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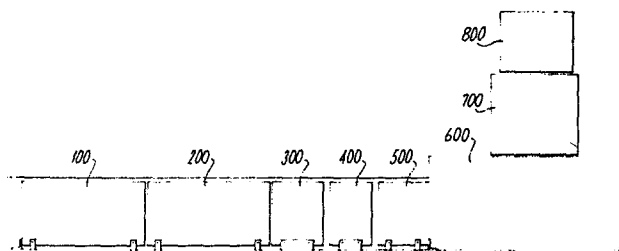
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⑤④ **A method of and apparatus for manufacturing binders.**

⑤⑦ The invention is concerned with a method of and apparatus for manufacturing a binder defined by a pair of elongate supports for clamping together a plurality of sheets of paper. The supports are manufactured from an extruded strip. The apparatus advances the extruded strip on a rail to a cutting station which cuts the strip into unit strips. A binder cover sheet is introduced into a unit strip and the strip is pressed to secure the cover sheet in position. The unit strip and cover sheet are advanced to a punching station and dimpling station for the punching of apertures in the channel and the formation of dimples. The unit strip is then transferred to an index station where the binder components are loaded onto the unit strip. Two unit strips and binder covers are then shrink wrapped together in polyethylene film.



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A METHOD OF AND APPARATUS FOR MANUFACTURINGBINDERS

The present invention relates to a method of and apparatus for manufacturing a binder defined by a pair of elongate supports for clamping together a plurality of sheets of paper, each support having two channels, one of the channels (hereinafter called the channel section) in each support being adapted to accommodate means for securing binder straps which pass through apertures in the base of the channel section, and the other of the channels (hereinafter called the box section) in each support being adapted to accommodate at least one suspension device for suspending the binder, a binder cover sheet also being attached to each of the elongate supports. In the assembled binder, the box sections both face in one direction and the channel sections face in mutually opposite directions and at ninety degrees to the direction faced by the box sections.

The invention provides a novel method and apparatus for manufacturing a binder of the kind defined.

According to the invention, there is provided a method of manufacturing a binder of the kind defined, the method including the following steps:

introducing a binder cover sheet into an elongate receiver located in the elongate support, (hereinafter called a unit strip), and pressing the unit strip to

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close the receiver and thereby to secure the binder sheet to the unit strip,

punching the base of the channel section to form the apertures needed to accommodate the flexible straps, and

punching the base of the box section to form dimples in the base and thereby to provide abutments internally of the box section for locating and retaining in the box section at least one binder suspension device when inserted therein.

The invention also provides an apparatus for manufacturing a binder of the kind defined, the apparatus including a plurality of operating means, including cutting means for cutting elongated lengths of the extruded strip into unit strips, pressing means for pressing the unit strip so as to secure a binder cover in the unit strip, punching means for forming in the base of the channel section the apertures needed to accommodate the flexible straps, and dimpling means for forming abutments internally of the box section for locating and retaining therein at least one binder suspension device.

The invention will be described more particularly with reference to the accompanying drawings, which show, by way of example only, one embodiment of the invention.

In the drawings:

Figure 1 is a cross-sectional end view of an

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extruded metal strip used to form the binder;

Figure 2 is a schematic representation of the stages of manufacture of the binder;

Figure 3 is a schematic representation of a pressing operation performed on the strip;

Figure 4 is a schematic representation of a punching operation performed on the strip;

Figure 5 is a schematic representation of a dimpling operation performed on the strip; and

Figure 6 is a plan view of the layout of one of the stages of manufacture of the binder, namely an indexing station.

Before describing the method of and apparatus for manufacturing a binder, it is necessary to briefly describe the extruded strip. The strip essentially comprises a channel section 10, a box section 20 and a web or flange 30 connecting the two sections. The channel section 10 is provided with a base 11 and a pair of lips 12 and the box section 20 is provided with a base 21 and a pair of lips 22. The strip is formed from an aluminium alloy by an extrusion process and is cut into lengths of approximately six metres.

As shown in Figure 2, the stages of manufacture are performed at a plurality of distinct stations namely; a saw station 100, a friction feed station 200, a press station 300, a punch station 400, a dimple station 500, an index station 600, a wrapping station 700 and a

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boxing station 800.

