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SLIDE FASTENER MANUFACTURE

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This invention relates to slide fasteners and, in particular, to the forming of interlocking fastener members directly upon fastener stringer tapes.

It is an object of this invention to provide an improved method of forming or casting interlocking fastener members directly upon fastener stringer tapes, wherein the concentric location of the formed interlocking fastener members with respect to the tape is assured and wherein the head or interengaging portions of the interlocking fastener members are formed by completely closed die surfaces preventing the formation of flash, sprues or gates on these portions of the fastener members.

It is a further object of this invention to provide a method and apparatus for forming interlocking fastener members directly upon stringer tapes wherein proper alignment of the stringer tapes with respect to the dies is readily accomplished and assured by the manner in which the fastener member forming material is fed to the dies.

It is a further object of this invention to provide such a method and apparatus wherein the die opening is disposed at the rear of the leg portions of the formed fastener members and wherein the formation of gates and sprues on the head portions is totally obviated.

These and other objects and advantages of the invention will appear from the following description taken in conjunction with the accompanying drawing which forms a part thereof, and will be pointed out in the appended claims.

In the drawing:

Fig. 1 is a side elevation of one form of apparatus for accomplishing the objects of this invention; and

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

Former methods of forming the interlocking fastener members of slide fasteners directly upon the slide fastener stringer tapes utilized dies provided with slots accommodating the edge portions of stringer tapes and having openings spaced from the extreme edge of the stringer tapes, within the die, for receiving fastener member forming material. The material which was either metal in molten condition or heated non-metallic resinous or plastic material was supplied to the interior of the die under extreme pressure directed toward the enclosed tape edge from points spaced from the enclosed tape edge in a direction generally opposite the direction in which the tape extended from the enclosed tape

edge and, in some cases, in quick shots resulting in impact upon the tape. The introduction of material in this direction toward the tape edge upon which the members were formed exerted against the stringer tapes projecting into the die cavity, forces tending to push the tapes from the dies and prevent sufficient extension of the tapes into the formed elements, or to throw the bead or reinforced stringer tape edges off center with respect to the die cavities with resultant production thereon of fastener members having leg portions of non-uniform thickness.

Furthermore, the formation of gates, sprues and flash on the head portions or interengaging portions of the fastener members were generally incident to these methods wherein the material was supplied under pressure causing it to move into the die cavity in this direction toward the tape edge upon which the fastener member was to be formed in the die cavity.

By utilization of the principles of this invention wherein the fastener member forming material is supplied equally at opposite sides of the tapes and directed toward the heads or interlocking portions of the fastener members to be formed in the general direction of the extent of the tapes toward the enclosed edge portions, all of the above disadvantages are totally obviated and certain other advantages achieved, as will hereinafter appear. The direction in which the material is supplied to the die cavity causes the material to guide and maintain the edge of the stringer tape in a position concentric of the die cavity, while urging the edge of the stringer tape into the die cavity rather than in an opposite direction, thus tending to stretch the portions of the stringer tape upon which the fastener members are formed and securing absolute concentric alignment of the formed fastener members with respect to the stringer tape.

In the illustrated form of apparatus for carrying out the invention, the base 11 which is adapted for attachment to any suitable table or other support is provided with a longitudinal die supporting channel 12 of substantially rectangular section. Drive means, such as the power driven roller 14, communicates with the bottom of the longitudinal channel 12.

Superposed upon the base 11 is a casing 15. This casing 15 is provided at its upper end with a detachable cover plate 16 which is removable for placing material in the charging cylinder 17 which leads downwardly from the upper end of the casing 15. This charging cylinder 17 is provided with a charging ram or piston 18 fitting

closely to the walls of the charging cylinder 17 and provided with a piston rod 19, by means of which pressure may be applied to the piston 18.

An annular chamber 20 in the wall of the charging cylinder 17 encloses a suitable heating coil 21, by means of which the material in the charging cylinder 18 may be heated. The terminals 22 and 23 of this coil 21 may be attached to any suitable source of electric energy for heating the coil 21.

The lower wall of the charging cylinder 17 is formed by a plurality of substantially frusto-conical depressions 24 which are separated by a wall 25 provided with a vertical longitudinally disposed stringer tape guiding channel 26. The channel 26 extends from side to side of the casing 15. The frusto-conical depressions 24 communicate at their lower ends with the charging material leads 27 which are progressively reduced from their upper to their lower ends and which are inclined downwardly and inwardly from the lower ends of the frusto-conical depressions 24, as shown in Fig. 2. The leads 27, at each side of the wall 25, communicate with a mold cavity supply recess 28 immediately above the longitudinal die supporting channel 12, as shown in Fig. 2. The cavity supply recesses 28 have arcuate upper surfaces and the cross sectional area is progressively reduced in the direction of travel of the stringer tape through the casing 15, as shown in Fig. 1.

