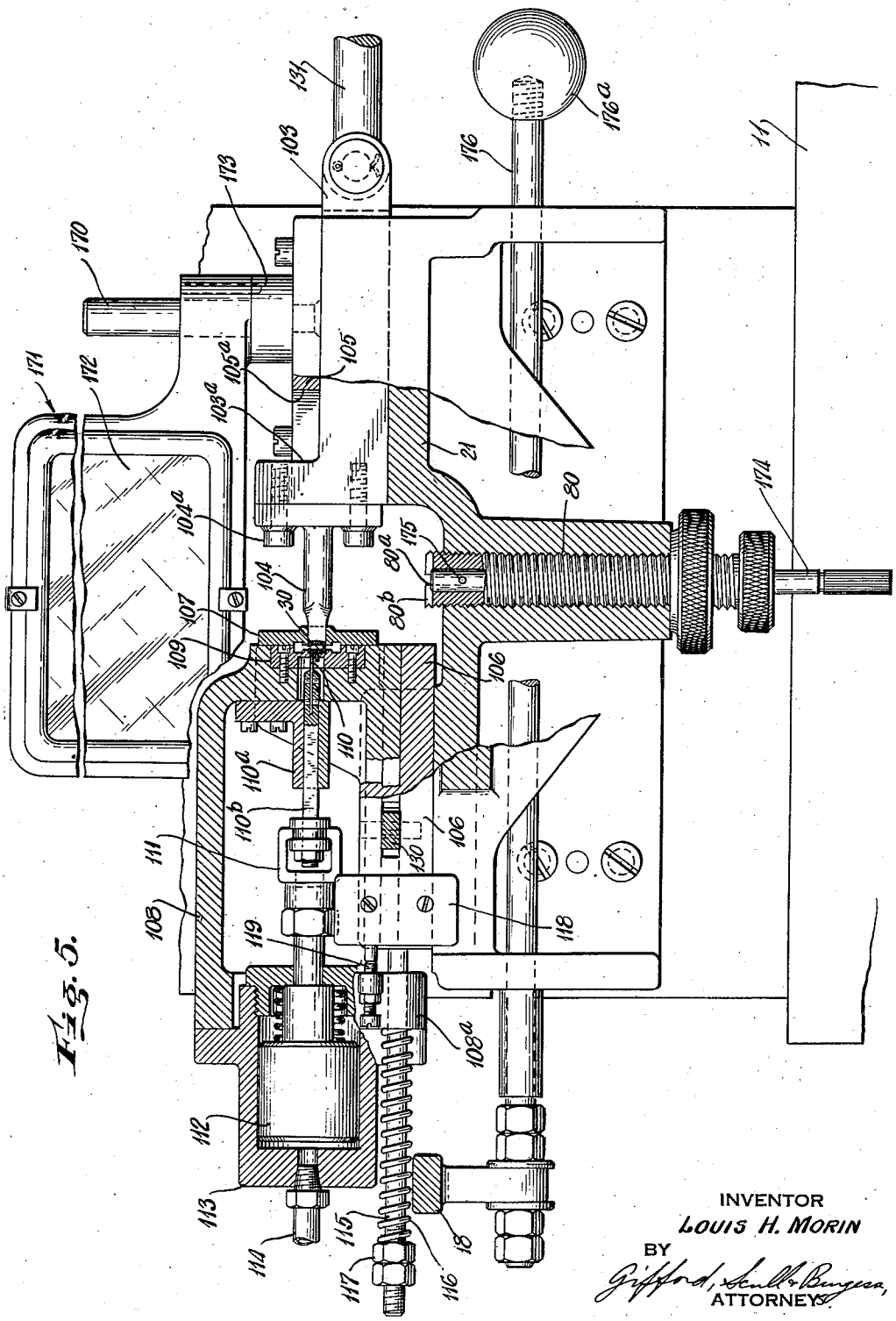


Fig. 5.

INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess,
ATTORNEYS

Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 6

Fig. 6b

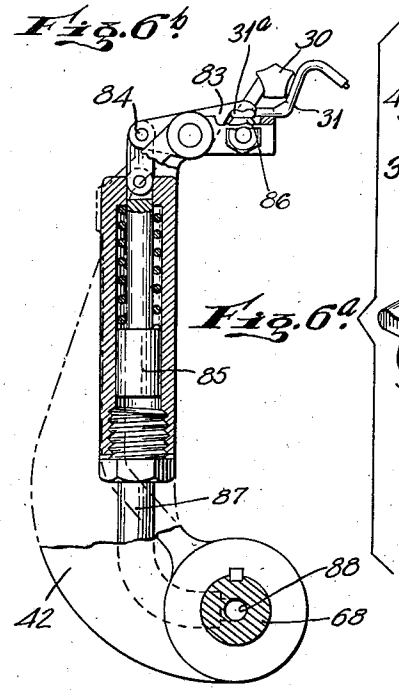


Fig. 6a

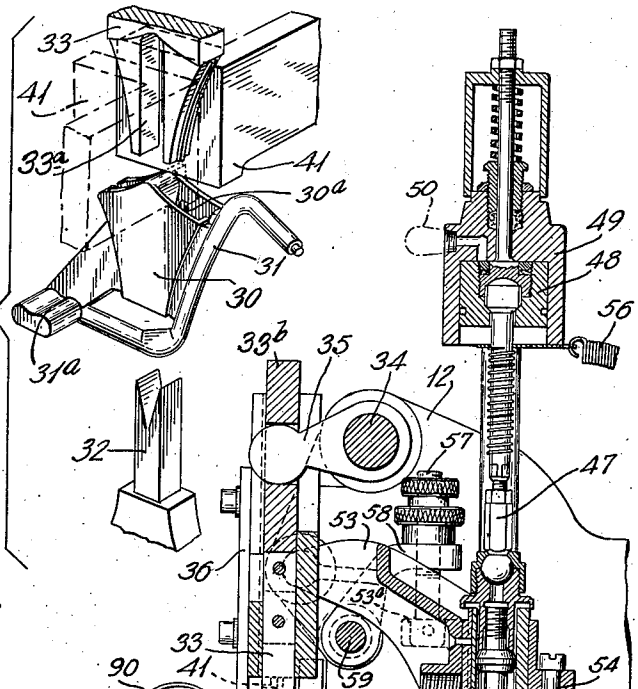
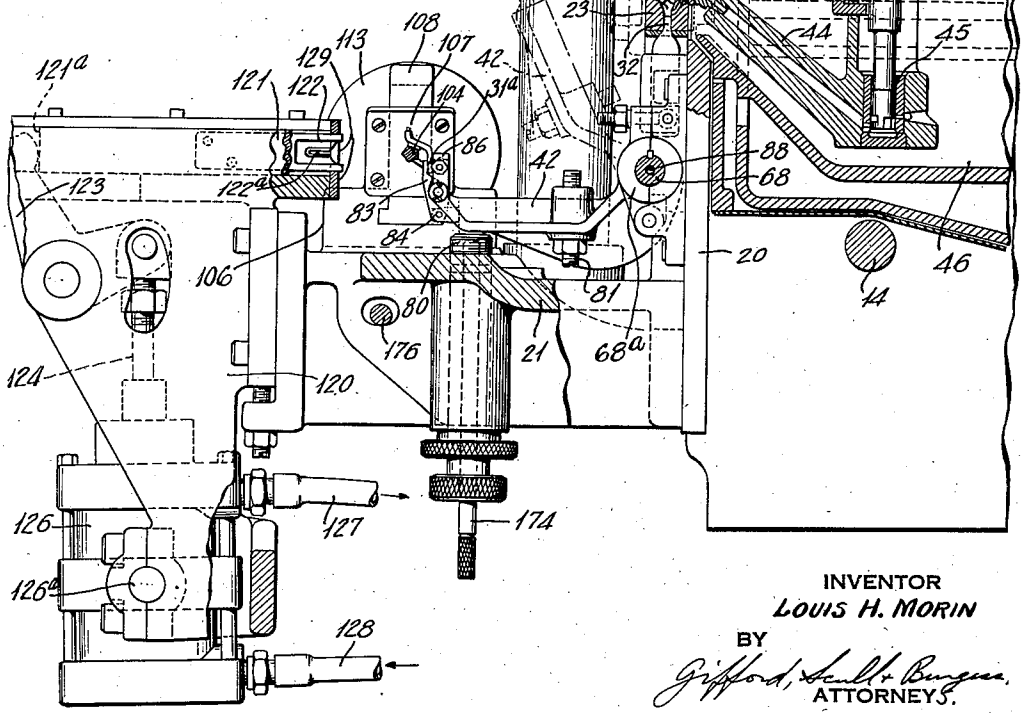


Fig. 6.



INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess,
ATTORNEYS.

Jan. 16, 1945. L. H. MORIN 2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Filed July 25, 1940 7 Sheets-Sheet 7

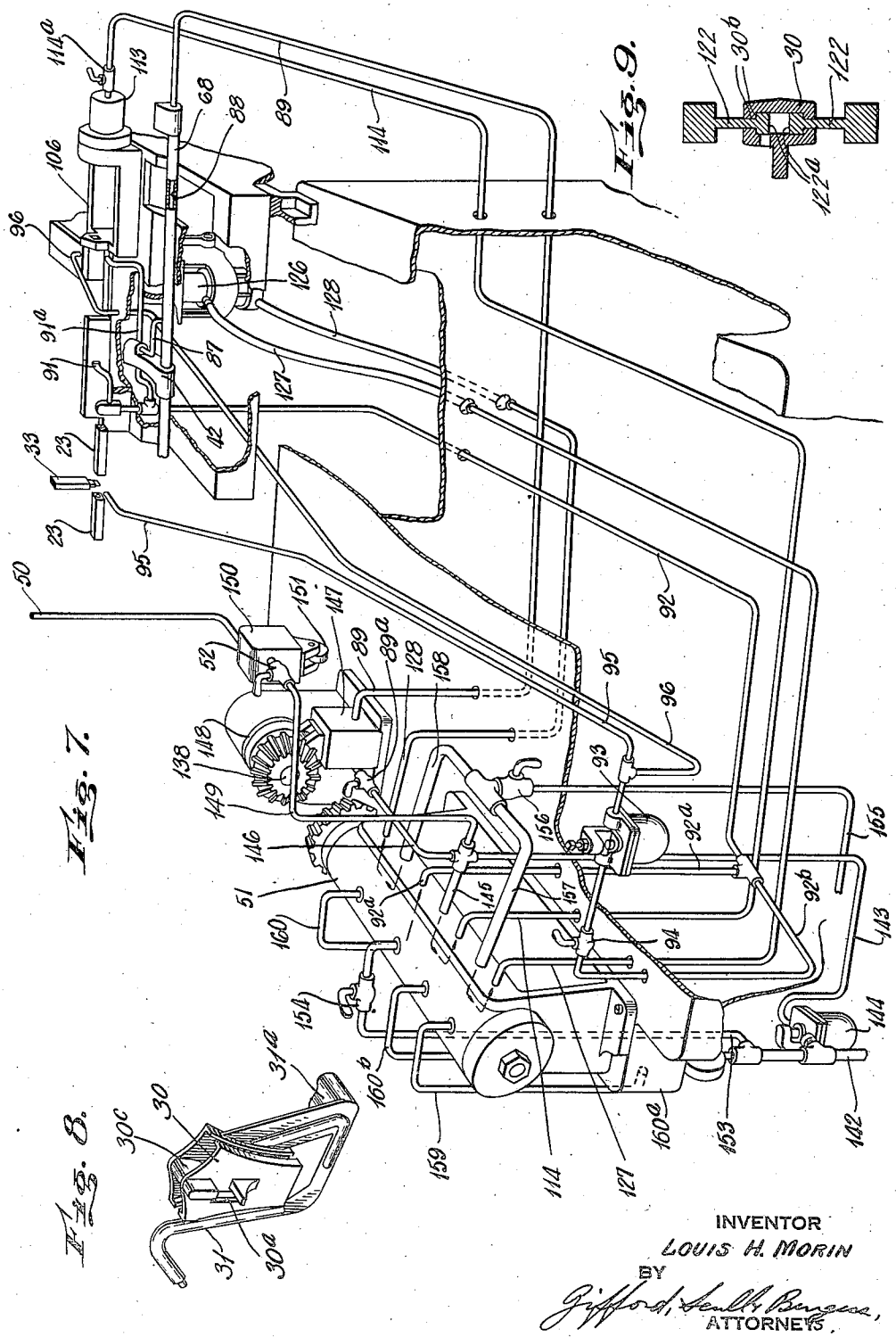


Fig. 7.

Fig. 8.

Fig. 9.

INVENTOR
LOUIS H. MORIN
BY
Gifford, Scull & Burgess,
ATTORNEYS.

