Dec. 18, 1962 L. H. MORIN 3,068,519

METHOD AND APPARATUS FOR CASTING MULTIPLE PLASTIC SCOOPS AND CONTROLLING PREDETERMINED STRINGER LENGTHS

Filed March 12, 1958 2 Sheets-Sheet 1

FIG. 1

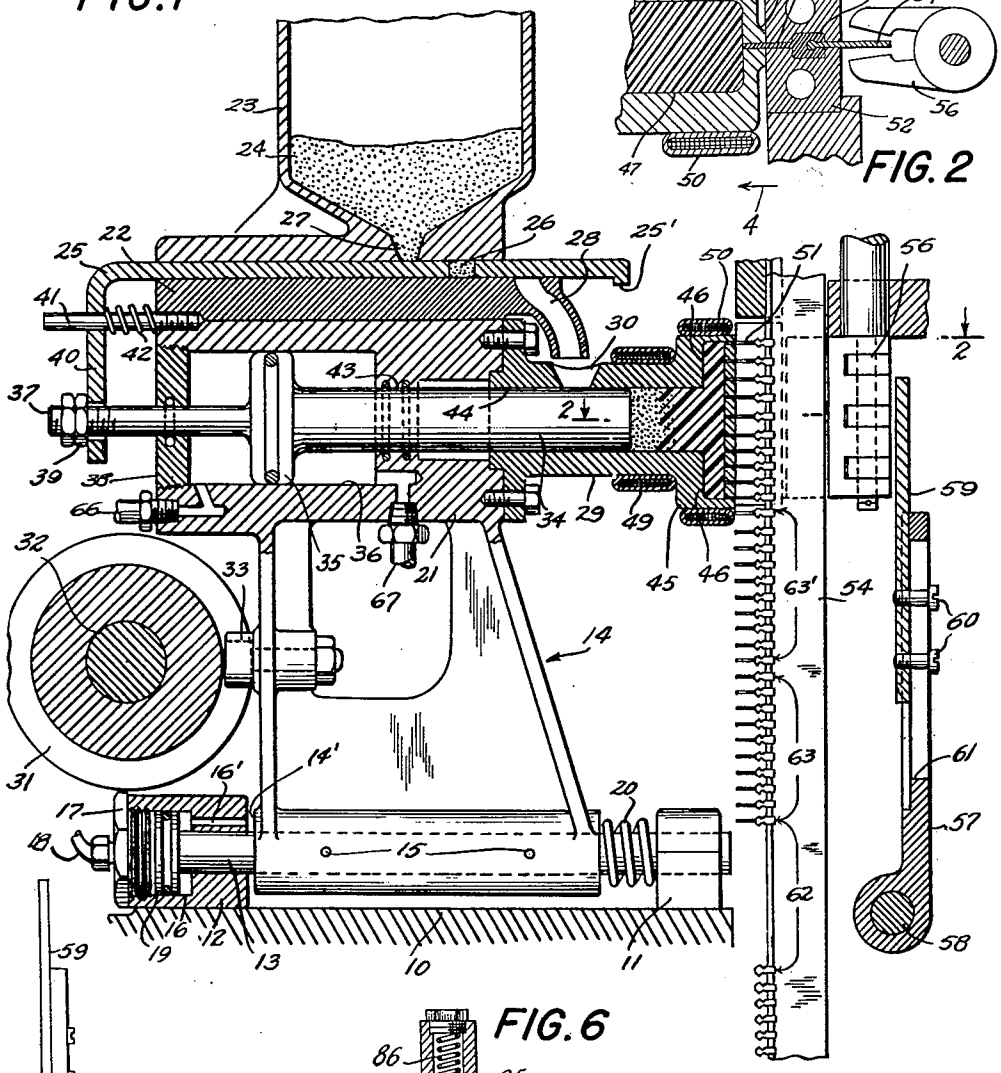


FIG. 2

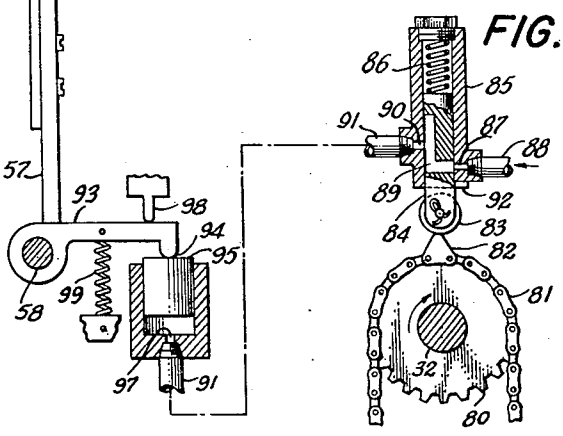