The method of and apparatus for manufacturing a binder will now be described with reference to the drawings. To initiate the manufacturing process, a plurality of six metre lengths of the extruded strip (in the present embodiment up to one hundred and eighty) are juxtaposed on a loading station. The strips are moved laterally by means of rodless pneumatic cylinders until one of the strips drops onto a guide rail with the channel section 10 of the strip seated on the guide rail. Rodless pneumatic cylinders are well known and comprise a sleeve located over an elongated tube. A magnetic member is located in the tube and is moved longitudinally along the tube by means of air pressure. A first photoelectric switch on the guide rail activates the rodless pneumatic cylinders when there is no strip on the guide rail. To commence manufacture of a binder, a second photoelectric switch on the saw section instructs a pneumatic cylinder to advance the strip on the rail. As the strip advances, it is threaded onto a machined rail 40 which is provided with grooves 42 for receiving the lips 12 of the channel section 10. Sections of the machined rail 40 are of a nylon material and sections are of steel, the steel sections being located at operating stations. When the strip passes under the second photoelectric switch, a saw feeding vice engages the strip and advances the end of the strip

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beyond the saw. The length of travel of the saw feeding vice is determined by the positioning of mechanical stops and limit switches. The positioning of the stops and limit switches determines the unit
5 length of strip for a binder. When the saw feeding vice encounters the mechanical stop and limit switch adjacent the saw, a holding vice at the saw station 100 is activated to hold the strip. The saw, which is a rotary saw, is then activated and is lowered onto the
10 strip by a pneumatic cylinder to cut the strip. The first and last cuts of the length of strip are scrap and have to be removed from the apparatus.

On the subsequent cycle of the saw feeding vice, the scrap length is advanced to a scrap removal section
15 in the machined rail 40. A portion of the rail 40 is modified by removing the grooves 42 which allow the strip to be threaded on the rail 40. A piece of flexible polypropylene is located by a frame over the machined rail 40 and presses against the box section 20
20 of the strip. A unit length of strip will bridge the scrap removal section and will not be forced off the machined rail 40 by the polypropylene. Lengths of strip which are less than the unit length will be forced off the machined rail into a scrap collection bin. The
25 length of the scrap removal section may be varied by removing or replacing sections of the machined rail 40.

As the saw feeding vice advances the uncut strip,

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the unit strips are advanced to the friction drive station 200 which comprises a plurality of friction drive rollers driven from underneath the machined rail 40 by an electric motor and chain drive. The friction drive rollers position the unit strips in a line, end to end, behind a gate mechanism comprising a gate fixed to a vertically mounted pneumatic cylinder. When the friction drive station 200 is fully loaded with unit strips, a third photoelectric switch senses when the movement of unit strips has stopped and an instruction is passed to the saw station 100 to suspend the sawing operation.

The advancement of the unit strips from the gate through the next three stations 300, 400 and 500 is achieved by four progressing clamps which move in unison. The positioning of the gate and the progressing clamps may be varied according to the physical length of a unit strip so that each unit strip is centrally positioned in the subsequent stations.

Each progressing clamp comprises a single movable jaw and a locating finger which is secured to the jaw. Under the action of a pneumatic cylinder the movable jaw slides laterally on a base member to clamp one side of a unit strip and the locating finger moves laterally behind the unit strip. The jaw returns to its rest position under spring action. The base member is secured to a shaft which is mounted parallel to a

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machined rail 40. The shaft and the four progressing clamps are reciprocated by a yoke which is moved by a pneumatic cylinder.

5 The saw feeding vice comprises a pair of jaws, one of which is mounted at each side of the machined rail 40. The jaws close under the action of a pair of pneumatic cylinders and are assisted in returning to the open position under spring action. The jaws slide on a base member which is slidably mounted on two fixed
10 shafts mounted parallel to the machined rail 40. The base member is reciprocated by a pneumatic cylinder independently of the progressing clamps.

When the first progressing clamp engages a unit strip, the gate is raised to allow the unit strip
15 to advance. As the first unit strip is advanced, the next unit strip following in line is held in position by a pinning device operated by a pneumatic cylinder. When the gate is lowered, the pinning device is released and the next unit strip is advanced to the gate by means of
20 the friction drive rollers.

The unit strip engaged by the first progressing clamp is advanced up to the press station 300 where a clamping device 310 operated by a pneumatic cylinder is activated to hold the unit strip in position in the
25 press (Figure 3). A binder cover 50 is introduced into the strip from the front of the press station 300. The binder cover 50 is inserted into the recess between the

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flange 30 and the base 11 of the channel 10. The flange 30 is then pressed down to secure the binder cover 50 between the flange 30 and the base 11 of the channel section 10. Due to the configuration of the strip, it is not possible to press down the flange 30 in one discrete operation. The pressing ram is therefore split into two parts 320, 330, with each part of the ram being driven by an eccentric. The two eccentrics, however, are offset so that the portion of the flange remote from the box section 20 is pressed first by the part 320 of the ram so as to reduce the angle between the flange 30 and the base 11 of the channel section 10. The second part 330 of the ram then presses down the portion of the flange adjacent the box section 20 to secure the unit strip about the binder cover 50.