Patented Jan. 16, 1945 2,367,303

UNITED STATES PATENT OFFICE

2,367,303

APPARATUS FOR FORMING AND TRIMMING DIE CASTINGS

Louis H. Morin, Bronx, N. Y., assignor, by mesne assignments, of one-half to said Louis H. Morin and one-half to Davis Marinsky, Bronx, N. Y.

Application July 25, 1940, Serial No. 347,426

27 Claims. (Cl. 29—33)

This invention relates to die casting machines, and particularly machines of this kind wherein a casting is first formed and then trimmed in each cycle of operation of the machine. More particularly the invention consists in a machine for forming die castings on two relatively movable cores and in including means for picking up and delivering a formed casting to a trimming station where the casting is trimmed in forming the finished product. The novel features of the invention will be best understood from the following description when taken together with the accompanying drawings, in which certain embodiments of the invention are disclosed and in which the separate parts are designated by suitable reference characters in each of the views and in which:

Fig. 1 is a plan view of the machine made according to my invention with parts of the construction broken away and in section.

Fig. 2 is a partial section on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view on the broken line 3—3 of Fig. 2.

Fig. 4 is a view looking in the direction of the arrow 4 of Fig. 2 on an enlarged scale showing only a part of the construction and with parts broken away.

Fig. 5 is a partial section on the line 5—5 of Fig. 1 on an enlarged scale.

Fig. 6 is a central vertical section substantially on the line 6—6 of Fig. 2 with parts of the construction broken away.

Fig. 6a is an enlarged perspective view of part of the construction shown in Fig. 6.

Fig. 6b is an enlarged sectional view of another part of the construction shown in Fig. 6.

Fig. 7 is a diagrammatic view illustrating the transmission of air from the main control valve to the various operative parts of the machine.

Fig. 8 is a perspective view of a slider cast in the machine and before trimming the same.

Fig. 9 is a sectional view of a part of the construction shown in Fig. 5 on an enlarged scale illustrating one of the trimming tools in the casting.

In the formation of intricate die castings; that is to say castings employing one or more core members, such for example as the slider of separable fasteners, it has been the common practice and procedure to first form the casting, remove or deliver the same from the machine, and then convey the same to a specially constructed trimming machine from which the castings are fed by a hopper or by hand into the trimming machine. In some instances these trimming operations have been multiple or even triple. The foregoing procedure has been extremely expensive, not only from the standpoint of handling and labor costs, but from the standpoint of machine construction and problems of automatic feeding of the cast members. It is the purpose of my present machine to form various types of intricate castings of the kind under consideration, to remove and pick up the castings from one core, and to feed the same to a trimming position or station where the casting is completely trimmed, producing a finished product, insofar as the shape and form of the product is concerned, and aside from any drilling or other forming operations which may be required.

My improved machine comprises an openwork base or table 11, only part of which is illustrated. Upon the base 11 is supported two upright frame members 12 and 13 in which is arranged a main drive shaft 14, at one end of which is a hand wheel 15 for manually rotating the shaft. Inwardly of the wheel 15 is a drive sprocket 16 driven by a chain from a motor not shown. A clutch 17 is keyed to the shaft 14 to place the shaft in operative engagement with the sprocket 16. The clutch 17 is operated by a lever 18 pivoted to a bracket as seen at 19 in Fig. 1 of the drawings.

Supported on the front of the vertical frames 12 and 13 is a face plate 20 having at its lower end an outwardly extending table portion 21. Coupled with the face plate 20 are guides 22 for two dies 23 movable toward and from each other by forwardly and backwardly reciprocating bars 24 operated by cams 25 on the shaft 14 through levers 26 pivoted as seen at 27 in Fig. 4 of the drawings. The bars 24 have cam surfaces, not shown, cooperating with similar surfaces on the dies to move the dies inwardly and outwardly toward and from each other, as taught in application No. 152,942, filed July 10, 1937, now Patent No. 2,244,425, issued June 3, 1941. At the inner end of the bars 24 are plunger rods 28 with which the arms 26a of the levers are freely coupled. The plungers are movable with respect to the bars 24, but the latter are driven through springs 29 so that in the event of the presence of any foreign material between the dies, the positive action of the levers 26, 26a will be taken up through the springs 29. It will be understood that the dies 23 are water cooled as taught in said application, but the illustration of the circulation of water through the dies is omitted simply to clarify the present illustration.

Adjacent abutting surfaces of the dies have impressions therein to form cast sliders 30 such as are commonly employed in coupling and uncoupling the stringers of separable fasteners. One of these sliders is shown in detail in Fig. 8 of the drawings. On the parting line of the dies is a gate aperture forming a gate 31 on the casting of the general contour seen in Fig. 8 and also indicated in other figures. The gate 31 has an end portion 31*a* which is shaped to receive a gripper mechanism, later described, in feeding the casting to the trimming stage or station as well as to an ejector station for ejecting the gate from the machine.

Supported between the dies 23 on the parting line thereof is a stationary but adjustable core 32 above which is a vertically movable core 33 having a forked end 33*a* for receiving the pin end of the stationary core 32 in forming the channels of the cast slider.

Arranged at the upper end of the frames 12 and 13 is a rocker shaft 34 carrying a rounded head arm 35 centrally thereof which is coupled with an extension 33*b* of the core 33 to actuate the same; the core being disposed in adjustable guide plates 36 arranged upon the plate 20. The shaft 34 is actuated through an arm 37 pivoted to a clamp secured to the shaft 34 as seen at 38 and having at its lower end a roller 39 operating in a cam 40 driven from the shaft 14, so that in each cycle of operation of the machine the core 33 is raised and lowered. In moving the core 33 into raised position, the casting 30 is stripped from the core by a stripper plate 41. At the same moment, the casting is picked up by a gripper or pick-up and carry mechanism 42, later described.

At 43 is shown the discharge nozzle at the end of a gooseneck 44 from which heated casting material is pressure injected into the cavity of the dies in forming the castings 30. In Fig. 6 of the drawings is indicated a plunger 45 operating in the gooseneck and controlling feed of casting material from the melting pot 46 into the gooseneck and the discharge of material therefrom. The plunger carries at its upper end an adjustable link or rod 47 which in turn carries at its upper end a piston 48 operating in an air cylinder 49 to which air is supplied through a pipe 50 from an automatic control valve 51 diagrammatically illustrated in Fig. 7. Arranged in the pipe 50 is a control or check valve 52 by means of which supply of air to the cylinder 49 may be cut off at will in making tests in the machine when the discharge of metal is undesirable. The plunger operating mechanism forms no direct part of the present invention and is illustrated simply to disclose a means for pneumatically operating the plunger 45 in pressure injecting the casting material into the dies.