In order that fastener member forming material such as molten metal or moldable plastic material, heated in the charging cylinder 17 and placed under pressure therein by the piston 18, may be maintained at a desired controlled temperature until placed in the die cavities, the leads 27 are heated by a heating coil 29 disposed in the chamber 30 surrounding the leads 27, as shown. The terminals 31 and 32 of the coil 29 are connected to any suitable source of electrical energy (not shown) and it is, of course, to be understood that the temperature of the coils 21 and 29 will be carefully controlled in known manner within predetermined desired limits in order that the fastener member forming material shall be delivered to the mold cavity supply recess 28 in predetermined desired condition.

Supported by the power driven roller 14 for longitudinal movement in the longitudinal die supporting channel 12, in the direction indicated in Fig. 1, is a two-part multiple cavity die 33 in the form of a pair of complementary die plates 34 and 35, in each of which is formed a part of the die cavity 37 and which are removably secured together by any suitable means, such as screws 36. Each of the die cavities 37 is, of course, complementary to the form of the fastener members desired to be formed or cast upon the reinforced edge of the stringer tape 38, which stringer tape 38 is supported, by means not shown, for longitudinal movement concurrently with the die 33 in a manner which will be readily understood.

As will be seen from Fig. 1, the pair of cavity supply recesses 28 communicate with a plurality of die cavities 37 at opposite sides of the tape 38 at a point spaced from the reinforced edge 39 thereof and these recesses 28 function as jets to direct the fastener member forming material (which is heated and under substantial pressure) convergently inwardly toward the tape and in a direction toward the reinforced edge 39 thereof. The interlocking fastener members 40 formed in the die cavities 37 thus have the head portions 41 thereof formed by continuous die surfaces, as may

be seen in Fig. 2, while the material is delivered to each die cavity in a direction toward the front or head portion 41 from the rear or leg end 42 of each fastener member 40.

As the die 33 is moved progressively from left to right, as seen in Fig. 1, the forward reduced end of each recess 28 exerts a packing effect upon the material in each die cavity 37 moving out of communication with the recesses 28, which is additional to the pressure exerted throughout the fastener forming material by the ram or piston 18. The forward edge of each recess 28 acts as a scraper or knife which fits closely to the upper surface of the die 33 and thus scrapes off the material beyond the end of the die cavity to prevent the formation of gates, sprues or flashes on these surfaces. Any roughness in the finished fastener members will, however, occur at the rear surface of the leg portions 42 thereof, as will be clearly understood. As these surfaces, in use, are in communication with the lateral flange surfaces of the fastener slider, this roughness, if existent, is removed by use of the fastener. While only a short length of die 33 is shown, it is, of course, to be understood that the same may be made of substantial length and that the form thereof may be substantially varied, as desired.

The operation of the above-described apparatus is as follows. The righthand end of the multiple cavity die 33 is inserted in the longitudinal die supporting channel 12 and the die is moved rightwardly, as seen in Fig. 1, until the first cavity 37 is adjacent the termination of the recesses 28 at the right. A length of stringer tape is inserted in the stringer tape guide channel 26 and threaded therethrough until the righthand end thereof is engaged by the stringer tape supporting means (not shown). Interlocking fastener member forming material, either plastic or metal, is placed in the charging cylinder 17.

The material may be heated to the desired temperature before being placed in the charging cylinder 17 or the temperature thereof may be raised to the desired point by the heating coil 21. In either case, the heating coil 27 is heated in order that the inner surfaces of the frusto-conical depressions 24 and leads 27 may be brought to the desired temperature, preferably before the material is inserted in the charging cylinder 17.

Constant desired pressure is then applied to the piston rod 19 to operate the ram or piston 18 and cause the die cavities 37 below the recesses 28 to be charged. Thereafter, the power driven roller 14 moves the multiple cavity die 33 rightwardly, as seen in Fig. 1, in the longitudinal die supporting channel 12, while constant pressure on the piston rod 19 is maintained, until the material in the charging cylinder 17 is exhausted or until the left end of the multiple cavity die 33 is reached. Suitable means may be provided, if desired, for cooling those portions of the multiple cavity die 33 disposed rightwardly of the casing 15, as seen in Fig. 1.

After the cavities 37 in the multiple die 33 have been filled, the multiple cavity die 33 is removed from the channel 12 and the members 34 and 35 thereof released from one another. Thereafter, the die members 34 and 35 are separated and the slide fastener stringer will then be in finished form comprising the stringer tape 38 having completely finished interlocking fastener members 40 cast upon the reinforced edge portion 39 thereof, as will be clearly understood.

In order automatically to produce gap spaces between successive rows of fastener members upon continuous tape, groups of a predetermined number of cavities 37 may be omitted at predetermined intervals, or as an alternative, predeterminedly spaced groups of these die cavities 37 may be filled temporarily with suitable material preventing the entrance of fastener member forming material during continuous operation of the die 33.

It is, of course, to be understood that the above description is merely illustrative and in nowise limiting and that I desire to comprehend within my invention such modifications as are included in the scope of the following claims.

