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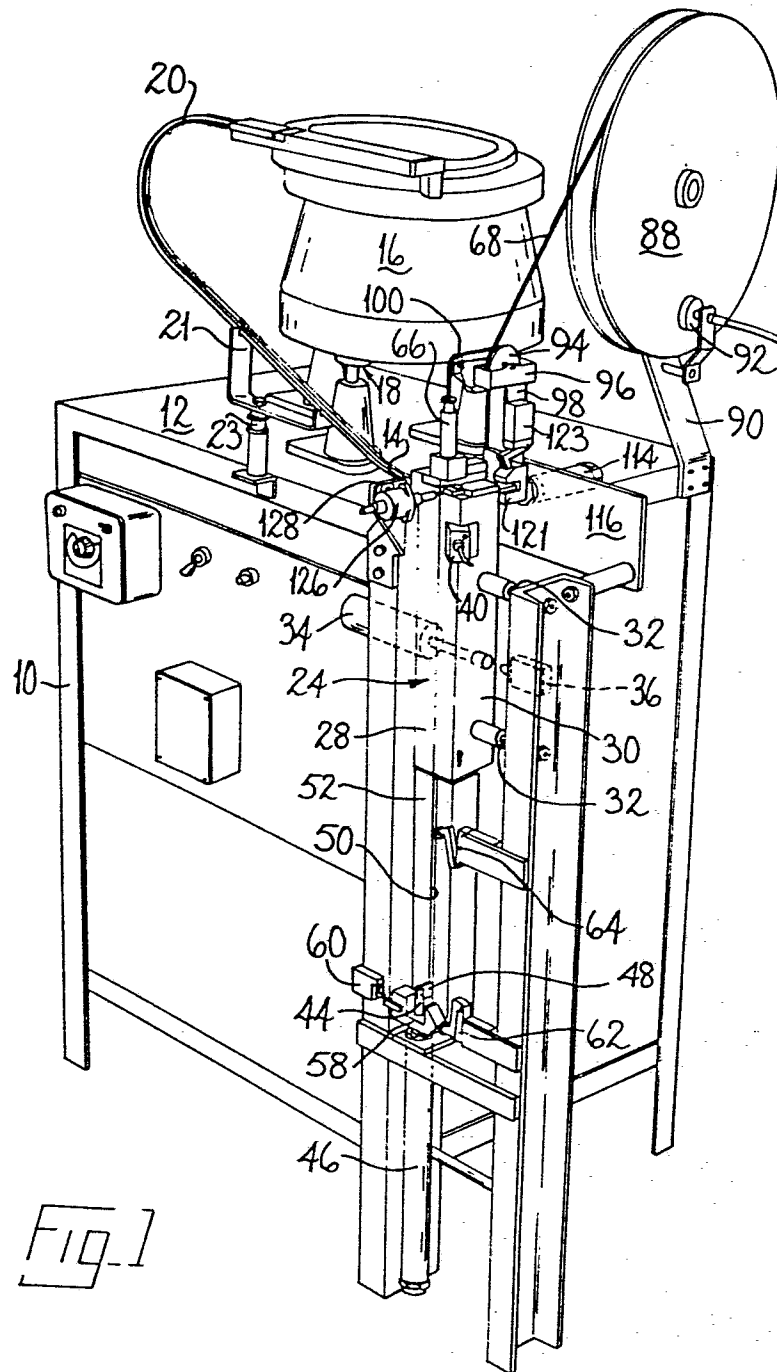
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(54) **Packaging machine for small tubular articles.**

(57) A machine for making packs of hollow rivets strung together head-to-tail on a flexible plastics tube. The machine has means (16, 20, 24) for collecting a desired number of rivets in a vertical column, means (46) for inserting a mandrel (50) of the machine upwardly through the column in a series of short movements until the leading end of the mandrel is free of the uppermost rivet and for thrusting it into the leading end of the tube (68), means (80) for supporting a coil of plastics tubing with a portion disposed to receive the end of the mandrel, and means (50) for retracting the mandrel to draw the tubing through the rivets. The machine also has means (114) for cutting the tubing above the uppermost rivet after it has been drawn right through the column, and for deforming the tube at each end to prevent the rivets falling off the resulting pack.