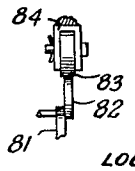


FIG. 6

FIG. 7



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FIG. 3

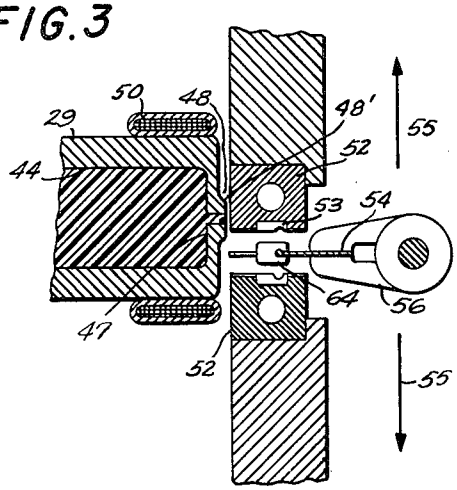


FIG. 4

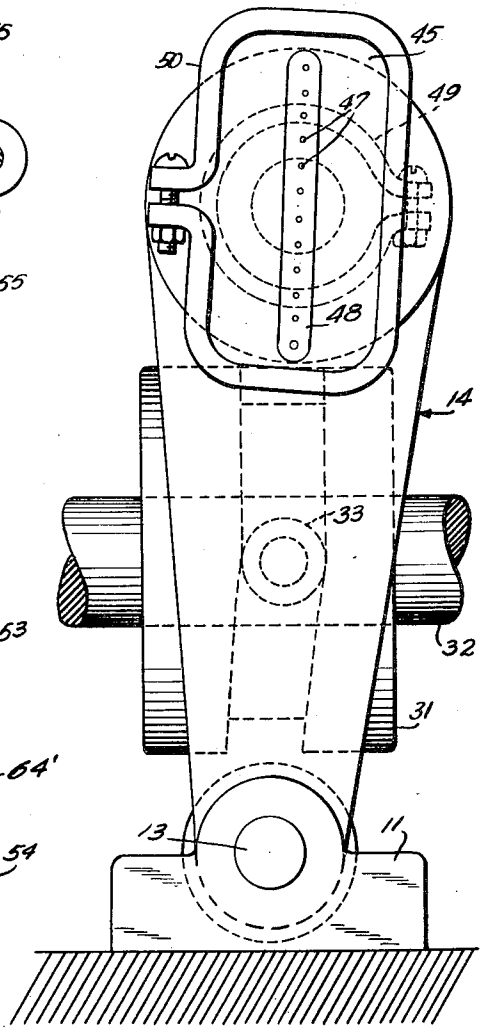
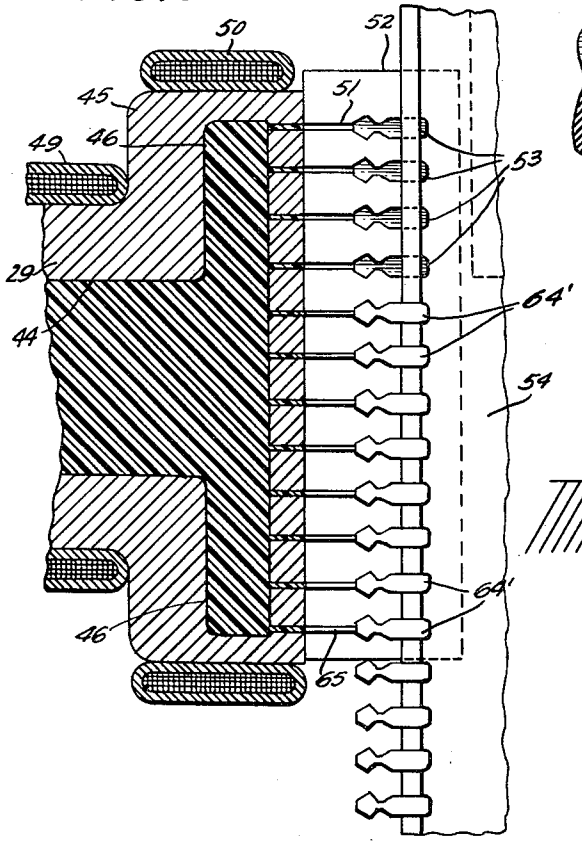


