June 3, 1941. D. MARINSKY ET AL 2,244,425

DIE CASTING MACHINE

Filed July 10, 1937 5 Sheets-Sheet 1

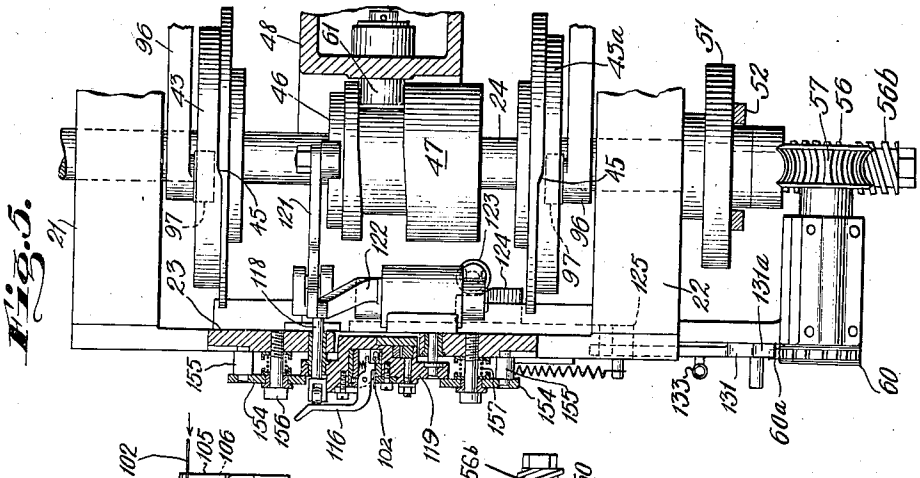


Fig. 5.

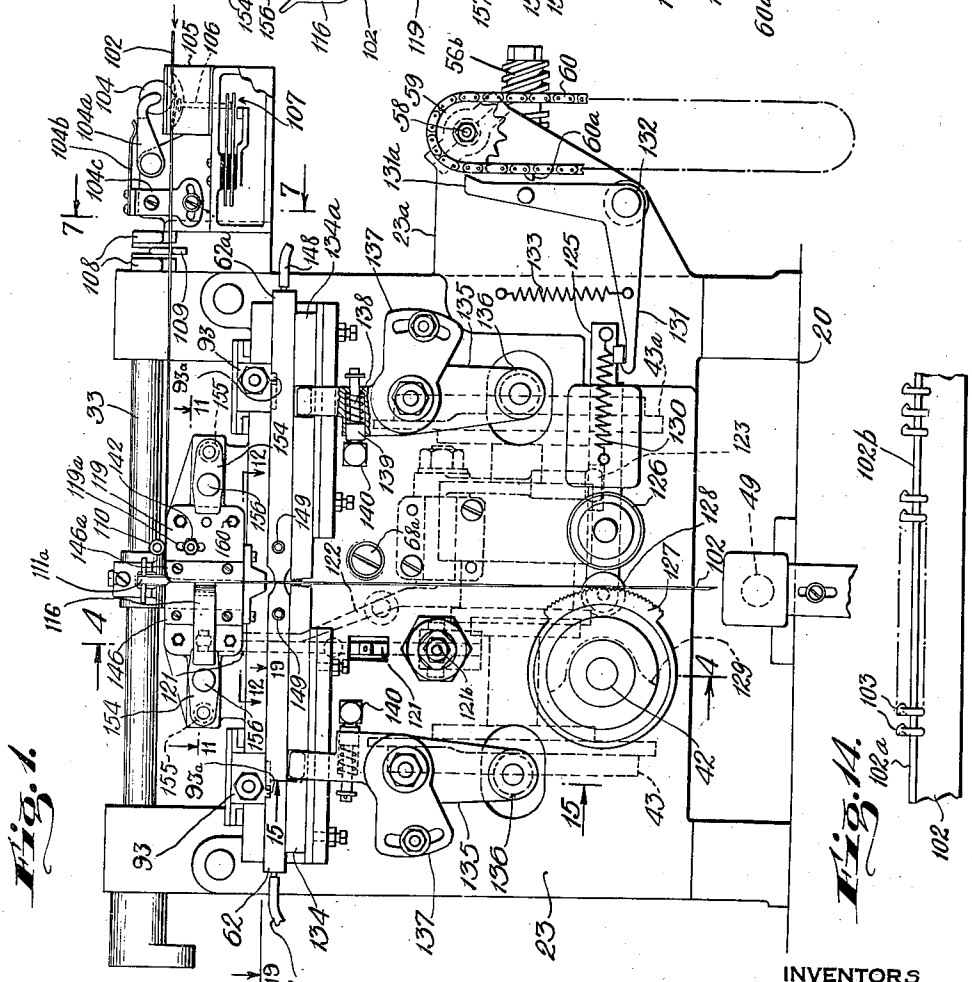


Fig. 1.

Fig. 14.

INVENTORS
DAVIS MARINSKY
LOUIS H. MORIN
BY
ATTORNEY

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DIE CASTING MACHINE

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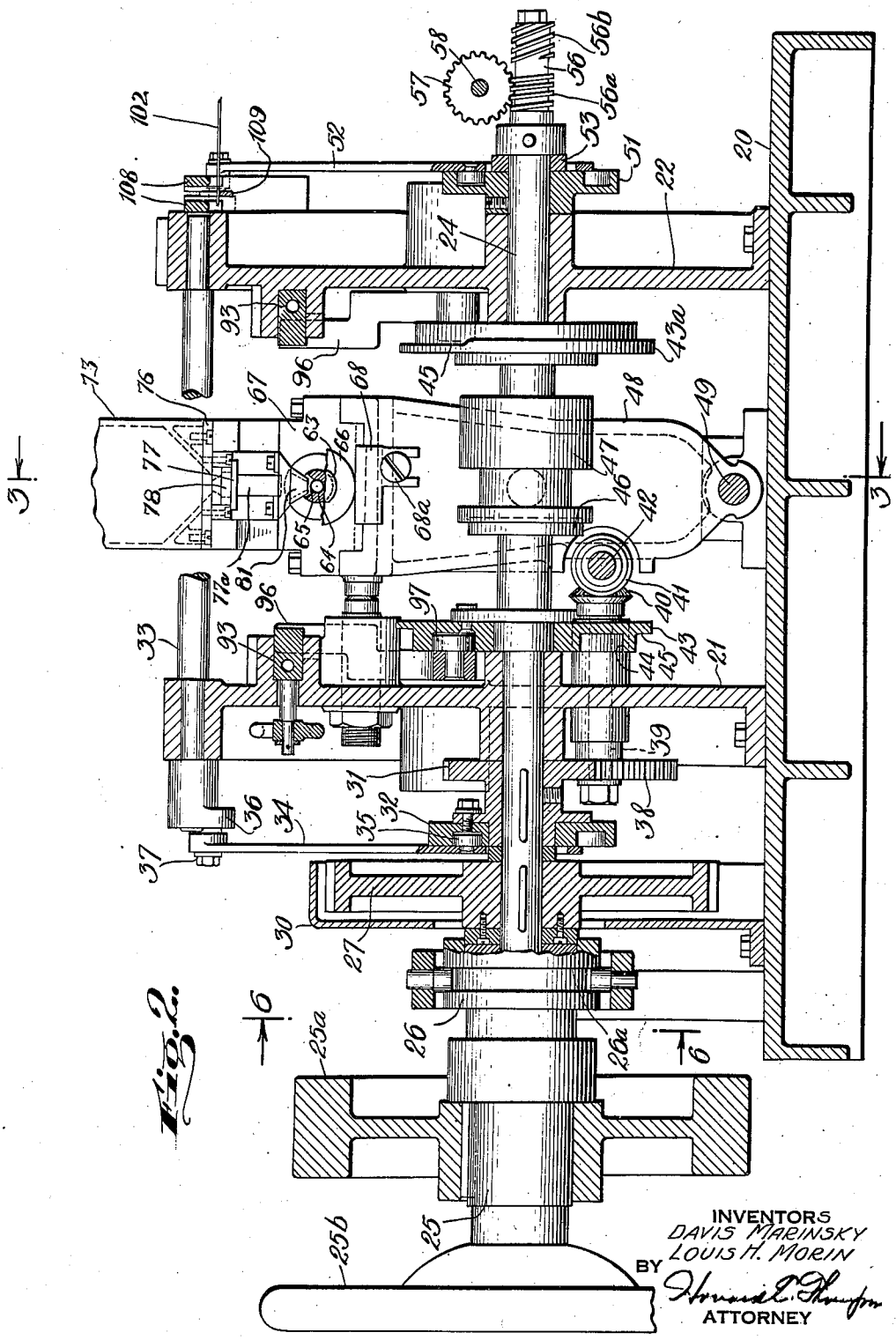


Fig. 2.