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

1. In a method of manufacturing slide fastener stringers by injection molding, the steps comprising enclosing one edge portion of a stringer tape in a mold cavity opening through a mold wall and of form complementary to the form of an interlocking fastener member having a head portion and tape engaging leg portions extending rearwardly from said head portion, said mold being open only at those portions corresponding with the rear surfaces of the leg portions of the fastener member, and supplying fastener member forming material through said mold cavity openings in said mold wall toward the enclosed tape edge to fill the mold cavity.

2. In a die for use in forming interlocking fastener members by injection molding directly upon slide fastener stringer tapes, a die body, a longitudinal stringer tape edge receiving channel extending inwardly of the die body from one surface of the die body, and a plurality of die cavities communicating with said channel and opening otherwise only at opposite sides of said tape edge receiving channel through said surface of the die body.

3. A die for use for forming interlocking fastener members by injection molding directly upon slide fastener stringer tapes including a plurality of detachable elongated die parts having therein complementary recesses forming multiple die cavities complementary with the form of finished fastener members having interlocking head portions and tape engaging leg portions extending rearwardly from said head portions, said die parts being provided with a connecting stringer tape edge receiving channel connecting the portions of said cavities corresponding with said leg portions, said die cavities being open otherwise only at each side of said channel, at the portions corresponding with the rear surfaces of the leg portions of the fastener members, said die cavities and said channel opening through a common die wall and the interior of said cavities providing continuous fastener member head portion forming surfaces.

4. In apparatus for forming interlocking fastener members by injection molding directly upon slide fastener stringer tapes, means defining at least one pair of spaced fastener member forming material delivery leads and an intermediate stringer tape guide channel, means for supplying fastener member forming material under pressure to said delivery leads, and movable die means having a stringer tape edge receiving channel with spaced die cavities connected thereby and extending therefrom inwardly of the die, said die cavities being com-

plementary with the interlocking fastener members to be formed and having gates at each side of said tape edge receiving channel and extending through the same die wall, said gates communicating progressively with said delivery leads upon movement of said die for receiving therefrom material under pressure for filling said cavities and forming spaced interlocking fastener members directly upon fastener stringer tapes in said channels.

5. In apparatus for forming interlocking fastener members by injection molding directly upon slide fastener stringer tapes, means defining at least one pair of laterally spaced converging fastener member forming material delivery leads and an intermediate longitudinal stringer tape guide channel, means for supplying fastener member forming material under pressure to said delivery leads, and longitudinally movable die means having therein a stringer tape edge receiving channel communicating with said tape guide channel and parallel thereto, said tape edge receiving channel having spaced die cavities extending therefrom inwardly of the die, said die cavities being complementary with the interlocking fastener members to be formed and having fastener member forming material receiving openings at each side of said tape edge receiving channel, said openings and said channel extending through the same die wall and said openings communicating progressively with said delivery leads upon longitudinal movement of said die for receiving material therefrom under pressure for filling said cavities and forming interlocking fastener members directly upon fastener stringer tapes in said channel.

6. In apparatus for forming interlocking fastener members directly upon slide fastener stringer tapes by injection molding, means defining at least one pair of laterally spaced converging frusto-conical fastener member forming material delivery leads and an intermediate longitudinal stringer tape guide channel, associated heating coil means for controlling the temperature of the material in said delivery leads, means for supplying fastener member forming material under pressure to said delivery leads, and longitudinally movable die means having a longitudinal stringer tape edge receiving channel communicating with said tape guide channel and complementary therewith to enclose a stringer tape, said die having spaced die cavities extending from said tape edge receiving channel inwardly of said die, said die cavities being complementary with the form of interlocking fastener members to be formed and having fastener member forming material receiving gates at each side of said tape edge receiving channel, said gates and said channel extending through the same die wall and communicating progressively with said delivery leads upon movement of said die for receiving material therefrom under pressure for filling said cavities and forming spaced interlocking fastener members directly upon fastener stringer tapes in said channel.

7. In apparatus for forming interlocking fastener members directly upon slide fastener stringer tapes by injection molding, a charging cylinder for containing fastener member forming material, at least one pair of converging delivery leads extending from said charging cylinder, means associated with said cylinder for forcing material therefrom through said con-

verging leads, a stringer tape guiding channel intermediate each pair of converging leads and accommodating the major portion of the width of a stringer tape, a die movable with respect to said leads and having therein a stringer tape edge receiving channel parallel to said stringer tape guiding channel and complementary therewith for enclosing the entire tape width, said die having predeterminedly spaced die cavities complementary in form to finished interlocking fastener members, said die cavities extending

from said stringer tape edge receiving channel and having continuous fastener member head forming surfaces and fastener member forming material receiving openings at opposite sides of said tape edge receiving channel, said channel and said openings extending through a common die wall and said openings progressively communicating with said leads upon movement of said die.

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