FIG. 5



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METHOD AND APPARATUS FOR CASTING MULTIPLE PLASTIC SCOOPS AND CONTROLLING PREDETERMINED STRINGER LENGTHS

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5 Claims. (Cl. 18—30)

This invention relates to the production of plastic stringers of separable fasteners in predetermined variable stringer lengths. More particularly, the invention deals with the novel method of simultaneously casting a plurality of plastic scoops on a stringer, then intermittently shifting the stringer tape in forming a predetermined stringer length and controlling this tape shifting, so as to control the final number of scoops cast in producing the desired number of scoops in a complete stringer length.

Still more particularly, the invention deals in a novel apparatus for producing plastic stringers of the type and kind defined.

The novel features of the invention will be best understood from the following description, when taken together with the accompanying drawing, 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 longitudinal sectional view through an apparatus, diagrammatically illustrating the method of simultaneously forming a plurality of cast plastic scoops on sections of an intermittently fed stringer tape, parts of the construction being shown in elevation and parts broken away.

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

FIG. 3 is a view, similar to FIG. 2, showing the parts in a different position, with clearances exaggerated.

FIG. 4 is an enlarged view looking in the direction of the arrow 4 of FIG. 1, omitting part of the background showing; and

FIG. 5 is an enlarged detail view of part of the construction shown in FIG. 1, illustrating a modified number of die cavities.

FIG. 6 is a view of a compressed air mechanism for operating a stop member at timed intervals; and

FIG. 7 is a partial view of a roller and chain shown in FIG. 6.

In FIG. 1 of the drawing, 10 diagrammatically illustrates a base of the machine, having spaced bearings 11 and 12 for a shaft 13. At 14 I have shown a swinging frame fixed to the shaft 13, as at 15, the shaft forming a pivot for swinging movement of the frame 14 in the bearings 11 and 12.

The bearing 12 is fashioned to form a cylinder portion 16, having at one end a discharge port 16', closed at its other or outer end by a cap 17, in which is supported an admission tube 18 for the injection of air or hydraulic medium into the cylinder 16 to actuate a piston 19 on the shaft 13 in providing movement of the frame longitudinally of the axis of the shaft 13 against the action of a spring 20 arranged between one end of the frame and the bearing 11.

At the upper end of the frame 14 is a cylinder 21, upon which is suitably supported a plastic discharge plate

22, upon which, in turn, is suitably supported a hopper 23 for support of plastic grains or crystals 24, as diagrammatically illustrated in FIG. 1. Movably supported between adjacent surfaces of the plate 22 and hopper 23 is a plastic measuring and transfer slide 25, having an aperture 26 therein for picking up, from the discharge 27 of the hopper 23, a predetermined measured amount of the plastic material for delivery to the discharge chute 28 of the plate 22. Supported upon the cylinder 21 is an injection cylinder 29, having a plastic admission aperture 30 registering with the discharge chute 28.