On completion of the pressing operation, the clamping device 310 releases the unit strip and the second progressing clamp advances the unit strip and cover to the punch station 400 where the unit strip is again clamped in position on the machined rail 40 by a clamping device 410 (Figure 4). The apertures required in the channel 10 for the operation of the binder are formed by punches 420 and dies 430, with the punches 420 coming from underneath through the machined rail 40. The dies 430 are carried on a platen which is lowered and locked in position using a toggle arrangement. The advantages of punching from underneath are (1) no burr

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which might catch on the machined rail 40 is produced inside the channel 10, (2), a larger and thus stronger die 430 can be used and (3) the machined rail 40 functions as a stripper for the punches 420.

5 On completion of the punching operation, the clamping device 410 releases the unit strip, and the third progressing clamp advances the unit strip and cover to the dimple station 500. At this station, a pair of double dimples are formed in the base 21 of the box
10 section 20 midway along the unit strip and a single dimple is formed at each end of the unit strip. To provide dimples, a pair of double dimpling units and two single dimpling units are located at the dimpling station 500. To commence the dimpling operation a
15 clamping device 510 (Figure 5) first clamps the unit strip to the machined rail 40, then three vertically mounted pneumatic cylinders are activated so as to contact heel units in each of the dimpling units. The heel units then move dimpling dies 520 horizontally into
20 the box section 20 of the unit strip. When the dimpling dies 520 are in position, four dimpling punches 530 under pressure from pneumatic cylinders are activated to form the required dimples in the base 21 of box section 20.

25 On completion of the dimpling operation, the clamping device 510 releases the unit strip and the fourth progressing vice advances the unit strip and

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cover to the end of the machined rail. On the next cycle of operation the unit strip and cover are advanced onto the index station 600 (Figure 3). At the index station 600 is a turntable having four arms. On each
5 cycle of operation the turntable is rotated through ninety degrees to advance the arms through the four fixed operating sub-stations 620, 630, 640 and 650.

An overhead frame 610 to which bowl feeders and pneumatic cylinders are mounted is provided over the
10 turntable. The first sub-station 620 of the index station 600 is the unit strip and cover loading sub-station and the second sub-station 630 is a lateral suspension bracket loading sub-station. In the completed binder, it is necessary to have the lateral
15 suspension brackets facing in the same direction. Thus each alternate unit of a binder set is provided with a lateral suspension bracket from a different one of two bowl feeders 635. In loading a unit strip with a lateral suspension bracket, the bracket is fired down
20 the box section 20 by one of two pneumatic cylinders, until the heel of the bracket is seated between the dimples of the first pair of dimples so as to allow the bracket to pivot about an axis transverse to the longitudinal axis of the strip.

25 On completion of the lateral suspension bracket loading operation, the turntable rotates to the third sub-station 640 at which horizontal suspension brackets

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are fitted to each end of each unit strip. The horizontal suspension brackets are fed from two bowl feeders 645 and are loaded by pneumatic cylinders. The horizontal suspension brackets are fitted on over the single dimples formed at the ends of the strip.

On completion of the horizontal suspension loading operation, the turntable rotates to the fourth sub-station 650, where the completed units are unloaded onto a wrapping station 700. A set of binder units, i.e. a left hand unit and a right hand unit are shrink wrapped in polyethylene film, together with a set of instructions and a polyethylene bag containing the additional necessary components for rendering the binder functional.

The additional components are a pair of nylon thongs for threading through the material to be bound, four recess clips for securing the thongs in the channel sections 10 of the binder units and a vertical index tab for insertion into a box section 20 of the strip of one of the binder units.

The polyethylene bags of components are fed to the packing line in a partially cut but continuous strip which is fed over a rotating drum. As each pair of binder units passes along the packing line, a knife is activated to completely cut a bag from the partially cut strip. The bag is then free to slide down a chute onto the pair of binder units.

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The binders are then fed to a boxing station 800, where they drop into boxes for transport and shipping.

The inter-relation of all moving components, pneumatic cylinders, limit switches and photoelectric switches is controlled by a programmed FESTO (Trade Mark) microprocessor unit.

The microprocessor unit also controls the automatic lubrication of all the moving parts of the apparatus. Typically lubrication might be applied every ten minutes per working hour of the apparatus.