INVENTORS
DAVIS MARINSKY
LOUIS H. MORIN
BY Howard P. Thompson
ATTORNEY

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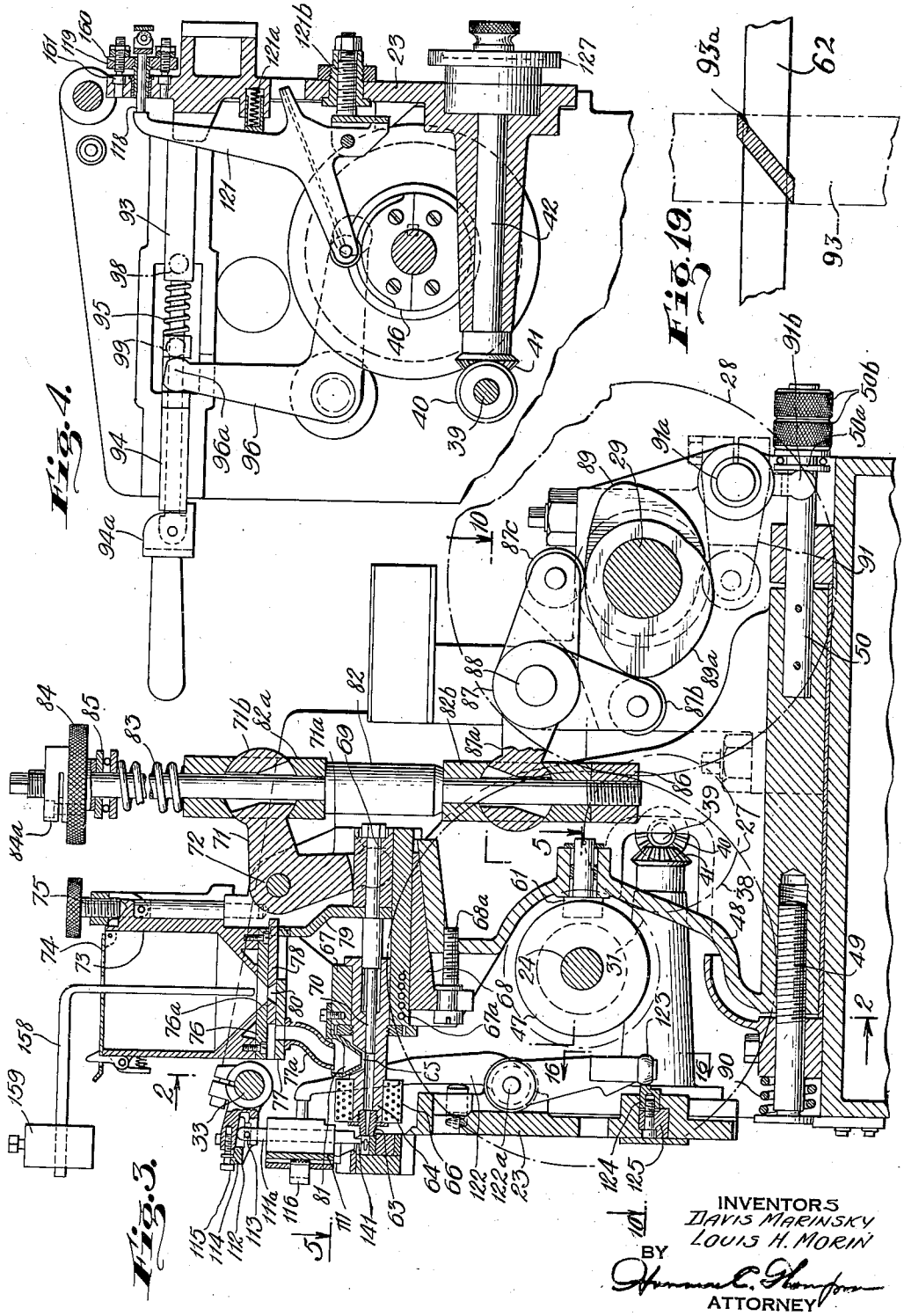


Fig. 4.

Fig. 19.

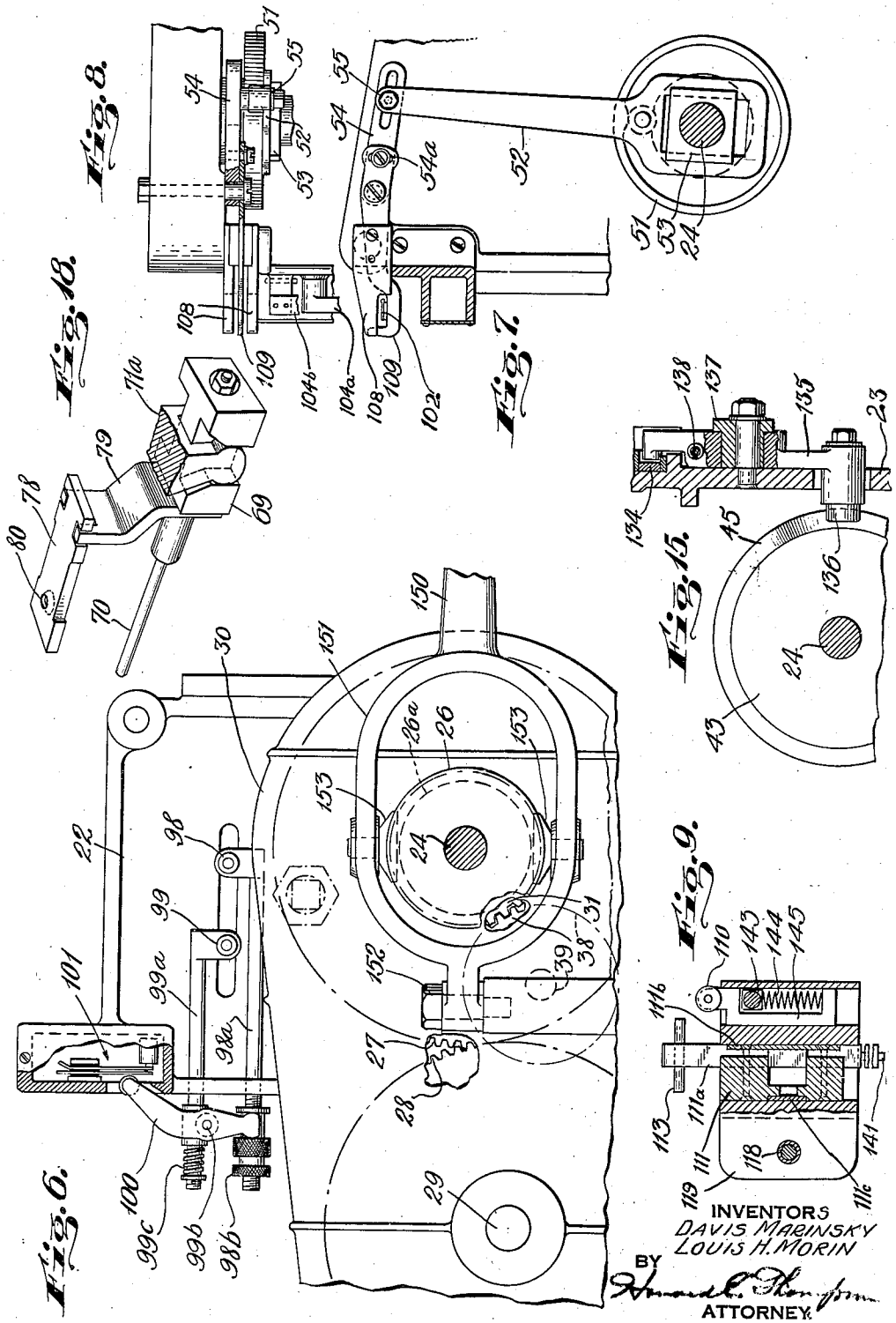
Fig. 3.