The above briefly described structure, namely cylinder 21, plate 22, hopper 23, slide 25 and injection cylinder 29, all constitute a unit part of the frame 14 which is movable longitudinally with respect to the axis of the shaft 13, as previously stated and is swung on said axis from the position of the parts, as illustrated in FIG. 2, to the position of the parts as seen in FIG. 3 and returned by means of a cam 31 on a suitably driven cam shaft 32 operatively engaging a roller 33 supported on the frame 14, as is clearly illustrated in FIGS. 1 and 4 of the drawing.

Operating in the cylinders 21 and 29 is an injection piston or plunger 34, the piston having a large diameter portion 35 operating in a large diameter portion 36 of the piston cylinder 21 and extending from the large diameter piston portion 35 is a reduced rod 37 which extends through a closure plate 38. Mounted on the extended rod 37 and operatively engaging adjustable nuts 39 on the rod is an offset end 40 of the slide 25. The slide moves on a pin 41, on which is arranged a spring 42 which normally urges the end 40 of the slide in engagement with the nuts 39. The piston 34 has a suitable bearing 43 in the cylinder 21 and a snug, but free, fit in the bore 44 of the injection cylinder 29.

The outer end of the cylinder 29 is enlarged, as seen at 45, the enlargement being in the form of upward and downward extensions, into which extensions of the bore 44 extend, as seen at 46, so as to register the bore with a multiplicity of vertically spaced nozzles 47 opening through an elongated outward offset 48, as most clearly seen in FIGS. 2 and 3 of the drawing.

In this connection, it will be apparent that the illustration in FIG. 1 of the drawing is somewhat diagrammatic.

Arranged upon the cylinder 29, including the enlarged portion 45 thereof, are two electric heater clamps, diagrammatically seen at 49 and 50, for heating the plastic material to the desired temperature for proper injection of the plastic material through the nozzles into correspondingly spaced sprue passages 51 of a pair of dies 52. Note, in this connection, FIGS. 2 and 3 of the drawing. The dies collectively form a corresponding number of scoop cavities 53 for the formation of scoops which are cast directly upon a stringer tape 54, positioned between the dies 52. The dies 52 are suitably actuated to be moved into the closed position shown in FIG. 2 and the open position, as illustrated in FIG. 3 of the drawing, the arrows 55 of FIG. 3 illustrating the separable movement of the dies. Each sprue passage 51 and the scoop cavity 53 with which it communicates may be called a "die cavity."

At 56 I have diagrammatically shown a pair of tape feeding grippers for normally moving the tape 54 a

predetermined distance to which the gripper feed is adjusted, for example, to feed the tape for the casing of a successive series of increments governed by the number of scoops simultaneously cast in each injection operation of the machine. Reference is made to my Patent No. 2,695,419 of 1954 and the patents mentioned therein, which show in greater detail gripper mechanism suitable for use in tape feeding. My Patent No. 2,499,010 shows details of pneumatically operated gripper jaws adapted to grip the tape during successive feeding operation.

In FIG. 1 of the drawing, ten scoops are simultaneously formed in this operation and, in illustrating a slight modification or variance in FIG. 5 of the drawing, twelve scoop cavities are shown in the dies and, accordingly, twelve scoops would simultaneously be formed.

At this time, it is pointed out that any desired number of scoops may be provided but I have found that, for practical purposes, scoop cavities in the neighborhood of ten to twenty are desirable and practical.