The cycling speed of the apparatus may be controlled to suit a particular manufacturing situation, however, it is possible with the present embodiment to obtain a four second cycle of operation.

An alternative embodiment of the invention differs from the embodiment described above in a number of respects. In the alternative embodiment, the pressing ram of the press station 300 is split into two parts 320, 330 but with both parts being driven by one eccentric. In the alternative embodiment the part 320 of the ram is spring loaded and leads the part 330 of the ram. Thus the part 320 of the ram contacts the portion of the flange remote from the box section 20 before the part 330 and presses the flange under the action of spring pressure.

Also in the alternative embodiment, the dies 430 of the punch station 400 are contained in a die set which

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is mounted on a fixed platen.

Another feature of the alternative embodiment is the provision of additional loading stations for the loading of recess clips into the channel section 10 of each strip and the loading of a vertical index tab into the box section 20 of each alternative strip. After the recess clips are inserted into the channel section 10, the ends of the channel section are closed by a cold rolling operation.

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CLAIMS:

1. A method of manufacturing a binder of the kind defined, the method including the following steps:

5 introducing a binder cover sheet into an elongate receiver located in a unit strip, and pressing the unit strip to close the receiver and thereby to secure the binder sheet to the unit strip

10 punching the base of the channel section to form the apertures needed to accommodate the flexible straps, and

15 punching the base of the box section to form dimples in the base and thereby to provide abutments internally of the box section for locating and retaining in the box section at least one binder suspension device when inserted therein.

2. A method as claimed in Claim 1, including the additional step of first cutting elongated lengths of extruded strip into unit strips, and then feeding the unit strips to the pressing station.

20 3. A method as claimed in either of Claims 1 or 2, in which, after the dimpling operation, at least one binder suspension device is inserted into the box section and located therein by the abutments formed in the box section.

25 4. A method of manufacturing a binder as claimed in any one of Claims 1 to 3, in which the pressing operation is performed on a flange between the channel

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section and the box section of the unit strip, so as to secure the unit strip to the binder cover, whereby the flange is pressed to lie substantially parallel with the base of the channel section; the punching operation is performed on the base of the channel section, the flange and the portion of the binder cover contained therebetween.

5. A method of manufacturing a binder as claimed in Claim 2, comprising loading the elongated lengths of the extruded strip onto guide means and advancing the extruded strip to a station where the extruded strip is cut into unit strips and subsequently advancing each unit strip on the guide means to further stations at which the subsequent operations are systematically performed.

6. A method of manufacturing a binder as claimed in Claim 5 comprising loading the elongated lengths of the extruded strip onto a rail and advancing each unit strip along the rail to succeeding stations where the pressing punching and dimpling operations are performed and advancing the unit strips onto an indexing table for subsequent advancement of the unit strips to stations where the components of the binder are loaded onto the unit strips.

7. Apparatus for manufacturing a binder of the kind defined, the apparatus including a plurality of operating means, including cutting means for cutting

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elongated lengths of the extruded strip into unit strips, pressing means for pressing the unit strip so as to secure a binder cover in the unit strip, punching means for forming in the base of the channel section the apertures needed to accommodate the flexible straps, 5 dimpling means for forming abutments internally of the box section for locating and retaining therein at least one binder suspension device.

8. Apparatus for manufacturing a binder as claimed in 10 Claim 7, further comprising guide means for guiding the unit strips through the operating stations of the apparatus, first advancing means for advancing an extruded strip to the cutting means and second advancing means for advancing the unit strips through the 15 succeeding operating stations of the apparatus.

9. Apparatus for manufacturing a binder as claimed in Claim 8, in which the guide means includes an elongated rail, and an indexing table the apparatus further comprising loading means for loading the elongated 20 lengths of the extruded strip onto the rail which serves to guide the elongated lengths of the extruded strip through the cutting means and which also serves to guide the unit strips through the succeeding operating station onto the indexing table which advances the unit strips 25 to stations where the components of the binder are loaded onto the unit strips.

10. Apparatus for manufacturing a binder as claimed in

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Claim 9, in which the means for loading the extruded lengths of strip onto the rail comprises a surface for supporting a plurality of juxtaposed extruded strips and a plurality of pneumatic cylinders to advance the
5 extruded strips laterally towards the rail.

11. Apparatus for manufacturing a binder as claimed in any one of Claims 7 to 10, in which the rail includes a portion which is adapted to engage with the extruded strip.