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Packaging machine for small tubular articles

This invention is concerned with a packaging machine for small tubular articles, more particularly for use in providing a pack consisting of a column of headed hollow rivets head to tail on a flexible plastics tube.

In European Patent Specification No. 78300382 (Publication No. 1343), there is described an assemblage or pack of hollow rivets comprising a column of the rivets assembled head to tail on a flexible plastics tube or sleeve. This assemblage is for use in loading hollow rivets on to a headed mandrel so that they can be set in a pull-through blind riveting operation. In such an operation, a column of, for example, 30 to 60 rivets is assembled on a mandrel, the mandrel is inserted in a blind riveting tool which has means for gripping and pulling the mandrel through a rivet to set it, and the rivets in the column are set by successive operations of the tool. There is accordingly a need for a machine which can make such assemblages or packs as just referred to.

The foregoing requirement is met in accordance with the invention by providing a rivet packaging machine which is characterised in that it comprises a collector for supporting a column of rivets in axial alignment one on top of another head lowermost, means for supporting a coil of flexible plastics tube with an end portion disposed above and in axial alignment with a column of rivets in the collector, a mandrel comprising a stem having transverse dimensions such that it can pass through the rivets, means for moving the mandrel upwardly to project its stem through the column of rivets and into gripping engagement with the end portion of flexible tube aligned

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therewith and to withdraw it downwardly to thread the tube through the rivets, means for cutting the threaded tube from the coil, means whereby the end portions of the tube projecting from the ends of the column of rivets are provided with deformations to restrain the rivets from falling off, and means whereby the pack consisting of the rivets on the tube is discharged from the collector.

Preferably, to ensure the mandrel overcomes any obstruction due to misaligned rivets in its passage up through the column, the means for moving it upwardly causes it to rise in a series of jerks.

Preferably also the mandrel has an upper end portion of reduced diameter which is of such dimension that it can enter the plastics tube causing the tube to expand and grip the mandrel so that, upon descent of the mandrel, the tube is pulled through the column of rivets. Preferably, also, to facilitate the mandrel being gripped by the tube, means is provided to resist movement of the tube away from the collector.

In order to facilitate the feeding of rivets from a substantially horizontal portion of a raceway into the collector reliably at high speed one after the other with their heads lowermost, air blowing means including a nozzle positioned adjacent said portion of the raceway is provided to blow air towards the exit end of the raceway and thereby cause the endmost rivet to accelerate relative to the others in the raceway and thereby be separated from them to fall into the passage.

Detecting means may also be provided to render the air blowing means inoperative when a selected number of rivets have been stacked in the column.

Preferably, the collector comprises two passage-defining members mounted for relative movement between

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a closed condition in which the two members co-operate to define the passage and an open condition in which a column of rivets stacked in the passage can be removed therefrom.

There now follows a detailed description, to be read with reference to the accompanying drawings, of a machine illustrative of the invention. It is to be understood that this illustrative machine has been selected for description by way of example and not of limitation of the invention.

In the drawings:

Figure 1 is a perspective view of the illustrative machine;

Figure 2 is a perspective view, on a larger scale than Figure 1, of a portion of a stacking device of the illustrative machine;

Figure 3 is an elevational view, partly in section and on a larger scale than Figure 2, taken in the direction of the arrow III in Figure 2;

Figure 4 is an exploded perspective view of a portion of the stacking device; and

Figure 5 is a side elevational view of a portion of the stacking device.