In controlling the formation of predetermined stringer lengths which are defined by the number of scoops in each stringer length, a given number of normal increment feedings of the grippers will take place and, then, an adjustable stop, diagrammatically seen at **57**, is employed swingable upon a shaft **58**, the stop having a stop plate **59** having a vertical adjustment through the medium of screws **60** fixed to the plate **59** and operating in an elongated aperture **61**. Automatic operation of adjustable stop **57** may be achieved by the apparatus of FIGS. 6 and 7. As shaft **32** rotates, it turns sprocket wheel **80** and thereby advances and endless loop of timing chain **81**, only part of which is shown in FIG. 6. Riding on the timing chain is a roller **83** attached to a valve stem **84**. When in contact with the normal links in the timing chain the roller, and therefore the valve stem, is located in what may be called a normal position (not shown). At desired locations on the timing chains a normal link is replaced by a tripping lug **82** which raises the roller **83** and valve stem **84** into what may be called a raised position, as shown in FIG. 6. The valve stem is slidably located in a valve body **85** and is biased by spring **86** so that roller **83** is maintained in contact with the timing chain at all times. A compressed air inlet port **87** is connected through tube **88** to a source of compressed air. When the valve stem is in the raised position an internal passage **89** therein connects inlet port **87** to outlet port **90** and allows the flow of compressed air through the valve to outlet tube **91**. When in the normal position the valve stem **84** blocks inlet port **87** and connects outlet tube **91** to the atmosphere by means of outlet port **90**, internal passage **89**, and a cut-away portion of the valve body at **92**.

Rigidly fastened to shaft **58** is rocker arm **93** having rounded end **94** bearing on the upper surface of piston **95**. Piston **95** is slidable in cylinder **96** which is connected to outlet tube **91** through port **97**. When the valve stem is in the raised position compressed air flows into the cylinder **96** and the piston rises onto the position of FIG. 6, moving rocker arm **93** into contact with stop **98** and turning shaft **58** sufficiently to place stop **57** in a blocking position with respect to the tape grippers. When the valve stem returns to the normal position, the compressed air pressure on piston **95** is removed and spring **99** rotates rocker arm **93** clockwise as shown and thereby removes the stop **57** from the blocking position.

Normally, the plate **59** will clear operation of the grippers **56**, but will intermittently be moved into position to check feed movement of the grippers governed by the adjusted position of the plate **59**, which, for purposes of illustration, can be said to be adjusted to a position to feed the tape **54** sufficiently to expose only four of the scoop cavities **53**, as diagrammatically seen in FIG. 5 of the drawing.

In considering the showing of FIG. 5, let us say, for example, the stringer length required was to include twenty-eight of the scoops. Then, in order to produce the desired stringer length, two full feeds of the tape **54** by the gripper **56** would take place, forming the two groups of twelve scoops, giving a total of twenty-four; then, in the next feed of the tape by the grippers, the feed is checked to expose only the four scoop cavities **53**, as noted in FIG. 5, and in the next injection stroke, the four scoops filling the exposed scoop cavities will be added to the scoops previously formed, resulting in the production of the twenty-eight scoop stringer.

After this operation has been performed and by suitable controls, the tape is fed to provide the tape spacing, as indicated by the bracketed arrows **62**, FIG. 1 of the drawing.

In FIG. 1, I have also illustrated bracketed arrows **63**, **63'** to indicate the full increment of cavities of the scoops on the stringer tape. The adjustment of the plate **59** takes place only as and when a production run of a varied number of scoops in the stringer length is required. The adjustment is such as to provide for the addition of one or more scoops to any series of complete increments of scoops that have been previously cast. It will be apparent that, in the partial feed of the tape, which is checked by the stop or check plate **59**, the pre-formed scoops will be positioned in the scoop cavities of the dies, the scoops being generally identified by the reference character **64** and the scoops positioned in the scoop cavities, as mentioned above, are indicated at **64'** in FIG. 5 of the drawing. These scoops, including their gate or sprue portions **65**, block the admission of additional plastics, while the four scoops are formed in the exposed scoop cavities **53** located at the top of FIG. 5 of the drawing.

Considering FIG. 1 of the drawing, it will appear that the slide **25** has a stop flange **25'** which operatively engages the plate in checking movement of the slide by the spring **42**, so as to definitely position the aperture **26** in registering position with the discharge **27** of the hopper **23**. This is when the piston or plunger **34** is in its retracted position, exposing the aperture **30** to the bore **44**, so as to drop the plastic grains or crystals directly in front of the piston **34** for feed forwardly into the heated end of the injection cylinder, preparing the plastics for discharge into the die cavities in the formation of predetermined increments of scoops on the stringer tape.