10 12. Apparatus for manufacturing a binder as claimed in any one of Claims 7 to 11, in which scrap removal means are provided between the cutting means and the pressing means.

13. Apparatus for manufacturing a binder as claimed in
15 Claim 8, in which a gate is positioned on the guide means between the cutting means and the succeeding stations and in which friction drive means are provided to accumulate unit strips behind the gate, which is adapted to open periodically to allow a unit strip to be
20 carried by the second advancing means to the succeeding stations.

14. Apparatus for manufacturing a binder as claimed in Claim 8, in which the first advancing means comprises a vice mounted laterally with respect to the guide means
25 and which is reciprocable in a direction parallel to the guide means, the vice being adapted to repeatedly grip a length of extruded strip, advance the strip on the guide

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means, release the strip and return to its original position.

15. Apparatus for manufacturing a binder as claimed in Claim 8, in which the second advancing means comprises a
5 plurality of clamps adapted to positively engage the unit strips on the guide means and which are reciprocable in a direction parallel to the guide means, the clamps being adapted to repeatedly engage unit strips, advance the unit strips on the guide means
10 release the unit strips and return to their original position.

16. Apparatus for manufacturing a binder as claimed in Claim 10, in which the means for loading the extruded lengths of strip onto the rail includes first sensing
15 means for detecting the absence of extruded strip on the rail and which instructs said means to load a length of strip on the rail.

17. Apparatus for manufacturing a binder as claimed in Claim 8, which includes second sensing means which
20 detects the presence of a length of strip on the rail and which instructs the first advancing means to advance the length of strip through the cutting means.

18. Apparatus for manufacturing a binder as claimed in Claim 7, in which the pressing means comprises a ram
25 having two parts, one part of the ram being adapted to press a unit strip so as to reduce the angle of the flange with respect to the base of the channel section

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and the second part of the ram being adapted to the pressing operation.

19. Apparatus for manufacturing a binder as claimed in Claim 18, in which each part of the ram is driven by an eccentric, the two eccentrics being offset to enable the first part of the ram to press the unit strip before the second part of the ram.

20. Apparatus for manufacturing a binder as claimed in Claim 18, in which both parts of the ram are driven by one eccentric, with the first part of the ram leading the second part and being spring loaded so as to initially press on the unit strip with reduced pressure.

21. Apparatus for manufacturing a binder as claimed in Claim 8, in which the punching means comprises a plurality of punches located below the guide means and a plurality of dies, located above the guide means.

22. Apparatus for manufacturing a binder as claimed in Claim 21, in which the dies are mounted on a movable platen which is locked in operating position by means of a toggle.

23. Apparatus for manufacturing a binder as claimed in Claim 20, in which the dies are mounted in a die block which is secured to a fixed platen.

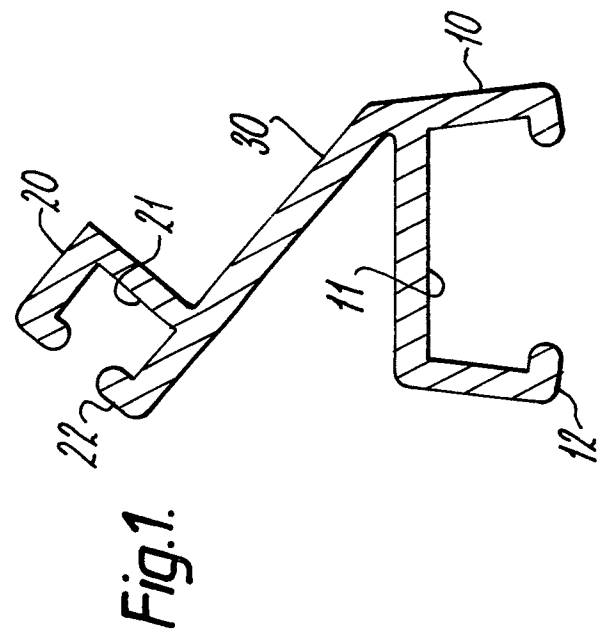


Fig.2.