INVENTORS
DAVIS MARINSKY
LOUIS H. MORIN
BY
Thomas C. Thompson
ATTORNEY

June 3, 1941. D. MARINSKY ET AL 2,244,425

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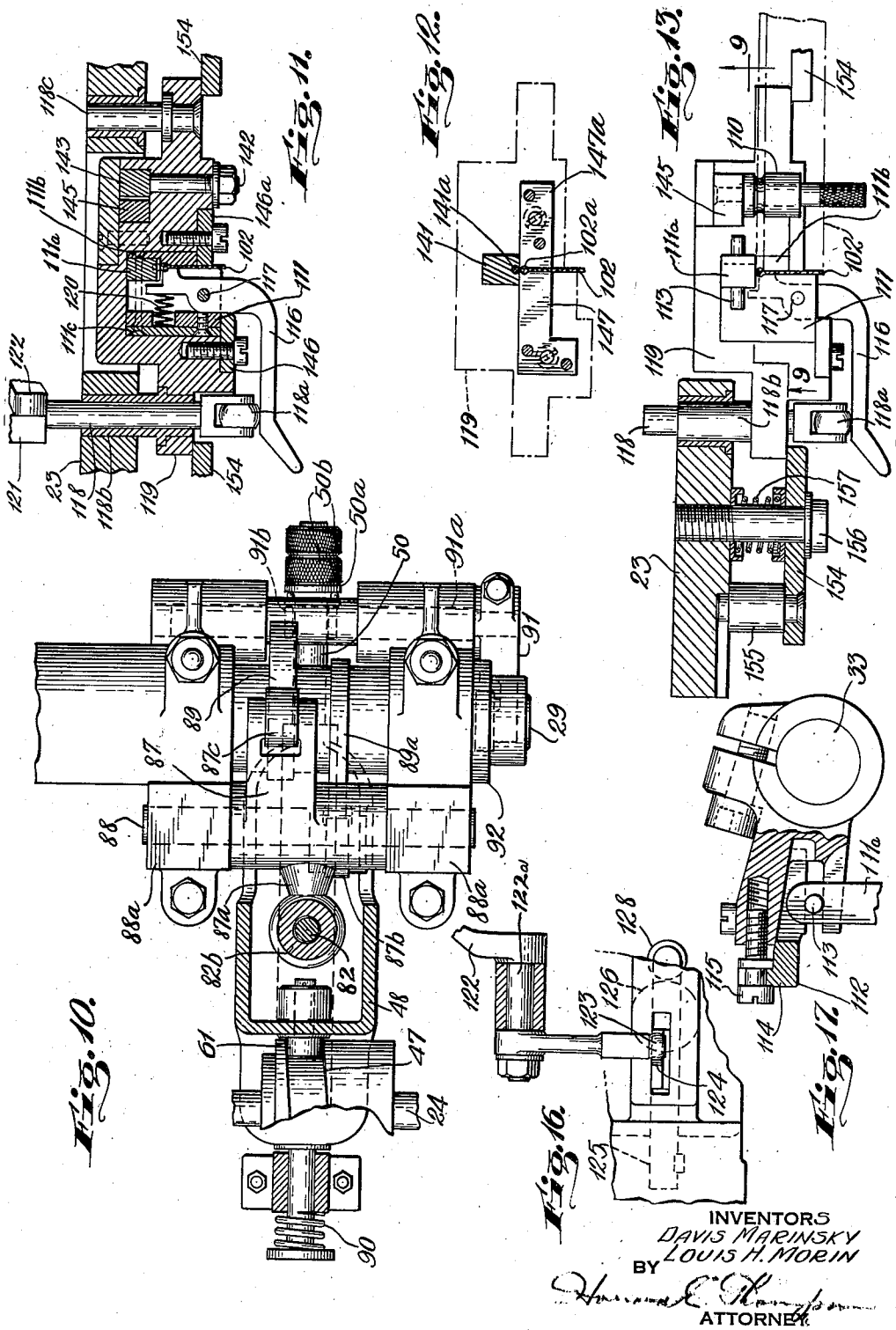


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 16.

Fig. 17.

INVENTORS
DAVIS MARINSKY
LOUIS H. MORIN
BY
ATTORNEY

Patented June 3, 1941

2,244,425

UNITED STATES PATENT OFFICE

2,244,425

DIE CASTING MACHINE

Davis Marinsky and Louis H. Morin, Bronx, N. Y., assignors to Whitehall Patents Corporation, Bronx, N. Y., a corporation of New York

Application July 10, 1937, Serial No. 152,942

32 Claims. (Cl. 18—30)

This invention relates to what are commonly known as die casting machines and particularly machines of this class for use in casting separable fastener devices, and the object of the invention is to provide a machine which is designed primarily for use in casting thermoplastic materials, such for example as cellulose acetate, and in the provision of means for intermittently feeding the casting material into a heated cylinder and in discharging the material from said cylinder by a plunger so as to provide a constant replenishment of the casting material consistent with the discharge of heated material from said cylinder; a further object being to provide means for supporting the entire supply unit of the casting material including the ejector nozzle employed, so as to swing back and forth in the machine to maintain said nozzle in constant engagement with at least one of the dies employed; a further object being to provide adjustable means for tensionally controlling the position of the nozzle with respect to the die in the swinging movement of said unit; a further object being to provide means involving universal link couplings for transmitting movement to the plunger from the drive shaft to compensate for the swinging movement of said unit in the frame of the machine; a further object being to actuate the plunger through adjustable tension means to provide automatic compensation of plunger operation with the varying amounts of casting material disposed in the heated cylinder of the machine; a further object being to provide means for controlling the delivery of a mounting tape or strand to the machine and for automatically stopping the machine when the end of a length of tape is reached; a further object being to provide means for supporting and controlling the feed of the tape through the machine, including means for intermittently feeding a relatively long portion of the tape through the machine to space the arrangement of castings thereon, a further object being to support the hopper feed of the casting material on the cool part of the cylinder and also in normally supporting the plunger in the cool part of the cylinder to avoid congestion or clogging of the cylinder and maintain the plunger clean; a still further object being to provide means for actuating the dies through tensional devices and further to automatically stop the machine in the event of improper actuation of the dies, and with these and other objects in view, the invention consists in a machine of the class and for the purpose specified which is simple in construction, efficient in use, and which is constructed as hereinafter described and claimed.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of our improvement are designated by suitable reference characters in each of the views, and in which:

Fig. 1 is a front view of the machine with parts of the construction broken away and in section and omitted.

Fig. 2 is a longitudinal section of the machine, the section being on the line of the broken line 2—2 of Fig. 3.

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

Fig. 4 is a transverse sectional view substantially on the line 4—4 of Fig. 1.

Fig. 5 is a sectional plan view on the broken line 5—5 of Fig. 3.

Fig. 6 is a sectional detail view on the line 6—6 of Fig. 2 with parts of the construction broken away.

Fig. 7 is a sectional detail view on the line 7—7 of Fig. 1.

Fig. 8 is a plan and sectional view of the structure seen in Fig. 7.

Fig. 9 is a sectional detail view substantially on the line 9—9 of Fig. 13.

Fig. 10 is a section on the broken line 10—10 of Fig. 3.

Fig. 11 is a partial section on the line 11—11 of Fig. 1.

Fig. 12 is a partial section on the line 12—12 of Fig. 1.

Fig. 13 is a plan view of the forward central portion of the machine.

Fig. 14 is a detail view of a part of a fastener tape made by the machine.

Fig. 15 is a partial section on the line 15—15 of Fig. 1.

Fig. 16 is a partial section on the broken line 16—16 of Fig. 3.

Fig. 17 is a detail sectional view of a part of the structure as shown in Fig. 3 on an enlarged scale.

Fig. 18 is a perspective detail view of a part of the structure shown in Fig. 3, and

Fig. 19 is a sectional plan view on the line 19—19 of Fig. 1 showing only a part of the construction.

In the accompanying drawings, we have shown at 20 a part of a base or bed-plate of the machine which may be supported upon suitable legs to bring the machine at a convenient height. Ex-

tending upwardly from the plate 20, and arranged in spaced relation to each other, are side frames 21 and 22 joined at the front by a front plate 23 mounted in suitable bearings. In the frames 21 and 22 is a driven shaft 24 coupled with a drive shaft 25, through a clutch 26, the shaft 25 having a drive pulley 25a or other means by which the shaft 25 may be driven. It is also preferred that a hand wheel 25b be employed for manually rotating the shaft whenever it may be desirable so to do.

Keyed to the shaft 24 adjacent the clutch 26 is a gear 27 which meshes with a gear 28 on a camshaft 29, the gears 27 and 28 being arranged in a suitable housing 30. Secured to the shaft 24 adjacent the gear 27, is a gear 31, to a sleeve extension of which is secured an internal cam 32, by means of which a rocker shaft 33 disposed at the upper end of the machine, may be actuated through a lever 34 having a roller 35 operating in the cam, the free end of the lever 34 being coupled with the crank 36 on the end of the shaft 33, as seen at 37, note Fig. 2.

The gear 31 meshes with a gear 38 on a shaft 39 mounted in the frame 21, the inner end of the shaft having a beveled gear 40 meshing with a corresponding gear 41 on a forwardly and backwardly extending shaft 42, the latter projecting through the front plate 23 of the frame.

Secured to the shaft 24 adjacent the inner surfaces of both frames 21, 22, are two similar cam units, 43, 43a, each having a cam groove 44 on the side face thereof, and an outer peripheral cam surface 45. These cams are employed primarily for actuating the dies as later described. On the shaft 24 between the cams 43, 43a, is a surface cam 46 for actuating the tape gripping mechanism, and at 47 is a cam for actuating the oscillating frame 48 mounted to swing upon the pins 49 and 50, as clearly seen in Figs. 2 and 3 of the drawings.