In the forward movement of the piston **34**, or the injection stroke thereof, the picked-up crystals in the aperture **26** will be dropped into the aperture **30** and rest upon the piston **34**, thus, in the return stroke of the piston, these crystals will drop in front of the piston, as and when other plastic crystals are picked-up by the aperture **26**.

For actuating the piston or plunger **34**, air or hydraulic medium can be introduced into opposed ends of the large diameter bore **36** of the cylinder **21** through suitable pipes or tubes **66** and **67**, note FIG. 1 of the drawing, the introduction of these pressure mediums being suitably and timely controlled by valves, not shown, for actuating the piston or plunger **34** in both directions, suitable means being provided to care for the discharge of the pressure mediums from each end of the cylinder, as the piston **35** operates in both directions. As these controls are well known, no attempt is made to illustrate the same.

After an injection charge of the plastic material has taken place, with the parts in the position, as seen in FIG. 2 of the drawing, then the frame unit **14** is actuated through the cam **31** to move the parts into the position shown in FIG. 3 and, at the beginning of this operation, the sprue or gate **65** is sheared, the dies are opened, as shown in FIG. 3, and the unit **14** is moved to a slight extent, so as to provide a slight clearance between the surface **48'** of the projection **48** and the surface of the die. The showing of this clearance is exaggerated in FIG. 3 of the drawing, as well as in the showing of the structure in FIG. 1 of the drawing. Actually, the movement is checked by the surface **14'** of the frame striking the bear-

ing 12, the action being through the medium of the spring 20 with the pressure on the piston 19 released.

In the injection charge of the apparatus, it will be understood that air or hydraulic medium is introduced into the cylinder 16 to act upon the piston 19 in forcibly supporting the surface 48' upon the surface of the dies 52 or in the position as shown in FIG. 2 of the drawing.

While many types of plastic materials can be used which are suitable for performing molding or castings of the character described, such materials as nylon and Delrin are desirable from the standpoint of strength and resistance to heat, keeping in mind that many articles upon which the separable fasteners are mounted are subjected to laundering.

It will be understood that, at a predetermined distance, after passing the casting station, the sprues or gates of the scoops are trimmed off at a trimming station, not shown, in producing the resulting end product.

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

1. A method of forming a series of castings on a continuous member through the use of a pair of dies adapted to close about the continuous member and having die surfaces defining a plurality of equally spaced die cavities of similar size, shape, and orientation comprising: closing the pair of dies about the continuous member; forming a plurality of similar castings on the continuous member in a first casting operation by filling the plurality of die cavities with castable material; opening the pair of dies; moving the extended member relative to the open dies; closing the pair of dies about the continuous member and simultaneously relocating a number of the castings formed in the first casting operation less than the total number then formed, each relocated casting being relocated in a die cavity other than that in which said casting was formed; and forming at least one casting on the continuous member in a second casting operation by filling at least one of the die cavities free of a relocated casting with castable material while simultaneously preventing the entry of castable material into at least one die cavity by blocking said entry with a relocated casting therein.

2. A method of forming a series of cast separable fastener scoops on a stringer tape through the use of a pair of dies adapted to close about the stringer tape and having die surfaces defining a plurality of die cavities, each cavity comprised of a sprue passage and a scoop cavity, comprising: closing the pair of dies about the stringer tape; forming a plurality of scoops on the stringer tape in a first casting operation by filling the die cavities with castable material; opening the pair of dies; moving the stringer tape relative to the open dies; closing the pair of dies about the stringer tape and simultaneously relocating a number of scoops formed in the first casting operation less than the total number then formed, each relocated scoop being relocated in a scoop cavity other than the scoop cavity in which it was formed; and forming at least one scoop on the stringer tape in a second casting operation by applying castable material under pressure to the die cavities and thereby filling the scoop cavities not occupied by scoops formed in the first casting operation with castable material while simultaneously preventing the entry of castable material into the occupied scoop cavities containing scoops formed in the first casting operation by blocking the flow of castable material into said occupied scoop cavities with castable material formed in the first casting operation.