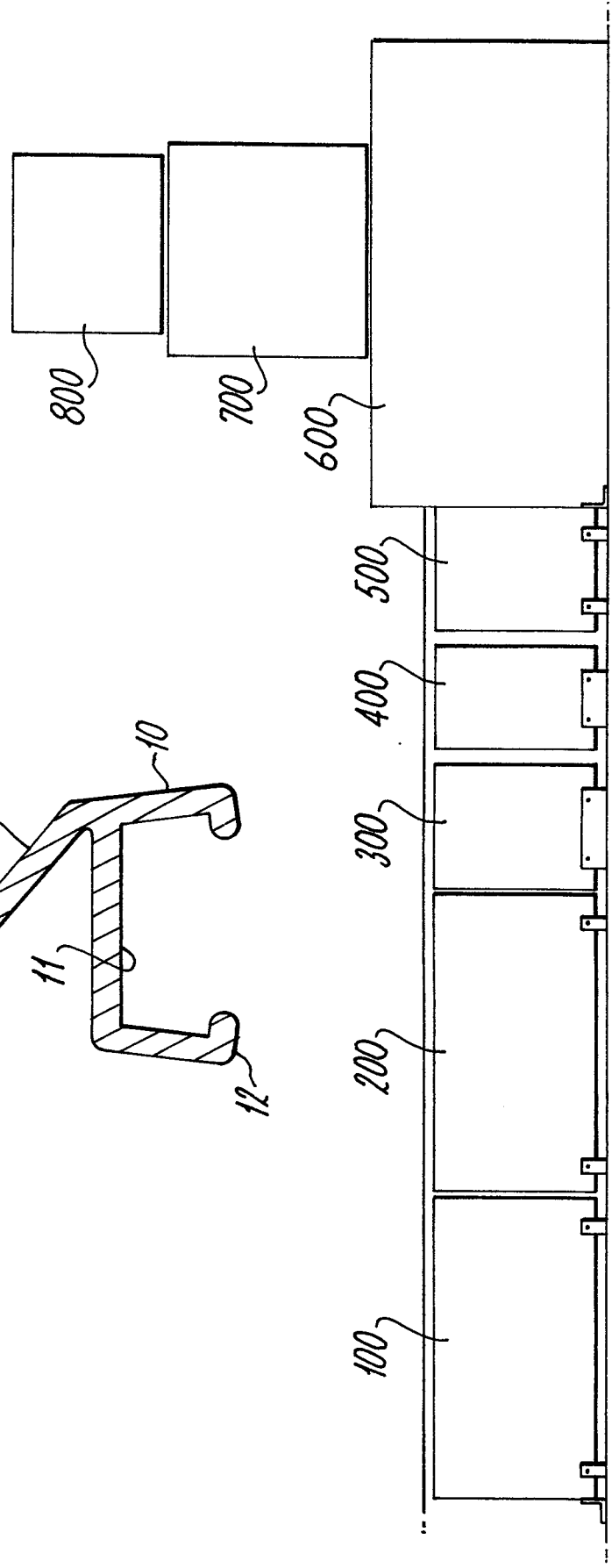


Fig.3.