The illustrative machine (Figure 1) is for making an assemblage or pack of hollow rivets R which have heads H and shanks S (See Figure 3). The machine comprises a framework 10 which supports a table 12 (Figure 1). The machine also comprises a stacking device which is supported by the framework 10 and the table 12.

The stacking device comprises feeding means including a substantially horizontal guide 14 (Figures 1 and 2) to which the rivets R are advanced one after the other with their shanks S substantially vertical. The

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feeding means also comprises a hopper 16 supported above the table 12 on vibrating means 18 operable to cause the hopper 16 to vibrate. The hopper 16 is of conventional design and is arranged when vibrated to feed rivets R placed in the hopper 16 one at a time into a raceway 20 of the feeding means. The raceway 20 is supported by a bracket 21 mounted on a flexible rubber bearing 23 mounted on the framework 10. The raceway 20 comprises a channel (not shown) in which the head H of a rivet is guided and a slot 22 through which the shank S of a rivet projects. The rivets R leaving the hopper 16 have their shanks pointing downwards but the raceway makes a 180° turn so that the rivets R are inverted and their shanks then point upwards. The guide 14 is thus arranged to hold the rivets with their heads H lowermost. The raceway 22 is connected to the guide 14 so that rivets R pass into the guide 14 from the raceway 20 when the hopper 16 and the raceway 20 are vibrated by the vibrating means 18.

The stacking device also comprises a collector 24 which defines a substantially vertical cylindrical passage 26 which has its upper end adjacent an open exit end of the guide 14 so that rivets leaving the guide 14 through the exit end fall into the passage 26. As the rivets are held in the guide 14 with their heads lowermost, when a rivet leaves the guide 14 through the exit end thereof, it falls head-first into the passage 26. The passage 26 has transverse dimensions such that rivets falling into the passage 26 are constrained to form a column one-above-the-other with their shanks S substantially in alignment (Figure 3), i.e. the passage 26 is of slightly greater diameter than the heads H of the rivets R. The collector 24 comprises two passage-defining members 28 and 30 each having a semi-circular

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groove therein which defines half of the passage 26. The member 28 is rigidly mounted on the framework 10 but the member 30 is slidable on two guide rods 32 mounted on the framework 10 towards and away from the member 28 under the action of a pneumatic piston and cylinder assembly 34. The member 30 can be moved by operation of the assembly 34 between a closed condition of the collector 24 in which the two members 28 and 30 co-operate to define the passage 26 (Figure 1) and an open condition in which a column of rivets stacked in the passage 26 can be removed therefrom. When the collector 24 is in the open condition, the member 30 operates a mechanically-operated pneumatic valve 36 mounted on the framework 10. The purpose of the valve 36 will appear from the description below of the operation of the illustrative machine.

The collector 24 also comprises detecting means operable to detect when a predetermined number of rivets have been stacked in the passage 26. The detecting means comprises a photo-electric cell 38 mounted at one side of the passage 26 on the member 28 and arranged to receive light from a light source provided by a lamp 40 mounted at the other side of the passage 26 on the other passage-defining member 30. The photo-electric cell 38 and the lamp 40 are arranged at an angle to the direction of movement of the member 30 so that the cell 38 and lamp 40 are only aligned in the closed condition of the members 28 and 30. Thus, light is received by the photo-electric cell 38 only when the collector 24 is in its closed condition and when the light from the lamp 40 is not intercepted by a rivet in the passage 26. The photo-electric cell 38 is arranged to signal that the predetermined number of rivets are in the passage. It is operative when the collector 24 is in the closed

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condition and when the light from the lamp 40 is interrupted for a predetermined time, which time is longer than the time which a rivet takes to fall past the photo-electric cell 38.