On the outer surface of the frame 22 a cam 51 is arranged upon the shaft 24 and is adapted to actuate an arm 52 keyed to a block 53 on the shaft 24, as seen in Fig. 7 of the drawings. This construction permits the movement of the arm 52 by the cam 51, the block 53 acting as a guide for said arm. The upper end of the arm 52 is adjustably coupled with a link 54 as seen at 55 for actuating certain of the tape mechanisms as later described.

Secured to the end of the shaft outwardly of the cam 51 is a worm unit 56 having two different worm gear portions 56a, 56b, each of which are adapted to, independently, operate a worm wheel 57 in variable speed drives of a shaft 58 which extends forwardly, and is mounted in a suitable bearing 23a in the frame. The forward end of the shaft 58 has a sprocket 59 over which a control chain 60 is adapted to pass, this chain controlling the automatic operation of the quick tape feed mechanism of the machine, and governs the lengths of groups of links arranged on the tape to govern the stringer lengths of separable fasteners to be produced.

The frame 48 has a roller 61 centrally thereof, which operates in the cam 47 by means of which the frame may be swung from a perpendicular position to a position to one side of the machine, for the purpose of maintaining the discharge nozzle 63 in constant engagement with at least one of the dies 62, 62a to prevent discharge of casting material from said nozzle.

The nozzle is supported in the outer end of a cylinder 64, into which casting material is fed through an opening 65. The outer end of the cylinder has suitable means 66 in the form of an electric heating coil for heating the cylinder to melt the casting material employed prior to the discharge of the material into the impression or mold cavity of the dies. The cylinder 64 is adjustably supported in the upper end of the frame 48, the cylinder being mounted in a block 67 secured to the upper end of the frame, and adjusted vertically by a wedge member 68 actuated through a screw 68a to control alinement of the nozzle 63 with the dies. A slide 69, note Fig. 18, is coupled with the outer end of a plunger 70. The slide 69 is actuated through a bell crank 71, pivoted in upwardly directed extensions on the block 67 as seen at 72, note Fig. 3.

Detachably supported upon the extensions of the block 67, is a container or hopper 73 into which the casting material is placed by moving a spring latched cover 74 into open position. Suitable means is provided at 75 for detachably supporting the hopper in the machine whenever desired. In this connection it will be understood that the hopper as well as the other mechanisms which are supported on the frame 48, all move with the frame in the swinging operation thereof. It will also be apparent however, that this swinging motion is a limited motion simply sufficient to compensate for the opening movement of one part of the die.

Secured to the lower end of the hopper 73, are two plates 76 and 77 between which is formed a slideway for a feed bar 78 which is coupled with and movable with the plunger 70 through the connection 79, so that in the forward and backward movement of the plunger, the bar 78 is correspondingly moved.

The bar 78 has an aperture or compartment 80 in which a more or less measured amount of granular pulverized or other casting material is adapted to drop from the hopper through a feed passage 76a in the plate 76. The plate 77 is provided with a tubular discharge 77a which extends forwardly and is arranged over a feed hopper 81 through which the casting material is directed into the aperture 65 of the cylinder. The hopper is independent of the tube 77a and cylinder 64, and is supported upon the block 67, as clearly seen in Fig. 3 of the drawings, so that the casting material when contained in the hopper 81, will be kept cool especially by virtue of the circulation of water through the cooling tubes 67a, which also serve to cool the plunger 70 when in its retracted position as seen in Fig. 3 of the drawings. Suitable flexible tubes, not shown, will be provided to circulate water through the tubes 67a.

At this time attention is directed to the fact that our present machine is designed to perform the steps of the method diagrammaticaly illustrated and described in a prior application filed by us March 18, 1937, Serial No. 131,606. The present machine operation, consists in the automatic feed of casting material from the hopper 73 into the cylinder forwardly of the plunger 70, by means of the slide or feed bar 78. The degree of forward movement of this bar, governed solely by the limit of forward movement of the plunger in any extrusion operation discharging the heated casting material into the dies, will control the amount of casting material replaced in the cylinder. It will be understood in this connection that should the forward movement of the plunger be insufficient to register the aperture 80 with the tube 77a, no material would be

discharged, thus avoiding excessive charging of the cylinder.

One end 71*a*, of the bellcrank 71 is coupled with the member 69, whereas the other end 71*b* is substantially in the shape of a ball to provide a universal mounting, in connection with a plunger operating rod 82 or a sleeve 82*a* thereon. The sleeve is mounted on a reduced upper end portion of the rod on which end is arranged a heavy coil spring 83, the tension of which is adjusted through a nut 84, between which and the spring end is disposed a ball bearing 85 to provide free adjustment of the nut. Suitable means 84*a* is provided to pinch the nut on the thread of the rod to prevent displacement. The lower end of the rod is also reduced, and a sleeve 82*b* is arranged thereon, held in position by a nut 86.

At 87 is shown a three-way crank, one ball end 87 of which engages the sleeve 82*b*, the same as the crank end 71*b*, to provide universal mounting. The crank 87 is rotatable on a shaft 88, suitably supported in the machine, as seen at 88*a*, note Fig. 10. Another arm of the crank extends downwardly and is provided with an anti-frictional roller 87*b*. The third arm extends rearwardly and is provided with a roller 87*c*. On the camshaft 29 are cams 89 and 89*a* which are adapted to operate on the roller 87*b* and 87*c* respectively, in lowering and raising the rod 82 to move the plunger 70 outwardly and inwardly as will be apparent in the downward movement of the rod 82 for advancing the plunger 70 forwardly to eject the casting material. It will be understood that the degree of movement imparted to the plunger will be governed through the spring 83 which automatically compensates for the variance in the amount of casting material arranged in the cylinder.

In the operation of forcing the casting material into the dies or the impressions therein, the entire frame 48, including its associated parts, is moved forwardly by the spring 90 mounted on the pin 49, which forward movement is controlled by the arm 91 operating upon the surface cam 92, note Fig. 10 of the drawings. The arm 91 is mounted on a shaft 91*a*, which shaft has a downwardly extending yoke-shaped portion 91*b* engaging an adjustable collar 50*a* on the pin 50, the cam being adjusted through nuts 50*b* which regulate the normal position of the nozzle 63 with respect to the die so as to avoid frictional engagement with the die, while at the same time arranging the discharge of the nozzle in such constant relationship to the die as to prevent discharge of the casting material from said nozzle, and also to prevent hardening of the material in the nozzle.

Slidably mounted in each side frame 21, 22, at the forward portions thereof, are die operating rods 93 coupled with supplemental rods 94 through springs 95, note Fig. 4 of the drawings, so that bellcranks 96, operated from the cam grooves 44 through rollers 97, cause the dies to be actuated by engagement of the upwardly extending parts 96*a* of the arms, with the supplemental rods 94. It will be understood that the rods 94 will force the rods 93 outwardly through the springs 95 in the operation of closing the dies 62, 62*a*, the outer ends of the rods 93 having beveled ribs 93*a* engaging corresponding grooves in the dies, in the manner taught in our prior patent, 1,975,966 and also as shown in Fig. 19, to provide the horizontal movement of the dies in the forward and backward movement of said operating rods. At the inner ends of the rods 94, are hand operated eccentrics 94*a* by means of which the dies may be separated by hand whenever desired.

On the rods 93, 94, at one side of the machine, are pins 98 and 99 which are coupled with the rods 93, 94 respectively, and operate in elongated slots in the frame 22. Coupled with these pins are rearwardly extending rods 98*a* and 99*a*, with which a switch actuating lever 100 is coupled so that in the presence of a differential action between the rods 93, 94, the lever 100 will operate to close a circuit between electrical contacts 101, in circuit with a suitable electrical control for automatically shutting off the motor for driving the machine. As the control forms no part of the invention, no showing or description thereof is made.

The engagement of the lever 100 with the rod 99*a* adjustable as seen at 99*b*, the lever being pivotally coupled with the rod 99*a* as at 99*b*. However, tensional means 99*c* is provided to compensate for a differential action between the rods 98*a* and 99*a*. It will be understood that the position of the rods 98*a* and 99*a* and associated parts as seen in Fig. 6 of the drawings, represents the position when the dies are closed, and these parts move away from the switch 101 when the dies are open. It will appear, however, that should a foreign substance or element present itself between the dies to prevent proper closing thereof, the rod 98*a* will not advance sufficiently, thus causing the upper end of the lever 100 to tilt forwardly and close the circuit through contacts 101.

In Fig. 1 of the drawings we have indicated at 102 the tape coming from a source of suitable supply for feeding through the machine in the application of links thereon to form the stringers of separable fasteners. This tape has a beaded edge 102*a*, note Fig. 14, to which the die cast links or scoops 103 are secured, these links being arranged in given stringer lengths controlled by the chain 60 with wide spacings 102*b* formed between adjacent stringer lengths or groups of closely arranged links.