The gooseneck 44 is adjustably and detachably supported in a bracket 53 as seen at 54, the bracket 53 being pivoted to the frames 12 and 13 by adjustable bearing pins 55, note Fig. 2 of the drawings. A spring 56 is coupled with the cylinder 49 to support the nozzle 43 in engagement with the dies 23 under sufficient pressure during the casting operation. However, an adjustable screw 57 is supported in connection with an arm 58 arranged upon a shaft 59 and cooperates with an extension 53*a* on the bracket in supporting the nozzle out of pressure engagement with the dies intermediate the casting stages. This is controlled by a long arm 60 secured to the shaft 59 and having a roller 61 at its free end operating upon the surface of a cam 62 mounted on the shaft 14. Adjacent the cam 62 is another cam 63 for actuating an arm 64, the rectangular frame end 65 of which is guided upon a square bearing 66 on the shaft. The arm 64 carries a roller 67 engaging the surface of the cam 63. This mechanism is employed to actuate the pick-up and carry mechanism 42.

The mechanism 42 comprises a swinging frame secured to a shaft 68 supported in suitable bearings 68*a* arranged on the plate 20. One end of the shaft 68 has a gear segment 69 secured thereto in connection with which operates the rack end 70 of an arm 71 pivoted as seen at 72. The arm 71 has an extension 71*a* arranged in the upper yoke-shaped end of a link 73 also pivoted on the stub shaft 72. The other yoke-shaped end of the link 73 receives the lower end of the arm 60 and is pivoted thereto by a pin 74, note Figs. 2 and 4 of the drawings. The link 73 has a top cross plate 73*a* through which freely passes a pin 75 pivoted to the extension 71*a* which is forked to receive the lower end of the pin. On the pin 75 is arranged a spring 76, the function of which is to control operative engagement between the lever 71 and the link 73. At 77 is shown a forked coupling link arranged on the pivot 74 and to which is coupled a spring 78 anchored as seen at 79, note Fig. 4, to support the roller 67 in constant engagement with the cam 63.

Adjustably supported in the bed plate 21 of the frame of the machine is a stop screw 80 which engages the frame 42 to limit downward movement of the frame. Another adjustable screw 81 is carried by the frame 42 and cooperates with a pin 82 on the plate 20 to control the positioning of the free end of the swinging frame with respect to the casting in order to accurately engage the end 31*a* of the gate portion thereof. Pivotally supported in the free end of the frame 42 is a gripper finger 83, to the other end of which is pivoted as seen at 84 an air operated piston 85 for actuating the gripper finger to engage the gate end 31*a* between it and a part 86 on the frame 42. Air is supplied to the cylinder in which the piston 85 operates through a pipe 87 which extends to and communicates with a bore or passage 88 formed in the shaft 68 and to which air is supplied from a pipe 89 coupled with one end of said shaft. The air supply to pipe 89 from the control valve cylinder 51 is later described.

In the operation of the machine it will be understood that when the frame 42 is moved into raised position as indicated in dotted lines in Fig. 4 of the drawings, air will be supplied to operate the gripper finger 83 instantaneously upon the stripping of the casting 30 from the core 33 so as to convey the casting including the gate 31 thereon to the trimming station where several trimming operations are performed. After this, the frame 42 is raised to the position indicated in dotted lines in Fig. 6 to bring the gate remaining in the gripper 83 in registering position with a large discharge tube 90. At this instant, air is cut off to release the gripper 83, and simultaneously a blast of air is discharged from a blow-off pipe 91 arranged in front of the discharge tube 90 to eject the gate into the tube, and air is supplied to the blow-off tube 91 from a pipe 92 coupled with the valve cylinder 51 through an extension 92*a*. The pipe 92 also has a branch 92*b* which extends to a lubricating oil supply device 93 through a control valve 94 so as to supply lubricant to two feed pipes 95 and 96; the pipe 95 extending to the dies and cores whereas the pipe 96 extends to the trimming tool,

later described. At 91a is another extension on the pipe 92 for supplying a blast of air at the trimming station to remove any particles that may prevail around the trimming tools. All of this structure is clearly illustrated in the diagrammatic showing in Fig. 7 of the drawings.

On the shaft 68 is a dog 97 keyed to a screw 98 supported in a lug 99 on the frame 21, note Fig. 2. Adjustable nuts 98a on the screw 98 serve to check sliding movement of frame 42 in both directions and also to maintain proper alinement thereof. The dog 97 is also disposed between a plunger pin 100 and an adjustable screw 101, note Fig. 1. The pin 100 and screw 101 are supported on an arm extension 102 on the plunger 103 which carries the trimming tool or punch 104. The plunger operates in a suitable bearing or guide 105 provided on the frame 21, note Fig. 5. The plunger 103 has an upstanding lug 103a which operates in a slot 105a in the bearing. The tool 104 is detachably supported on the plunger by screws 104a. The plunger pin 100 provides yieldable sliding movement of the frame in advancing the casting by the punch 104 in the direction of the trimming tools, whereas the pin 101 serves to return the swinging frame to properly alined position in the movement of the plunger 103 to withdraw the plunger 104.

Supported at the inner end of a channeled bracket 106 is a die plate 107 for trimming peripheral edges of the casting 30 forced through the plate by the punch 104 which also trims off the gate 31. Slidably mounted in the channel of the bracket 106 is a plunger casing 108 carrying at its forward end a die pad 109 for receiving the casting 30 and to support the same in alinement with a piercing tool 110 for piercing a hole 30a in the casting to trim the same. The piercing punch is adjustably supported on a coupling 111 on the reduced end of a piston 112 arranged in an air cylinder 113 carried by the plunger casing 108. A pipe 114 places the cylinder 113 in communication with the valve 51 through a shut-off valve 114a as diagrammatically illustrated in Fig. 7. The plunger casing 108 carries at one side thereof a lug 108a movable on a rod 115 on which is arranged a spring 116, the tension of which is adjusted by nuts 117. The spring serves to hold the casing 108 in position and to resist or cushion the action of the punch 104 upon the workpiece and the pad 109 as will be apparent. At 110a is shown a guide for supporting and guiding the large part 110b of the punch.

Supported upon the bracket 106 is a micro switch 118 which cooperates with an adjustable screw 119 on the lug 108a, which is part of the frame 108, so that in the event of improper operation of the punch 104 which would tend to move the sliding frame 108 against the action of the spring 115, the contact of the screw 119 will be broken with the switch causing the machine to automatically stop.