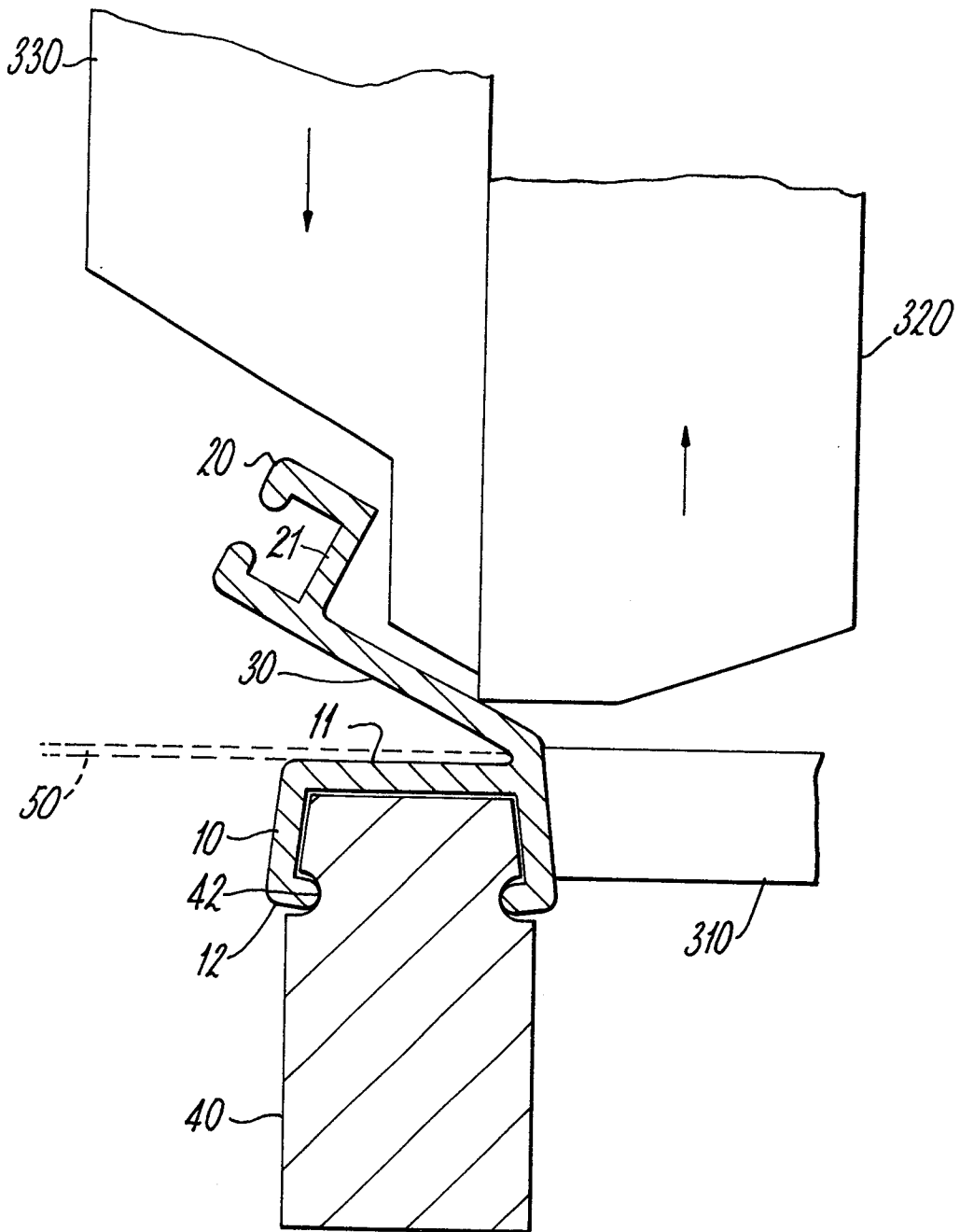


Fig.4.