The tape 102 first passes beneath a spring pressed roller 104 which is arranged over a recess formed in a block 105, in which block is a vertical pin 106 which is adapted to be depressed, if no tape appears beneath the roller 104, to close the circuit through spring contacts 107 which actuate suitable electric mechanisms for stopping the motor or driving means of the machine. The tape next passes beneath spaced guide fingers 108 between which is an upwardly directed hook-shaped finger 109 which is adjustably coupled with the lever 54 as seen at 54*a* and forms a part thereof as seen in Figs. 7 and 8 of the drawings. In each cycle of operation of the machine, the finger 109 moves upwardly to form a kink in the tape, which operation takes place when the tape is gripped by the grippers, later described, and this serves as means for feeding the tape from its source of supply, and to provide the necessary slack in the tape to meet the demands of the feed of tape through the machine in the formation of successive series of castings thereon.

From the finger 109 the tape passes to the central portion of the machine, and below a spring pressed roller 110, which applies sufficient tension to the tape to support the same in the tape gripping and feed mechanism. This mechanism consists of a yoke-shaped slide 111 coupled with a fork 112, secured to the rocker shaft 33. The core

slide 111 has an elongated bar 111a secured thereto by spaced rivets, as indicated by dotted lines in Fig. 9 of the drawings, which rivets also pass through a gripper backing plate 111b, another plate 111c being secured to the slide 111 and forms a backing for a spring later described, note Fig. 11. The bar 111a has a transverse pin 113 at its upper end operating in the yoke, and adjustable means 114 is provided in the form of a tapered wedge held by a set screw 115 as will be apparent. A gripper lever 116 is pivoted to the core slide as seen at 117, note Fig. 11, the lever 116 being actuated by a pin 118 having a roller 118a at its free end, the pin being supported in the core holder 119, and projects inwardly through the front plate 23 of the machine. A spring 120 serves to normally support the inner end of the lever in gripping engagement with the tape 102, whereas the outward movement of the pin 118 will serve to free the gripping lever from the tape when the slide moves upwardly.

Engaging the inner end of the pin 118 are two levers 121 and 122, the lever 121 operating in each cycle of the machine through the cam 46 as clearly seen in Fig. 4 of the drawings. A spring 121a serves to hold the lever in constant engagement with the cam, the pivot of the lever being adjustable by means of the supporting screw 121b and associated parts shown in Fig. 4 of the drawings. This adjustment is primarily to regulate the contact of the upper end of the lever with the pin 118.

The lever 122 is pivoted to the rear surface of the plate 23 as seen at 122a, and extends downwardly and is provided at its lower end with a roller 123, engaging a cam segment 124 on the sliding bar 125 arranged at the lower right side of the machine so that in the movement of said bar to the left, the upper end of the lever 122 will be moved outwardly to actuate the pin 118, to release the gripper lever 116, this structure being also shown in Fig. 16. At this time attention is directed to the fact that both levers 121 and 122 engage and operate the pin 118 as and for the purposes stated. This operation is timed prior to the quick feeding of a predetermined length of the tape 102 through the machine to form the spacings as at 102b, note Fig. 14. This spacing or feeding of the tape is accomplished by the movement of a rubber or other roller 126 supported on the bar 125 toward the feed segment 127 arranged on the outer end of the shaft 42, as clearly seen in Fig. 1 of the drawings. The free end of the bar is provided with a roller 128 cooperating with a cam 129 which permits the said movement of the bar by a spring 130 when a pawl 131 releases said bar. The pawl is pivoted as seen at 132, and is provided with a spring 133 for normally supporting the pawl in operative position, the pawl being released by a trip 60a on the chain 60, engaging the upwardly extended offset end 131a of the pawl as will be apparent.

It will also be understood that the cam 129 serves to immediately return the bar 125 to its normal or latched position where it is held by the pawl, in which position the roller 126 is held in spaced relation to the segment 127, providing free downward passage of the tape 102 as will be apparent.

In addition to the upper gripper 116, lower grippers 134 are employed and arranged below the dies 62, 62a. These grippers work in conjunction with the upper gripper 116 to engage and hold the tape 102 when fed downwardly by the upper gripper in the upward or return movement of the upper gripper so as to prevent any movement of the tape, and to insure proper spacing. The roller 110 also serves, in this operation, to maintain the tape in proper position. At this time it will be understood that the timing of the quick long feed of the tape by the segment 127 and roller 126, will be such as to take place when the lower grippers are out of engagement with the tape. The lower grippers 134, 134a, are actuated through similar levers 135 having rollers 136 at their lower inner ends, operating upon the cams 45. The adjustable eccentric segments 137 on the levers 135 simply compensate for tapes of different thicknesses, the springs 138 actuating the pins 139 on the levers to normally support the grippers 134, 134a in separated position, the pins 139 engaging stop blocks 140.

In addition to the tape gripping and feed mechanism, and as part of the slide 111, is a core pin 141, supported on the lower end of the core bar 111a and which extends into the impression of the dies to form a recess in the cast link, and also means for supporting the link in the separation of the dies and a feed of the link, in conjunction with the tape in the operation of spacing the successive links on the tape in the successive casting operations, in accordance with the teachings disclosed in our prior Patent 1,975,966, excepting that in the present case, the tape as well as the link is fed, especially in the casting of thermoplastics.

The holder 119 is provided at one side with an elongated slot 119a by means of which a bolt 142 may be adjusted vertically in the holder, the bolt having at its inner end a block 143 operating upon a spring 144 which controls the tension of the roller 110 by reason of the yoke-shaped support 145 for said roller as seen in Fig. 9 of the drawings. The slide 111 is held in position by removable plates 146, 146a as clearly seen in Fig. 11 of the drawings.

Arranged upon the lower surface of the holder 119, and forwardly of the core are two tape guides 147, 147a which support the tape adjacent the upper surfaces of the dies to prevent any lateral pull on the tape in the operation of separating the dies.

Suitable flexible tubes 148 are provided for introducing water into the dies for cooling the same, which water is discharged at the adjacent ends of the dies through other flexible discharges as indicated at 149.

The clutch 26 is actuated through a hand lever 150, the yoke end 151 of which is pivoted as seen at 152, the yoke having opposed shoes 153 operating in the circumferential groove 26a of the clutch 26 as will be apparent. In this connection it will be understood that the detail structures of several of the parts of the machine are not dealt with specifically, in that these parts are generally known in the art and require no specific consideration.

The guide and holder 119 is supported in connection with the plate 23 and keyed thereto by the bushing 118b at one side and by a pin 118c at the opposite side. Two clips 154 are provided at each side of the guide 119 and carry at their free ends spacing and key pins 155 operating in grooves in the plate 23, and bolts 156 pass through elongated slots in the clips 155 in adjustably coupling the clips with said guide in order to provide a quick attachment and detachment of the entire tape gripping and core unit. Springs 157 are disposed on the bolts 156 to exert outward pressure on the retaining clips 154

to support the same in constant engagement with the heads of the bolts.

A wire or rod 158 is arranged upon a suitable support 159 in the machine, note Fig. 3. This rod extends through an elongated opening in the cover 74, and into the hopper 73 to a point adjacent the discharge 76a, and will serve to agitate or stir the casting material in the hopper, in the back and forth swinging movement thereof, it being understood that the rod 158 is stationary.

The spring pressed roller 104 is supported on an arm 104a and the spring 104b for actuating the roller, is supported on an adjustable plate 104c, note Fig. 1, for adjusting the tension of said spring.

Mounted in the holder or carrier 119 are four adjustable screws 160 which engage the face of the plate 23 or studs 161 arranged therein, to properly aline and space the holder 119 upon the plate as indicated in Fig. 4 of the drawings.

The operation of the machine will be readily understood from the foregoing description when taken in connection with the accompanying drawings and the following statement. Assuming that the dies are in open position, as the beginning of a cycle of operation, said dies are moved into closed position at which time the core pin 141 is moved into position between the dies, and the dies are moved into closed position through the action of the bellcranks 96 as before stated. When the dies are in closed position, the nozzle 63 is brought into firm engagement with the dies by the spring 90, released through the action of the lever 91 and cam 92. The plunger 70 is then moved forwardly by the cam 89a, engaging the roller 87c which depresses the arm 87a, moving the plunger rod 82 downwardly through the spring 83 which oscillates the bellcrank 71, imparting the forward movement to said plunger.

At this moment it will be understood that prior to the forward movement of the plunger, a quantity of the casting material has been delivered into the cylinder, forwardly of the plunger through the hopper 81. The forward motion of the plunger 70 discharges the casting material from the nozzle 73 into the impression of the dies 62, 62a, and around the pin 141, as well as that part of the tape, principally the beaded edge 102a thereof disposed within the impression of the dies.