Arranged upon the frame 21 is an adjustable bracket 120 which carries at its upper end a punch adapter or slide 121 supporting on its inner end a trimming punch or tool 122 for trimming the casting 30 when supported between the punch 104 and pad 109 as seen in Fig. 5. The tool 122 serves to trim the casting longitudinally of the channel thereof, the tool 122 being operated by a bell crank 123 engaging an aperture 121a in the adapter, and to the other end of which is pivoted the connecting rod 124 of a piston 125 supported in an air cylinder 126. The connection between the rod 124 and bell crank is adjustable to properly set the position of the tool 122. Air is admitted to the cylinder 126 through a pipe 127 to move the tool inwardly, and is admitted into the cylinder 126 through a pipe 128 to retract the tool. In this latter operation the trimmed casting is removed from the tool 122 by a stripper plate 129 and the casting is dropped through the machine into a suitable receiver. The pipes 127, 128, note Fig. 6, extend from the cylinder 123 and as illustrated in the diagrammatic view, Fig. 7, are directed to the control valve 51 which regulates the timing of the operation of the punch 122.

It will appear from a consideration of Fig. 6 of the drawings that the cylinder 126 is mounted to swing about an axis 126a in the bracket 120 to compensate for the swinging movement of the bell crank. It will also appear from a consideration of Fig. 1 of the drawings that a hand operated lever 130 may be pivotally supported in connection with the bracket 106 to engage the sliding housing 108 to manually operate the same at will.

Coupled with and extending from the plunger 103 is a connecting rod 131, the end of which is adjustably and operatively supported within the forked end 132 of a follower 133 carrying a roller 134 operating in connection with a cam 135 and an upper roller 136 operating in connection with a cam 137. The cams 135 and 137 serve to impart the forward and backward movement to the plunger as will be apparent. These cams are mounted on a shaft 138 having a beveled gear 139 meshing with a beveled gear 140 on the drive shaft 14, note Fig. 1 of the drawings. Arranged opposite to and in alinement with the shaft 138 is the rotatable valve element 51a of the valve 51 which constitutes a shaft carrying at its inner end a beveled gear 141 also in operative engagement with the gear 140. The valve element 51a has a series of ports and passages so arranged with respect to the various pipes leading to the cylinder 51 as to automatically control the supply of air to the various distributing points as will readily appear. In Fig. 7 of the drawings is shown a high pressure air supply pipe 142 from a suitable source of controlled supply, from which a high pressure pipe line 143 passes from a lubricator 144 to the cylinder 51 through the pipe 145.

The valve 51a controls the discharge through the pipe 114 to the cylinder 113. A pipe 146 also leads to a control valve 147 actuated by a cam 148 on the shaft 138 in controlling the passage of air through the pipe 89 which leads to the gripper mechanism, thus controlling the operation of the gripper. A shut off valve 89a is provided in the pipe 146 to control the gripper mechanism. Another pipe 149 extends to another control valve 150 in controlling the supply of air to the pipe 50 which leads to the cylinder 49 in controlling the operation of the plunger 45 discharging the casting material. Note in this connection Figs. 3 and 7.

The operation of the valve 150 is controlled by a roller 151 operating upon a cam 152 adjustably mounted on a sleeve extension of the cam 40, as indicated in Figs. 1, 2 and 3 and diagrammatically in Fig. 7. At 153 is shown a blow-off line leading from the high pressure inlet controlled by a shut-off valve 154, note Fig. 7, which enters the valve casing 51, the valve 51a of which controlling discharge through the pipe 92a which leads to the pipes 92 and 92b for supplying the blast of air through the pipes 91, 91a and also for the supply of lubricant to the pipes 95 and 96, as previously described. At 155 is a low pressure air

supply from a suitably controlled and regulated source, not shown, which extends to a valve 156 supplying air to the valve cylinder 51 through pipes 157 and 158, note Fig. 7. The valve 51a controls the passage of air from the pipe 157 to the pipe 127 for supply to the cylinder 126, whereas the valve 51a controls the transmission of air from the pipe 158 to the pipe 128, also directed to said cylinder. At 159 and 160 are shown exhaust pipes from the cylinder 51 to exhaust the air from the cylinder 126 to a muffler casing 160a, in the different operations thereof, and another exhaust pipe 160b also extends to said casing; whereas suitable exhausts will be provided for the other air lines as will be apparent.

Coupled with one of the bars 24, note Fig. 4, is a rod 161 carrying at its inner end an adjustable collar 162. A switch lever 163 is pivoted as seen at 164 and engages the collar 162 as well as a collar 165 on another rod 166. The rod 166 is pivoted to the plunger 28 movable relatively to the bar 24 to which the rod 161 is pivoted. This construction serves to control the operation of the switch lever 163 to actuate a micro switch 167 to automatically stop the machine in the event of the presence of any foreign material between the dies or improper closure thereof which will set up a differential movement between the rods 161 and 166. At 168 is shown a stop screw which limits the movement of the lever in the direction of the switch so as to prevent any strain on the switch which is highly sensitive. At 169 is shown a cam lever for manually throwing the dies into open position, as is taught in the application hereinbefore referred to.

Arranged upon an upstanding post 170 on the right front side of the machine is a swinging frame 171, note Figs. 1 and 5, supporting a transparent panel of non-breakable material 172 to be positioned in front of the dies during the casting operations of the machine, the frame being held in this position by a pin 173 operating in a socket of a flange on the base of the post 170. By raising the frame, the same can be swung into inoperative position to give access to the dies and may be supported in this other position by the pin 173.

Slidably supported in the adjustable bottom stop screw 80 is a pin 174 having a cross pin 175 near the upper end thereof which normally seats in a slotted portion 80a of the screw in maintaining the pin 174 in depressed position. By raising the pin 174 and turning the same 90° the cross pin 75 may be dropped into recesses 80b in the upper surface of the screw 80 so as to support the pin end above the screw to limit downward movement of the swinging frame, and in fact to prevent the casting from coming in alinement with the trimming tools. Thus at any time a casting with the gate thereon may be removed from the machine for inspection or any other purpose. At 176 is shown a long operating lever which is coupled with the lever 18 and extends to the right side of the machine and is provided with a hand grip 176a whereby the clutch may be operated at the right side of the machine as well as the left side thereof as will be apparent.