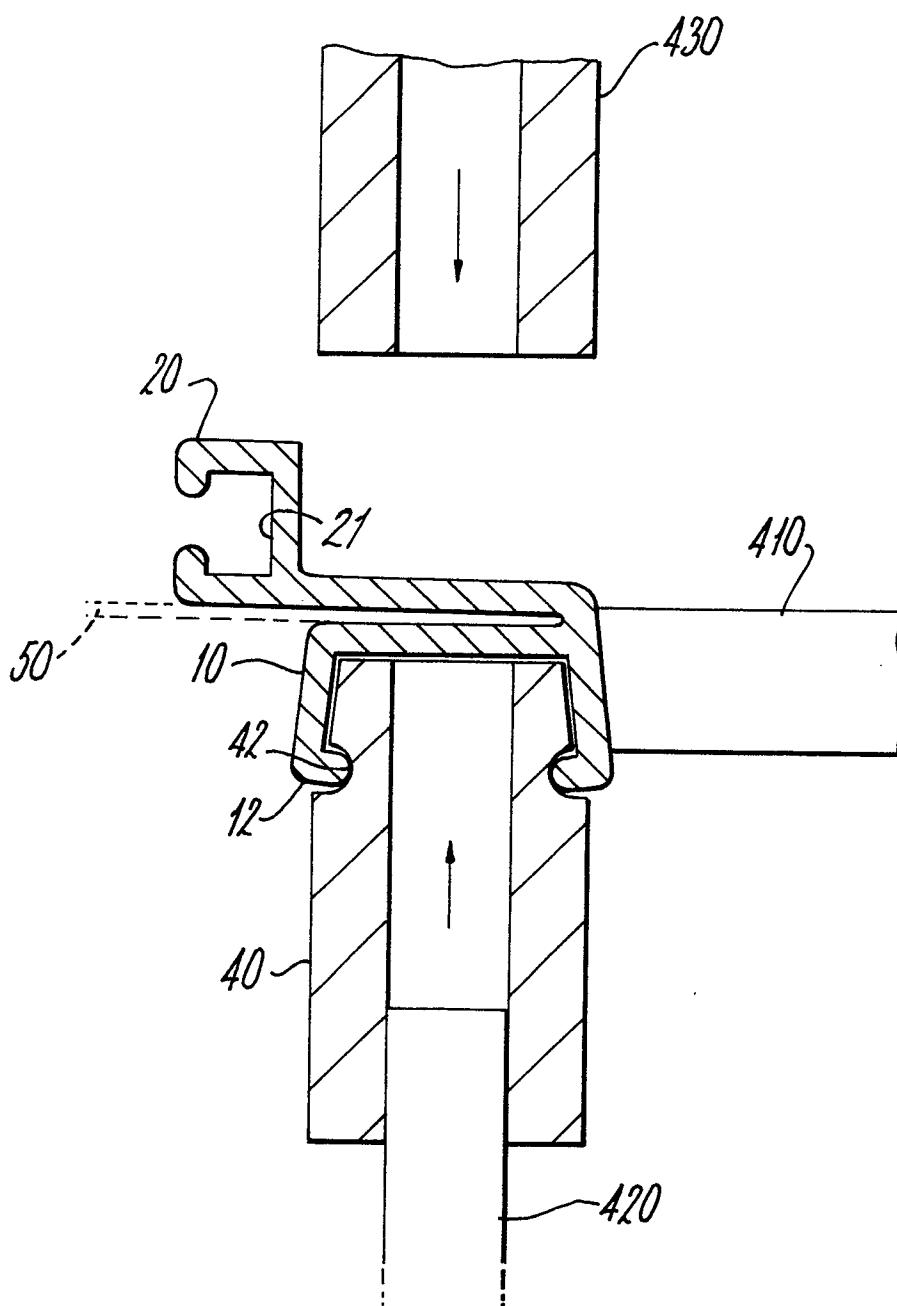


Fig. 5.

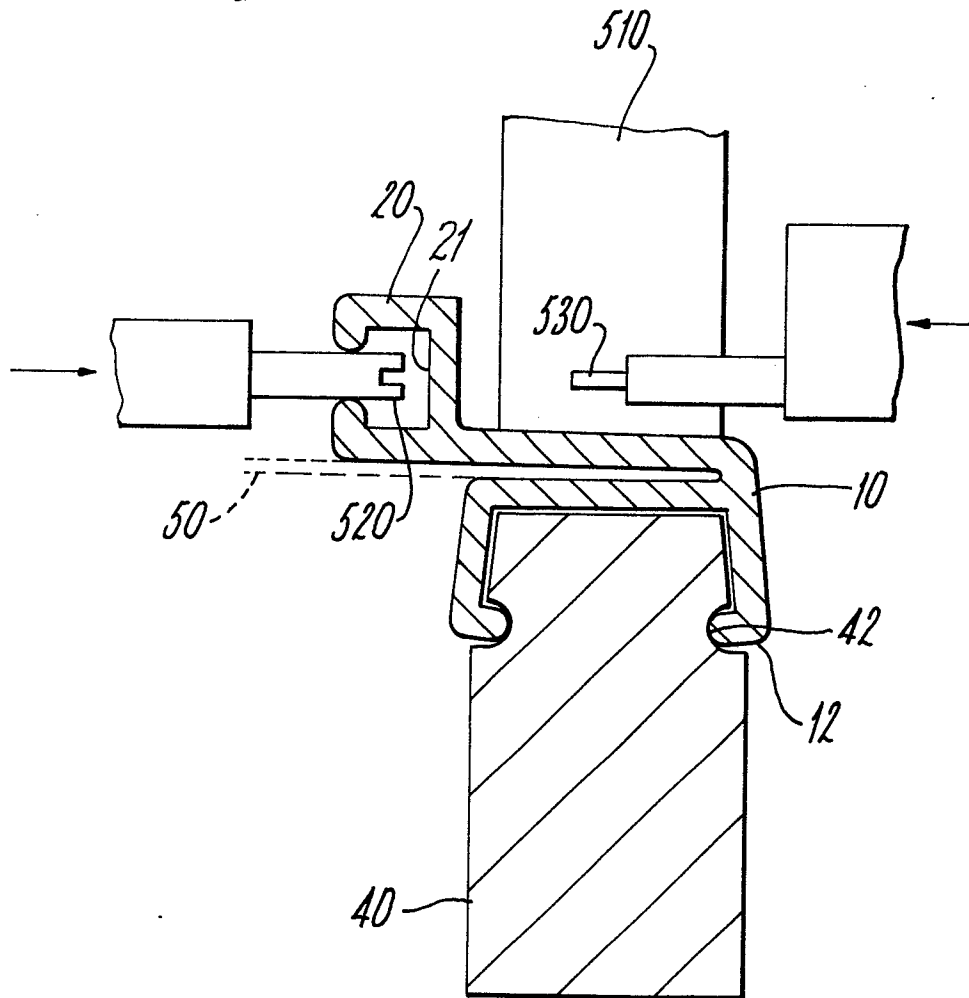


Fig.6.