At the beginning of the aforesaid operation, the lower grippers 134, 134a are in engagement with the tape 102, whereas the upper gripper 116 is in open position. However, during the operation of injecting the heated casting material into the dies, the upper gripper 116 is closed, and when the plunger has been retracted or returned to the position shown in Fig. 3, the dies start to open previous to which, the lower grippers 134, 134a have been opened. At this moment, the core bar 111a, including the tape 102 is moved downwardly by the cam 32 operating through the lever 34 and crank 36, and before the upper gripper 116 is released from the tape, the lower grippers 134 have again grasped the tape. Immediately thereafter, the upper gripper, including the core bar, is moved upwardly by the cam 32 operating through the lever 34 and crank 36, during which period the tape is firmly supported between the lower grippers and the roller 110.

In the upward movement of the core bar, the dies are partially closed, and the casting previously formed on the core pin 141 and which has been moved below the dies in the downward movement of the core, is stripped therefrom. This closing operation of the dies continues until the core has reached its uppermost position, after which it is moved downwardly into proper position between the dies to again repeat the cycle of operation above described.

The above operations continue in the formation of a successive series of cast links 103 on the beaded edge 102a of the tape, and when the desired number of links have been formed to govern and control a predetermined stringer length, the trip 69a on the chain 60 actuates the pawl 131 to release the rod 125 to permit the roller 126 to move into engagement with the segment 127, which is controlled and timed by the cam 129 so as to function when the lower grippers 134, 134a are in open position, as well as when the top gripper has been opened by the actuation of the lever 122 through the cam 124 and the pin 118.

In each cycle of revolution of the machine, the finger 109 is moved upwardly when the tape is held by both grippers 116, 134, 134a, and this forms the desired slack in the tape between the source of supply, or the tension roller 104 and the roller 110, so that no stress or strain is exerted upon the tape feeding means in the operation of spacing the links or the successive castings thereon.

In the above described operation of moving the dies toward and from each other, the frame 48 is rocked or swung on its axis 49—50 so as to maintain the nozzle 63 in engagement with, or in close proximity to, the inner surface of at least one of the dies 62, 62a. It is understood that when the dies are closed, and prior to the forward movement of the plunger 70, the discharge of the nozzle 63 is in alinement with the admission opening into the impression of the dies, and the movement of the nozzle toward and away from its registering position with the die impression takes place prior to the opening and closing of the dies. That is to say, the dies remain closed a longer period than the period of registration of the nozzle with the impression therein. The movement of the nozzle relatively to the dies serves to shear the outer end of the gate of the casting.

It will be understood that the outer end portion of the gripper lever 116, where the roller 118a engages the same, is sufficiently wide to compensate for the upward and downward movement of the lever.

In the above described operation of moving the plunger 70 forwardly, it will be understood that the feed plate 78 having the measuring aperture 80 therein, is also moved forwardly from the position shown in Fig. 3 to a position over the feed tube 77a, so that the material deposited in the aperture 80 will be dropped through said tube into the hopper 81 in the manner heretofore stated. This construction provides an automatic replenishment of the casting material to the cylinder, and by heating the outer end of the cylinder including the nozzle, and cooling the inner end of the cylinder, the casting material is kept in the melted state at the discharge end of the cylinder or in said nozzle, and in a non-melted condition where the plunger 70 engages the same, thus preventing clogging or congestion in the cylinder as might otherwise prevail.

It will be understood that a machine of the type and kind herein illustrated, may be utilized in the casting of various kinds and classes of casting materials which can be suitably handled in a machine of our design. The machine is designed,

however, primarily for casting thermoplastics, such for example as cellulose acetate so as to form links or scoops of this material directly upon the tape in producing stringers for separable fasteners. It will also be apparent that other types and kinds of castings may be made than those herein named, whether or not the castings are formed on a mounting tape or strand. In other words, independent and unattached castings may be formed in which event the tape gripping and feeding means can be dispensed with, as well as the several parts dealing with the guide and feed of the tape into and through the machine.

It will be apparent that a suitable electric control will be provided for controlling the temperature, or in maintaining a desired temperature, of a casting material in the manner taught in our Patent 1,975,966, so as to insure the formation of proper castings consistent with the speed of which the machine is operated, as well as with the different types and kinds of materials employed which may require different temperatures.

It will also be apparent that the length of the chain 69 employed, will govern the length of the stringer to be formed, and in some cases, two or more of the trips 69*a* may be incorporated thereon. When it is desired to form long stringers, and to avoid the necessity of using excessively long chains, the worm 56 may be reversed to reduce the speed of rotation to one half the normal speed, or another ratio, thereby permitting the use of shorter chains. For this reason, the two worm portions 56*a*, 56*b* are employed.

It will also be noted that several of the adjustments provided for the different mechanisms are all so arranged as to be readily accessible, even to the provision of a hole in the front plate 23 to permit the passage of a screwdriver therethrough for engaging the screw 61. By these adjustments, proper alinement and relative arrangement of the several parts of the chain may be maintained at all times, not only to compensate for wear between certain of the parts, but also to care for materials of different kinds and classes, such for example, differences in the tape as well as in the adjustment of the spring tension 83 to compensate for the different casting materials employed.

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

1. In a die casting machine for intermittently forming a successive series of cast parts between relatively movable dies, an elongated cylinder at one side of the dies, a discharge nozzle at one end of the cylinder supported in constant engagement with at least one of said dies, a plunger movably supported in the other end of the cylinder, means for heating the first named end of the cylinder to melt casting material therein and in said nozzle, means for cooling the other end of the cylinder, means for intermittently feeding measured quantities of casting material into the cylinder forwardly of and adjacent said plunger, means for actuating the plunger through a spring in the pressure discharge of heated casting material from the nozzle of said cylinder into said dies, means for moving the cylinder and the nozzle thereof to maintain engagement of said nozzle with at least one of the dies, means for tensionally supporting the nozzle in engagement with the dies in the operation of ejecting casting material from said cylinder into the dies, and means for relieving pressure of the nozzle on the dies in the other positions thereof.

2. In a die casting machine for intermittently forming a successive series of cast parts between relatively movable dies, an elongated cylinder at one side of the dies, a discharge nozzle at one end of the cylinder supported in constant engagement with at least one of said dies, a plunger movably supported in the other end of the cylinder, means for heating the first named end of the cylinder to melt casting material therein and in said nozzle, means for cooling the other end of the cylinder, means for intermittently feeding measured quantities of casting material into the cylinder forwardly of and adjacent said plunger, means for actuating the plunger through a spring in the pressure discharge of heated casting material from the nozzle of said cylinder into said dies, means for moving the cylinder and the nozzle thereof to maintain engagement of said nozzle with at least one of the dies, means for tensionally supporting the nozzle in engagement with the dies in the operation of ejecting casting material from said cylinder into the dies, means for relieving pressure of the nozzle on the dies in the other positions thereof, and means for adjusting the tension of the pressure engagement of the nozzle on said dies.

3. In a die casting machine for intermittently forming a successive series of cast parts between relatively movable dies, an elongated cylinder at one side of the dies, a discharge nozzle at one end of the cylinder supported in constant engagement with at least one of said dies, a plunger movably supported in the other end of the cylinder, means for heating the first named end of the cylinder to melt casting material therein and in said nozzle, means for cooling the other end of the cylinder, means for intermittently feeding measured quantities of casting material into the cylinder forwardly of and adjacent said plunger, means for actuating the plunger through a spring in the pressure discharge of heated casting material from the nozzle of said cylinder into said dies, means for moving the cylinder and the nozzle thereof to maintain engagement of said nozzle with at least one of the dies, means for tensionally supporting the nozzle in engagement with the dies in the operation of ejecting casting material from said cylinder into the dies, means for relieving pressure of the nozzle on the dies in the other positions thereof, and means for adjusting the cylinder to properly aline the nozzle with said dies.

4. In a die casting machine employing relatively movable dies with an impression formed between adjacent surfaces of the dies, having an opening on the parting line of the dies through which casting material may be forced under pressure into said impression, a cylinder for the casting material employed, said cylinder having a nozzle at the discharge end thereof, means for movably supporting the cylinder to move the nozzle thereof to maintain constant engagement with one of said dies, the nozzle assuming a frictionless engagement with said die when in a non-casting position, and means asserting pressure of the nozzle on the dies when said nozzle is in position to permit the discharge of casting material from said cylinder into the impression of the dies.

5. In a die casting machine employing relatively movable dies with an impression formed between adjacent surfaces of the dies, having an opening on the parting line of the dies through which casting material may be forced under pressure into said impression, a cylinder

for the casting material employed, said cylinder having a nozzle at the discharge end thereof, means for movably supporting the cylinder to move the nozzle thereof to maintain constant engagement with one of said dies, the nozzle assuming a frictionless engagement with said die when in a non-casting position, means asserting pressure of the nozzle on the dies when said nozzle is in position to permit the discharge of casting material from said cylinder into the impression of the dies, means for pressure discharging casting material from the cylinder into the impression of the dies, and means in operative engagement with said last named means for intermittently feeding a measured quantity of casting material into the cylinder in successive operations of said last named means.