In Fig. 1 of the drawings is diagrammatically illustrated at 177 a housing containing an automatic throwout mechanism, the structure of which forms no direct part of the invention, and for this reason no specific description thereof is given except to illustrate that the cam 40 is driven from the shaft 14 through this clutch mechanism so that in the event of the downward movement of the core 33, due to any clogging or congestion in the machine, the strain or stress placed upon the cam will cause the automatic clutch to break the driving connection between the shaft 114 and the cam. In view of the fact that the cam 152 is mounted on the hub or axis of the cam 40, it will also appear that the stopping of the drive of the cam 40 will also prevent the cam 152 from operating the valve 150, and thus no casting material will be ejected from the nozzle 43 until such time as the necessary congestion or stoppage of downward movement of the core 33 has been corrected or repaired.

From the foregoing description the operation of my machine will be readily understood when taken in connection with the accompanying drawings and the following statement in which the operation is briefly reviewed. Starting the cycle of operation from the point where the dies are closed with the upper core 33 in its lowermost position and between the dies, the nozzle 43 makes firm contact with the dies through the action of the cam 62 and spring 56. The cam 152 then operates the valve 150 which in turn operates the plunger 45 and a charge of casting material is pressure injected into the die cavities and around the cores 32 and 33. The dies are then opened and the core 33 moves upwardly carrying the casting with it because of greater surface engagement with the casting. During this operation the swinging frame or carrier 63 moves from the trimming stage to the dotted line position indicated in Fig. 6 in alinement with the discharge tube 90, and then after a short rest continues to swing upwardly while the core is in its upward movement. The gripper of the frame or carrier is opened as it approaches the casting supported in connection with the core, and timely, upon the stripping of the casting from the core by the stripper plate 41, the gripper engages the part 31a of the gate. After the core has completed its upward movement, the swinging frame or carrier is then swung downwardly carrying with it the casting supported in the gripper until it reaches the trimming stage where it is supported by the stop screw 80. While supported in the trimming position, the punch 106 moves in the direction of the casting and forces it through the die plate 107 into the position shown in Fig. 5, trimming the gate portion from the casting in this operation and otherwise trimming flared metal at peripheral edges of the casting. During this operation, the piercing tool 110 is moved in the direction of the casting and pierces the aperture 30a to trim the same. Immediately upon the completion of this operation, the second trimming tool 122 enters the workpiece or casting to trim the same along the edges of the channel therein, in the manner clearly illustrated in Fig. 9 of the drawings to trim the edges 30b of the flange portions of the casting, as well as the web 30c which is shown in Fig. 8 of the drawings; the web portion being trimmed by the recessed part 122a of the tool as illustrated in Fig. 9 and also seen in Fig. 6 of the drawings. After this, the tool 122 moves outwardly carrying with it the casting held on the tool 122 which is stripped by the plate 129 from the tool as this outward movement continues and drops into a suitable receptacle, not shown, which will be provided in the machine.

It will be understood that during the last mentioned trimming operation, upon a casting another casting is being formed in the dies which have been moved into and firmly held in closed

position, and the swinging frame or carrier 42 is moved from the trimming stage shown in full lines in Fig. 6, to the dotted line position shown in said figure, carrying with it the gate, and is held for a short period of time in the dotted line position. When in this position, the valve 51a will release the air to discharge a blast from the pipe 91, and simultaneously the valve 147 is actuated to relieve the air from the gripper piston 85, thus releasing the gripper 83 allowing the gate 31 to be blown into the tube 90. At the same time a blast of air will be directed upon the trimming tools from the pipe 91a to remove any particles of metal that may be present. Furthermore, the lubrication will be supplied to the tools through the pipe 96 and to the dies 23 and core 33 through the pipe 95.

From the dotted line position, the swinging frame or carrier 42 will then proceed to its casting engaging or gripping position as previously described. This complete cycle of operation is repeated in forming automatically a successive series of castings. It will appear that by performing the trimming operations on one previously formed casting simultaneously during the formation of the next successive casting, no retarding in the production of the machine is experienced. This is made possible by using the casting pick-up and carrier member which can be performing its functions while the dies and core and other mechanisms relative to the production of castings are performing their operations. This construction and method of procedure will maintain a speed of casting which is limited solely by the capacity of a machine for producing die castings of a given type and kind.

It will of course be apparent that the illustration of the invention is applicable to the formation of a specific type and kind of casting and is simply illustrative of one method of carrying the invention into effect. The machine may be utilized to cast and simultaneously trim die castings of any type and kind so as to produce finished merchandise insofar as the castings are concerned, aside from any other operations, such as plating operations, which may be performed thereon. It will be understood that a machine of this type and kind will effect a material saving in the production of die castings by eliminating the several trimming operations which are usually performed in separate machines as well as the handling of the castings in conveying the same from one machine to another.

It will be understood that the present machine shows the adaptation of my invention in forming metallic die castings. However, it will be apparent that insofar as the automatic trimming operations are concerned, these are applicable to die casting machines producing non-metallic or thermoplastic castings, as will be apparent.

It will be understood that the various air lines have been omitted from the several views and shown in the diagrammatic arrangement in Fig. 7 in order to simplify the disclosure. In other instances various parts of the machine are omitted, again for the purpose of simplifying the illustration. It will be apparent that by providing the various air actuated mechanisms or devices, quick or responsive operations of these mechanisms can be performed in a relatively simple manner, and by this is meant that many wearing parts are dispensed with. Furthermore, the employment of air provides many desirable functions, such for example as the discharge of the gate, the clearing of the trimming tools of trimmed particles, and the supply of lubricant to certain parts of the machine. It will also appear that by reason of the construction of the machine, substitute die parts or tools may be readily inserted in the machine suitable for forming and trimming castings of different types and kinds; the limitations of which are solely within the capacity or size of any machine. It will be further apparent, however, that the machine may be constructed in sizes to adapt itself to the production of castings of any kind or class wherein it would be practical to form and trim the casting.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a die casting and casting trimming machine, relatively movable dies with a mold cavity formed between abutting surfaces of the dies into which casting material is pressure injected at the parting line of the dies, a core extending into the mold cavity on the parting line of the dies and upon which the casting is formed, means moving the core relatively to the dies when separated to move the casting formed thereon out of the path of movement of said dies; a trimming station disposed in spaced relation to said dies, means movable between the casting on said core and said station for transmitting the casting from the core to said station, means for freeing the casting from the core, and means on said second named means engaging the casting when freed from said core to convey the same to said trimming station in the movement of said second named means.