3. A machine for casting a series of castings on a continuous member comprising: separable dies movable into a closed position to embrace a segment of the continuous member; gripper means for intermittently advancing the continuous member between the dies while said dies are separated, said gripper means normally advancing the continuous member a predetermined normal increment during each operation thereof; die surfaces on the dies defining a plurality of die cavities for forming a plurality of castings on the segment of the continuous member while embraced by the dies, said die cavities being so spaced that the advance of the continuous member over a normal increment following the formation of a plurality of die castings in the die cavities on the continuous member will carry the die castings so formed past all the die cavities; stop means for modifying the movement of the gripper means in advancing the continuous member, said stop means being adapted to limit the movement thereof to a reduced increment, said reduced increment being less than the normal increment and said reduced increment being so related to the spacing of the die cavities that the advance of the continuous member through a reduced increment following the formation of a plurality of die castings in the die cavities on the continuous member positions at least one of the die castings so formed relative to the dies so that movement of the dies to the closed position while said die casting is so positioned will relocate said die casting in a die cavity other than that in which it was formed; nozzle means for applyng castable material under pressure to the die cavities and for introducing said castable material into the die cavities which are free of relocated castings; and pressure means for supplying castable material under pressure to the nozzle means.

4. In a machine for die casting a series of castings on a continuous member during a series of casting operations, the combination comprising: separable dies movable into a closed position; surfaces on the dies defining a plurality of die cavities, said cavities shaped to embrace the continuous member when the dies are in the closed position and said die cavities being of similar size, shape, and orientation and being spaced at equal intervals; a plurality of nozzles, each nozzle adapted to communicate with a die cavity when the dies are in the closed position; pressure means for supplying material to be cast to the nozzles during a casting operation; intermittently operable gripper means for moving the continuous member relative to the dies while the dies are separated, said gripper means having a normal incremental feeding movement for moving the continuous member through a distance such that all the castings produced in an initial casting operation prior to the normal incremental feeding movement are carried past the die cavities during said normal incremental feeding movement prior to the closing of the dies in preparation for a subsequent casting operation and said gripper having a reduced incremental feeding movement for moving the continuous member through a distance such that a number of the castings produced during an initial casting operation prior to the reduced incremental feeding movement less than the total number then produced are relocated in die cavities other than those in which they were produced when the dies are closed following the reduced incremental feeding movement in preparation for a subsequent casting operation; and control means operable to select either the normal incremental feeding movement or the reduced incremental feeding movement of the gripper after a casting operation.

5. A machine for casting a series of slide fastener scoops on a stringer tape comprising: separable dies movable into a closed position to embrace a segment of the stringer tape; die surfaces on the dies defining a plurality of die cavities, said die cavities being of similar size, shape and orientation and spaced to embrace the edge of the stringer tape at equally spaced points on said stringer tape when the dies are in the closed position and each of said die cavities comprising a scoop cavity and a sprue passage leading to the scoop cavity; a plurality of nozzles equal in number to the die cavities, each nozzle adapted to communicate with a sprue passage when the dies are in the closed position; a cylinder; a piston slidable in the cylinder to place under pressure castable material held in the cylinder; an enlarged end portion of the cylinder communicating with the nozzles for transfer of

castable material from the cylinder to the nozzles; tape grippers movable relative to the dies following the formation of castings in the die cavities during a casting operation to transport the stringer tape relative to the dies in a direction longitudinal to the stringer tape, said tape gripper being adapted normally to move the tape a distance equal to the number of die cavities multiplied by the distance separating corresponding points of adjacent die cavities; and a selectively operable stop engageable with the gripper following a selected casting operation to allow movement of the gripper but to limit the movement of the tape under the influence of the gripper to a distance equal to a number of die cavities less than the total number of die cavities multiplied by the distance separating corresponding points of adjacent die cavities.

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