6. In a die casting machine of the class described, employing relatively movable dies with an impression formed between adjacent surfaces of said dies, a mounting member adapted to be supported between the dies with part of said member arranged in said impression, means in advance of the dies and movable toward and from the dies for engaging and intermittently feeding said member relatively to the dies when the dies are in open position, means for intermittently ejecting casting material under pressure into the impression of the dies when in closed position to form a successive series of castings in spaced relation to each other on said member, and the means for feeding said member comprising grippers spaced longitudinally of said member.

7. In a die casting machine of the class described, employing relatively movable dies with an impression formed between adjacent surfaces of said dies, a mounting member adapted to be supported between the dies with part of said member arranged in said impression, means in advance of the dies and movable toward and from the dies for engaging and intermittently feeding said member relatively to the dies when the dies are in open position, means for intermittently ejecting casting material under pressure into the impression of the dies when in closed position to form a successive series of castings in spaced relation to each other on said member, the means for feeding said member comprising spaced grippers, and one of said grippers being movable with and independently of said member in the intermittent feeding of said member relatively to the dies.

8. In a die casting machine of the class described, employing relatively movable dies with an impression formed between adjacent surfaces of said dies, a mounting member adapted to be supported between the dies with part of said member arranged in said impression, means in advance of the dies and movable toward and from the dies for engaging and intermittently feeding said member relatively to the dies when the dies are in open position, means for intermittently ejecting casting material under pressure into the impression of the dies when in closed position to form a successive series of castings in spaced relation to each other on said member, the means for feeding said member comprising spaced grippers, one of said grippers being movable with and independently of said member in the intermittent feeding of said member relatively to the dies, and means involving a tensional device and the other of said grippers for supporting said member against movement relatively to the dies in the operation of moving the first named gripper relatively to said member.

9. In a die casting machine of the class described, employing relatively movable dies with an impression formed between adjacent surfaces of said dies, a mounting member adapted to be supported between the dies with part of said member arranged in said impression, means for intermittently feeding said member relatively to the dies when the dies are in open position, means for intermittently ejecting casting material under pressure into the impression of the dies when in closed position to form a successive series of castings in spaced relation to each other on said member, the means for feeding said member comprising spaced grippers, one of said grippers being movable with and independently of said member in the intermittent feeding of said member relatively to the dies, means involving a tensional device and the other of said grippers for supporting said member against movement relatively to the dies in the operation of moving the first named gripper relatively to said member, and means for forming and maintaining a slack in said member prior to entering said dies.

10. In a die casting machine of the class described, employing relatively movable dies with an impression formed between adjacent surfaces of said dies, a mounting member adapted to be supported between the dies with part of said member arranged in said impression, means for intermittently feeding said member relatively to the dies when the dies are in open position, means for intermittently ejecting casting material under pressure into the impression of the dies when in closed position to form a successive series of castings in spaced relation to each other on said member, the means for feeding said member comprising spaced grippers, one of said grippers being movable with and independently of said member in the intermittent feeding of said member relatively to the dies, means involving a tensional device and the other of said grippers for supporting said member against movement relatively to the dies in the operation of moving the first named gripper relatively to said member, means for forming and maintaining a slack in said member prior to entering said dies, and means controlled by said member for automatically stopping the machine when the supply of said member to the machine is substantially consumed.

11. In a die casting machine for forming a successive series of thermoplastic castings on a mounting strip or strand, said machine employing relatively movable dies, movable toward and from said strip, means for intermittently feeding thermoplastic material under pressure into the dies to form a successive series of castings on said strip, and means in advance of the dies engaging and movable with and independent of said strip to feed the same and the casting formed thereon relatively to the dies to bring spaced sections of the strip between said dies in spacing the castings formed on said strip.

12. In a die casting machine for forming a successive series of thermoplastic castings on a mounting strip or strand, said machine employing relatively movable dies, movable toward and from said strip, means for intermittently feeding thermoplastic material under pressure into the dies to form a successive series of castings on said strip, means in advance of the dies engaging and movable with and independent of

said strip to feed the same and the casting formed thereon relatively to the dies to bring spaced sections of the strip between said dies in spacing the castings formed on said strip, said last named means comprising one strip gripping element movable with and relatively to, the strip in the operation of intermittently feeding said strip, and another gripping element engaging the strip to support the same against movement when the first named element moves relatively to said strip.

13. In a die casting machine for forming a successive series of thermoplastic castings on a mounting strip or strand, said machine employing relatively movable dies, movable toward and from said strip, means for intermittently feeding thermoplastic material under pressure into the dies to form a successive series of castings on said strip, means in advance of the dies engaging and movable with and independent of said strip to feed the same and the casting formed thereon relatively to the dies to bring spaced sections of the strip between said dies in spacing the castings formed on said strip, said last named means comprising one strip gripping element movable with and relatively to the strip, in the operation of intermittently feeding said strip, another gripping element engaging the strip to support the same against movement when the first named element moves relatively to said strip, said strip feeding means including a core upon which the respective castings are formed, and said core being movable with the first named gripping element in the feeding and spacing of said strip.

14. In a die casting machine for forming a successive series of thermoplastic castings on a mounting strip or strand, said machine employing relatively movable dies, movable toward and from said strip, means for intermittently feeding thermoplastic material under pressure into the dies to form a successive series of castings on said strip, means in advance of the dies engaging and movable with and independent of said strip to feed the same and the casting formed thereon relatively to the dies to bring spaced sections of the strip between said dies in spacing the castings formed on said strip, said last named means comprising one strip gripping element movable with and relatively to the strip, in the operation of intermittently feeding said strip, another gripping element engaging the strip to support the same against movement when the first named element moves relatively to said strip, said strip feeding means including a core upon which the respective castings are formed, said core being movable with the first named gripping element in the feeding and spacing of said strip, and means in operative engagement with said first named gripping element and with said strip, for periodically feeding a long section of the strip relatively to the dies to provide a wide space between adjacent castings formed on said strip.

15. In a machine for forming a successive series of thermoplastic castings on an elongated mounting member by relatively movable dies intermittently moved toward and from spaced sections of said member in forming said successive series of castings, means in advance of and in close proximity to said dies for directly engaging and feeding said member relatively to the dies when in open position to bring the spaced sections of said member intermittently between said dies, said means comprising a gripper movable longitudinally with the member in feeding and spacing said member, and then longitudinally of the member in an opposed direction, and other means for supporting said member against movement in the last named movement of said gripper means.

16. In a die casting machine employing relatively movable dies, an elongated cylinder arranged at one side of the dies, means for intermittently feeding casting material into the cylinder and for heating the same prior to discharge into said dies in forming a casting therein, a plunger movable longitudinally of the cylinder for pressure feeding the heated casting material into the dies, means for swinging the cylinder in a plane common to the plane of movement of said dies, to maintain the discharge of the cylinder in constant engagement with at least one of said dies, and means involving free couplings for actuating said plunger.

17. In a die casting machine of the class described, a pair of dies movable toward and from each other, an elongated cylinder disposed angularly to the dies, a plunger in said cylinder and movable longitudinally thereof for pressure discharging casting material therefrom into said dies, means moving the cylinder bodily toward and from shaid dies, other means for moving said cylinder bodily longitudinally of the direction of movement of said dies, a rod, means connecting said rod to said plunger including a universal joint, a cam, and means connected to said rod and cooperating with said cam for driving said rod, said last named means also including a universal joint.

18. In a die casting machine of the class described, a pair of dies movable toward and from each other, an elongated cylinder disposed angularly to the dies, a plunger in said cylinder and movable longitudinally thereof for pressure discharging casting material therefrom into said dies, means moving the cylinder bodily toward and from said dies, other means for moving said cylinder bodily longitudinally of the direction of movement of said dies, a rod, means connecting said rod to said plunger including a universal joint and adjustable resilient means, a cam, and means connected to said rod and cooperating with said cam for driving said rod, said last named means also including a universal joint.

19. In a die casting machine employing relatively movable dies, an elongated cylinder arranged at one side of the dies, means for intermittently feeding casting material into the cylinder and for heating the same prior to discharge into said dies in forming a casting therein, a plunger movable longitudinally of the cylinder for pressure feeding the heating casting material into the dies, and means for moving the cylinder in a plane common to the plane of movement of said dies to maintain the discharge of the cylinder in constant engagement with at least one of said dies to trim the gate of the casting in such movement.