2. In a die casting and casting trimming machine, relatively movable dies with a mold cavity formed between abutting surfaces of the dies into which casting material is pressure injected at the parting line of the dies, a core extending into the mold cavity on the parting line of the dies and upon which the casting is formed, means moving the core relatively to the dies when separated to move the casting formed thereon out of the path of movement of said dies, a trimming station disposed in spaced relation to said dies, means movable between the casting on said core and said station for transmitting the casting from the core to said station, means for freeing the casting from the core, means on said second named means engaging the casting when freed from said core to convey the same to said trimming station in the movement of said second named means, a plurality of trimming tools at said station operatively engaging the casting in completely trimming the same, and one of said tools including means to deliver the trimmed casting from the machine.

3. A machine for forming and trimming die castings, said machine comprising relatively movable dies having a cavity on abutting surfaces of the dies, a core arranged on the parting line of the dies and extending into said cavity, means pressure injecting casting material into the die cavity on the parting line thereof to form a casting on said core including a gate portion, a trimming station arranged in spaced relation to said dies, a carrier movable between said dies and the trimming station, means for freeing the casting from said core upon the separation of said dies, means on said carrier engaging the gate portion of said casting simultaneously upon removal from said core to pick up and carry the casting into predetermined position in the trimming station in the swinging movement of said

carrier, and means at the trimming station operatively engaging the casting to remove the same from the gate and to trim the same and to eject the trimmed casting from the machine.

4. A machine for forming and trimming die castings, said machine comprising relatively movable dies having a cavity on abutting surfaces of the dies, a core arranged on the parting line of the dies and extending into said cavity, means pressure injecting casting material into the die cavity on the parting line thereof to form a casting on said core including a gate portion, a trimming station arranged in spaced relation to said dies, a carrier movable between said dies and the trimming station, means for freeing the casting from said core upon the separation of said dies, means on said carrier engaging the gate portion of said casting simultaneously upon removal from said core to pick up and carry the casting into predetermined position in the trimming station in the swinging movement of said carrier, means at the trimming station operatively engaging the casting to remove the same from the gate and to trim the same and to eject the trimmed casting from the machine, said carrier supporting the gate after the casting is removed therefrom, and means intermediate the dies and trimming station for ejecting the gate from the machine while momentarily supporting the carrier in stationary position.

5. In a combination die casting and trimming machine, a casting station and a trimming station arranged in spaced relation to said casting station, means comprising dies and a core at the casting station for forming a die casting on a core, means operating the core upon separation of the dies at said casting station to remove the casting from the core, a conveyor member automatically movable between said stations, an automatically actuated gripper on said member gripping the casting in the removal thereof from said core and conveying the casting to the trimming station, means alining said member to properly position the casting in said trimming station, and means at the trimming station for completely trimming the casting and for ejecting the same from the machine.

6. In a combination die casting and trimming machine, a casting station and a trimming station arranged in spaced relation to said casting station, means comprising dies and a core at the casting station for forming a die casting on a core, means operating the core upon separation of the dies at said casting station to remove the casting from the core, a conveyor member automatically movable between said stations, an automatically actuated gripper on said member gripping the casting in the removal thereof from said core and conveying the casting to the trimming station, means alining said member to properly position the casting in said trimming station, means at the trimming station for completely trimming the casting and for ejecting the same from the machine, the casting station including means forming a gate on the casting, said gripper engaging the gate portion of the casting whereby in trimming said casting the gate remains on said member, means for supporting the member in stationary position intermediate said stations, and means whereby in the said stationary position of said member said gate will be released from the gripper and discharged from the machine.

7. In a combination die casting and trimming machine employing spaced casting and trimming stations, a swingable carrier automatically movable between said stations, a gripper mechanism on said member, means delivering a formed casting at the casting station to the gripper of said member whereby the casting may be conveyed by said member to the trimming station, and means at the trimming station for removing the die casting from said member and for trimming the same to produce a completely trimmed casting delivered from the machine.

8. In a combination die casting and trimming machine employing spaced casting and trimming stations, a swingable carrier automatically movable between said stations, a gripper mechanism on said member, means delivering a formed casting at the casting station to the gripper of said member whereby the casting may be conveyed by said member to the trimming station, means at the trimming station for removing the die casting from said member and for trimming the same to produce a completely trimmed casting delivered from the machine, said gripper supporting a gate portion of the casting after initial trimming thereof, and means automatically releasing and dispensing the gate portion from said member.

9. In a die casting and trimming machine of the class described employing a casting station and a trimming station arranged in spaced relation to the casting station, means for conveying a casting formed at the casting station to said trimming station, said trimming station comprising a plurality of trimming tools, at least one of said trimming tools being air operated, and said air operated tool including means for removing the trimmed casting from the machine.

10. In die casting and trimming machines of the class described, means to form a casting, an automatically actuated trimming mechanism for trimming castings formed in the machine, means for conveying a casting formed in the machine to said trimming mechanism, said mechanism comprising a punch cooperating with a die plate trimming peripheral edges of the casting and removing the casting proper from the gate thereof, another trimming tool transversing the casting at right angles to said punch, said last named tool being air operated in both directions, said last named tool moving the casting out of alinement with the punch, and means stripping the casting from said tool to deliver the finished trimmed casting from the machine.

11. In die casting and trimming machines of the class described, means to form a casting, an automatically actuated trimming mechanism for trimming castings formed in the machine, means for conveying a casting formed in the machine to said trimming mechanism, said mechanism comprising a punch cooperating with a die plate trimming peripheral edges of the casting and removing the casting proper from the gate thereof, another trimming tool transversing the casting at right angles to said punch, said last named tool being air operated in both directions, said last named tool moving the casting out of alinement with the punch, means stripping the casting from said tool to deliver the finished trimmed casting from the machine, and said trimming mechanism including an air actuated piercing tool arranged in axial alinement with said punch.

12. In die casting and trimming machines of the class described, means to form a casting, an automatically actuated trimming mechanism for trimming castings formed in the machine, means for conveying a casting formed in the machine to said trimming mechanism, said mechanism com-

prising a punch cooperating with a die plate trimming peripheral edges of the casting and removing the casting proper from the gate thereof, another trimming tool transversing the casting at right angles to said punch, said last named tool being air operated in both directions, said last named tool moving the casting out of alinement with the punch, means stripping the casting from said tool to deliver the finished trimmed casting from the machine, said trimming mechanism including an air actuated piercing tool arranged in axial alinement with said punch, and an automatically actuated micro switch forming part of the trimming mechanism for automatically stopping the machine upon improper operation of said trimming mechanism.

13. In a machine of the character described, a workpiece forming station and a workpiece trimming station, a pick-up and carry member movable between said stations, said member having an automatically actuated gripper for engaging a formed workpiece at the forming station and conveying the same to and alining the same in the trimming station, and means at the trimming station completely trimming the workpiece and delivering the same from the machine.

14. A combination die casting and trimming machine comprising a casting station having air actuated means for pressure injecting casting material into dies in forming a die casting, a trimming station having a plurality of trimming tools, air actuated means for operating at least two of said tools, a member movable between said stations conveying a formed casting to the trimming station, an air actuated gripper on said member to pick up and carry the casting to and supporting the same in the casting station, and automatically actuated valves controlling the timely supply of air in controlling the operation of the several air actuated mechanisms.

15. A combination die casting and trimming machine comprising a casting station having air actuated means for pressure injecting casting material into dies in forming a die casting, a trimming station having a plurality of trimming tools, air actuated means for operating at least two of said tools, a member movable between said stations conveying a formed casting to the trimming station, an air actuated gripper on said member to pick up and carry the casting to and supporting the same in the casting station, automatically actuated valves controlling the timely supply of air in controlling the operation of the several air actuated mechanisms, and means controlled by one of said valves for supplying air discharged lubricant to the casting and trimming stations.

16. A combination die casting and trimming machine comprising a casting station having air actuated means for pressure injecting casting material into dies in forming a die casting, a trimming station having a plurality of trimming tools, air actuated means for operating at least two of said tools, a member movable between said stations conveying a formed casting to the trimming station, an air actuated gripper on said member to pick up and carry the casting to and supporting the same in the casting station, automatically actuated valves controlling the timely supply of air in controlling the operation of the several air actuated mechanisms, means controlled by one of said valves for supplying air discharged lubricant to the casting and trimming stations, and for supplying a blast of air to the trimming station to remove trimmed particles therefrom.

17. In a die casting and casting trimming machine, means for forming a casting, means for trimming the casting formed by the first named means, a member associated with the first named means and upon which the casting is formed, a pick-up and carry mechanism movable back and forth intermediate the casting means and the trimming means, a gripper on said mechanism, means for removing the casting from said member and for simultaneously actuating the gripper of said mechanism to pick up the casting and to convey the same to the trimming means, means for actuating said trimming means to completely trim the die cast product supported in said gripper and to deliver the product from the machine.

18. In a die casting and casting trimming machine, means for forming a casting, means for trimming the casting formed by the first named means, a member associated with the first named means and upon which the casting is formed, a pick-up and carry mechanism movable back and forth intermediate the casting means and the trimming means, a gripper on said mechanism, means for removing the casting from said member and for simultaneously actuating the gripper of said mechanism to pick up the casting and to convey the same to the trimming means, means for actuating said trimming means to completely trim the die cast product supported in said gripper and to deliver the product from the machine, the remainder of the casting comprising a gate portion being retained in the gripper after the actuation of said trimming means, and means for removing the gate from the machine simultaneously upon releasing the gripper from said gate.

19. In a die casting and casting trimming machine, means for forming a casting on a member, said casting comprising a gate part and a product part, means for removing the casting from said member, means automatically picking up the removed casting and conveying the same to said trimming means, means whereby the operation of said trimming means will remove a trimmed product from the gate part of said casting leaving one of said parts disposed on said pick-up and conveyor means, and means for automatically removing the last mentioned part from said pick-up and conveyor means.

20. In a die casting and casting trimming machine, means for forming a casting on a member, said casting comprising a gate part and a product part, means for removing the casting from said member, means automatically picking up the removed casting and conveying the same to said trimming means, means whereby the operation of said trimming means will remove a trimmed product from the gate part of said casting leaving one of said parts disposed on said pick-up and conveyor means, means for automatically removing the last mentioned part from said pick-up and conveyor means, and automatically actuated switch devices in operative engagement with the casting means, and said trimming means controlling the operation of the machine.

21. In a die casting and casting trimming machine, two stations arranged in spaced relation to each other in the machine, one station having means for forming a casting and for releasing a formed casting, the other station having a plurality of tools for operating upon a formed cast-

ing, pick-up and carry means for engaging a casting released at the first named station and conveying said casting from the casting station to the tools of said second named station, and means actuating the tools of said second named station in producing a trimmed and finished product of the casting delivered to said station by said pick-up and carry means.

22. In a die casting and casting trimming machine, two stations arranged in spaced relation to each other in the machine, one station having means for forming a casting and for releasing a formed casting, the other station having a plurality of tools for operating upon a formed casting, pick-up and carry means for engaging a casting released at the first named station and conveying said casting from the casting station to the tools of said second named station, means actuating the tools of said second named station in producing a trimmed and finished product of the casting delivered to said station by said pick-up and carry means, said pick-up and carry means supporting the casting in position to be engaged by at least one of said tools, and means supporting the casting in position to be engaged by other of said tools.

23. In a die casting and casting trimming machine, a casting station, a tool station arranged in spaced relation to the casting station, conveyor means movable between said stations, means at the casting station to form a cast body having a part in predetermined position with respect to the product portion on said body, means for releasing the cast body at the casting station, and said conveyor means having means engaging said part of the cast body when released in moving the cast body from the casting station to the tool station.

24. In a die casting and casting trimming machine, a casting station, a trimming station, means for moving a cast body formed at the casting station to the trimming station, means at the casting station to form on a cast body a part arranged in predetermined fixed position thereon spaced with respect to a product portion of the cast body, means for releasing the cast body at the casting station, and said part forming means adapted to be engaged by said first named means in moving the released cast body from the casting station to said trimming station.

25. In a die casting and casting trimming machine, a casting station, means having a gripper for engaging and moving a casting from the casting station to a predetermined trimming position spaced with respect to said station, means at the casting station for moving a formed casting into gripper receiving position, and means releasing the casting from the last named means when engaged by the gripper of the first named means.

26. In a die casting and casting trimming machine, a casting station, two other stations spaced with respect to each other and to said casting station, means for freeing a cast body at said casting station, means for picking up and conveying said body from the casting station successively to both of the other stations and intermittently supporting the cast body in predetermined position at said stations, at least one of said stations having tools operating upon the cast body in performing predetermined operations thereon.

27. In a die casting and casting trimming machine, a casting station, two other stations spaced with respect to each other and to said casting station, means at the casting station for moving a cast body into released position, means picking up the released body to convey the same from the casting station successively to both of the other stations and intermittently supporting the cast body in predetermined position at said stations, at least one of said stations having tools operating upon the cast body in performing predetermined operations thereon in forming a finished product, and means for removing the remainder of said body at the other of said stations.

LOUIS H. MORIN.