20. In a machine for forming a successive series of castings between relatively movable dies, means for moving said dies toward and from each other and to support the same in engagement under pressure, means for feeding casting material under pressure into said dies, when held in closed position, through a gate passage opening into the impression of the dies, and means for moving said last named means into and out of registering alinement with said gate passage, said movement operating to shear the gate of the cast-

ing and to maintain said second named means in constant engagement with at least one of said dies.

21. In a die casting machine of the class described, employing relatively movable dies with an impression formed between adjacent surfaces of said dies, a mounting member adapted to be supported between the dies with part of said member arranged in said impression, means for intermittently feeding said member relatively to the dies when the dies are in open position, means for intermittently ejecting casting material under pressure into the impression of the dies when in closed position to form a successive series of castings in spaced relation to each other on said member, the means for feeding said member comprising spaced grippers, and means forming a slack in said member prior to entering the feeding means of said member to relieve strain on said feeding means.

22. In a die casting machine for forming a successive series of thermoplastic castings on a mounting strip or strand, said machine employing relatively movable dies, movable toward and from said strip, means for intermittently feeding thermoplastic material under pressure into the dies to form a successive series of castings on said strip, means engaging said strip to feed the same and the casting formed thereon relatively to the dies to bring spaced sections of the strip between said dies in spacing the castings formed on said strip, said last named means comprising one strip gripping element movable with and relatively to, the strip, in the operation of intermittently feeding said strip, another gripping element engaging the strip to support the same against movement when the first named element moves relatively to said strip, and means for feeding said strip into the machine and forming a slack therein when the strip is supported between said gripping elements.

23. A machine of the class described comprising dies movable toward and from each other, a cylinder arranged at one side of the dies, a discharge nozzle at the end of said cylinder and in engagement with said dies, a plunger in said cylinder for ejecting heated casting material from the cylinder into an impression formed between said dies, means in operative engagement with the plunger for intermittently feeding casting material into the cylinder forwardly of said plunger to replenish the supply of material to the cylinder in successive operations of said plunger, said last named means comprising a hopper in which the casting material for supply to said cylinder is stored, a measuring and delivery slide for transmitting the material from said hopper to said cylinder, said cylinder, hopper, and associated parts being arranged and supported on a swinging frame unit, means for swinging said frame unit, and means for moving said unit longitudinally of the axis of said unit in the direction of said dies whereby to maintain the nozzle of said cylinder in constant engagement with at least one of said relatively movable dies irrespective of the movement of said dies.

24. A machine of the class described comprising dies movable toward and from each other, a cylinder arranged at one side of the dies, a discharge nozzle at the end of said cylinder and in engagement with said dies, a plunger in said cylinder for ejecting heated casting material from the cylinder into an impression formed between said dies, means in operative engagement with the plunger for intermittently feeding casting material into the cylinder forwardly of said plunger to replenish the supply of material to the cylinder in successive operations of said plunger, said last named means comprising a hopper in which the casting material for supply to said cylinder is stored, a measuring and delivery slide for transmitting the material from said hopper to said cylinder, said cylinder, hopper, and associated parts being arranged and supported on a swinging frame unit, means for swinging said frame unit, means for moving said unit longitudinally of the axis of said unit in the direction of said dies whereby to maintain the nozzle of said cylinder in constant engagement with at least one of said relatively movable dies irrespective of the movement of said dies, and means involving universal couplings for actuating said plunger through resilient means.

25. A machine of the class described comprising dies movable toward and from each other, a cylinder arranged at one side of the dies, a discharge nozzle at the end of said cylinder and in engagement with said dies, a plunger in said cylinder for ejecting heated casting material from the cylinder into an impression formed between said dies, means in operative engagement with the plunger for intermittently feeding casting material into the cylinder forwardly of said plunger to replenish the supply of material to the cylinder in successive operations of said plunger, said last named means comprising a hopper in which the casting material for supply to said cylinder is stored, a measuring and delivery slide for transmitting the material from said hopper to said cylinder, said cylinder, hopper, and associated parts being arranged and supported on a swinging frame unit, means for swinging said frame unit, means for moving said unit longitudinally of the axis of said unit in the direction of said dies whereby to maintain the nozzle of said cylinder in constant engagement with at least one of said relatively movable dies irrespective of the movement of said dies, means involving universal couplings for actuating said plunger through resilient means, and means for adjusting the tension of said resilient means.

26. In a die casting machine for intermittently forming a successive series of cast parts between relatively movable dies, an elongated cylinder at one side of the dies, a discharge nozzle at one end of the cylinder and in engagement with at least one of said dies, a plunger movably supported in the other end of the cylinder, means for heating the first named end of the cylinder to melt the casting material therein and in said nozzle, means for cooling the other end of the cylinder means movable with the plunger for intermittently feeding measured quantities of casting material into the cylinder forwardly of and adjacent said plunger, means for actuating the plunger through a spring in the pressure discharge of heated casting material from the nozzle of said cylinder into said dies, means for swinging the cylinder and the nozzle thereof to maintain constant engagement with at least one of the dies, and means for moving the cylinder and said nozzle longitudinally of the swinging axis of the cylinder in the direction of the dies to maintain engagement with at least one of the dies.

27. In a die casting machine of the character described, dies movable toward and from each other, an elongated cylinder extending angularly from one side surface of the dies, a discharge nozzle at one end of the cylinder adapted to register with an impression formed between adjacent sur-

faces of the dies, a hopper for storage of the casting material employed, means for intermittently feeding material from said hopper into the cylinder adjacent the nozzle end thereof, means at said end of the cylinder for heating said material to a degree sufficiently to insure formation of proper castings in the discharge of said material through said nozzle into the impression of the dies, means arranged in the other end of the cylinder and involving a yieldable element for forcing the casting material under pressure into the impression of the dies, said first named means and last named means being operated simultaneously to automatically control and regulate the supply of casting material to said cylinder, and means for moving the cylinder and associated parts in the direction of the movement of one of said dies and transversely of the die movement to maintain the discharge nozzle in constant engagement with said die.

28. In a machine for forming a successive series of thermoplastic castings on an elongated mounting member, by relatively movable dies intermittently moved toward and from spaced sections of said member in forming said successive series of castings, means in advance of and in close proximity to said dies for directly engaging said member, and means for actuating said engaging means to feed said member relatively to the dies when in open position to bring the spaced sections of said member intermittently between said dies.

29. A machine of the class described comprising dies movable toward and from each other, a cylinder arranged at one side of the dies, a discharge nozzle at the end of the cylinder and in close proximity to said dies, the cylinder having an admission port inwardly of the discharge end of said nozzle, a plunger in said cylinder for feeding casting material introduced into the cylinder through said port in the direction of the nozzle end of the cylinder and for ejecting heated casting material from the cylinder into an impression formed between said dies, a slide having means therein for holding a measured quantity of casting material, means connecting the slide to the plunger to move the slide with the plunger to bring the slide into position to deliver the measured quantity of casting material into the port of said cylinder when the plunger is in its advanced position.

30. In a machine of the class described, means forming a mold cavity, a cylinder having a nozzle arranged to discharge molding material into said cavity, a plunger in said cylinder and means for reciprocating it to feed material into said cavity, said cylinder having an opening therein at a point forwardly of the front end of the plunger when in its rearmost position, a slide connected to said plunger to move therewith, said slide having a reservoir, a conduit having one end discharging into said opening and having the other end in position for said slide to move across it during the feed stroke of the plunger to receive material from said reservoir, and a container above said slide and positioned to deliver material to said reservoir when said slide has been moved to the position it occupies at the completion of the return stroke of the plunger.

31. In a machine of the class described, means forming a mold cavity, a cylinder having a nozzle arranged to discharge molding material into said cavity, a plunger in said cylinder and means for reciprocating it to feed material into said cavity, said cylinder having an opening therein at a point forwardly of the front end of the plunger when in its rearmost position, a slide connected to said plunger to move therewith, said slide having a reservoir, a conduit having one end discharging into said opening and having the other end in position for said slide to move across it during the feed stroke of the plunger to receive material from said reservoir, a container above said slide and positioned to deliver material to said reservoir when said slide has been moved to the position it occupies at the completion of the return stroke of the plunger, and means maintaining the reservoir closed between said positions.

32. In a machine of the class described, means forming a mold cavity, a cylinder having a nozzle arranged to discharge molding material into said cavity, a plunger in said cylinder and means for reciprocating it to feed material into said cavity, said cylinder having an opening therein at a point forwardly of the front end of the plunger when in its rearmost position, a slide connected to said plunger to move therewith, said slide having a reservoir, a conduit having one end discharging into said opening and having the other end in position for said slide to move across it during the feed stroke of the plunger to receive material from said reservoir, a container above said slide and positioned to deliver material to said reservoir when said slide has been moved to the position it occupies at the completion of the return stroke of the plunger, and means maintaining the reservoir closed between said positions and at least partially closed when said feed stroke is less than its maximum.

DAVIS MARINSKY.
LOUIS H. MORIN.