When a rivet R falls into the passage 26, it comes to rest, if it is the first rivet in a column, with its head resting on a catcher 37 (Figure 5). The catcher 37 is mounted on a lower portion of the member 30 of the collector 24 and is horseshoe-shaped with an opening 39 therein facing the member 28. Subsequent rivets R come to rest on top of previous rivets. A guidance tube 41 is mounted on a lower portion of the member 28 of the collector 24 closing the passage 26 below the catcher 37 except for the bore 43 of the tube 41. The tube 41 carries a hook 45 which projects towards the member 30 entering a slot 47 in the member 30 when the collector 24 is in its closed condition. The hook 45 also projects upwardly to a point just below the level of the catcher 37.

The stacking device also comprises an elongated mandrel 42 (Figures 3 and 5) supported on the piston rod 44 of a pneumatic piston and cylinder assembly 46 mounted on the framework 10 beneath the collector 24. The mandrel 42 has transverse dimensions such that it can be threaded through a column of rivets formed in the passage 26. The assembly 46 provides moving means operable to move the mandrel 42 upwards longitudinally thereof so that the mandrel 42 is threaded through the column as aforesaid and to withdraw the mandrel 42 from the column again (Figure 1). The mandrel 42 is mounted on a bracket 48 which projects sideways from the piston rod 44 into a groove 50 in a block 52 mounted on the framework 10. The groove 50 acts as a guide for the mandrel 42 and connects with the lower end of the tube 41 (Figure 5)

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so that the mandrel 42 can enter the passage 26 by passing through the bore 43 in the tube 41.

The mandrel 42 has a reduced upper free end portion 54 (Figure 3) which terminates in a pointed end 56. The operation of the assembly 46 to move the mandrel 42 upwards through a column of rivets takes place as a series of jerks i.e. the mandrel 42 is first moved upwards then there is a pause during which the mandrel 42 remains stationary or moves slightly downwards before the next upward movement. The series of jerks assists the mandrel 42 to pass through the rivets R in the column since it allows time for the rivets to re-align themselves slightly as the mandrel 42 passes through them. The fact that the mandrel 42 enters the column from below assists in its passing through the column since the rivets R can be lifted relative to one another during re-alignment of the rivets R as the mandrel 42 passes therethrough.

The piston rod 44 of the assembly 46 carries a crosshead 58 which is arranged to operate three mechanically-operated pneumatic valves 60, 62 and 64 mounted on the framework 10. The valves 60 and 62 are arranged to be operated when the mandrel 42 is completely out of the column of rivets and the valve 64 is arranged to be operated when the mandrel 42 is fully in the column with the reduced end portion 54 thereof projecting beyond the top of the column. The purpose of each of the valves 60, 62 and 64 will appear from the description below of the operation of the illustrative machine.

The stacking device also comprises holding means 66 arranged to hold a sleeve 68 made of resilient plastics material with an open end of the sleeve adjacent to the upper end of the passage 26 and to resist movement of the sleeve 68 away from the passage 26. The

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reduced end portion 54 of the mandrel 42 has transverse dimensions such that it can enter the sleeve 68 causing the sleeve 68 to expand and grip the portion 54. Thus, after passing through the column of rivets in the passage 26, the portion 54 can enter the sleeve 68 held by the holding means 66 and be gripped thereby, and, upon operation of the assembly 46 to withdraw the mandrel 42 from the column of rivets, the sleeve 68 is pulled through the column so that the rivets become threaded on the sleeve 68.

The details of the holding means 66 appear from Figure 3. The holding means 66 is mounted on a block 70 supported by the member 28 of the collector 24. The holding means comprises a vertical tube 72 having a bore 74 therethrough a bottom end portion of which tapers outwardly. An inner tube 76 is vertically slidable in the bore 74 being urged upwardly by a spring 78 which acts between a shoulder in the bore 74 and a shoulder on the inner tube 76. The movement of the inner tube 76 is restrained by a pin 80 mounted on an upper portion of the tube 72 and extending through an elongated slot 82 in the inner tube 76. A lower end portion of the inner tube 76 has three equally-spaced radial bores 84 extending through the wall thereof and a ball 86 is contained in each of the bores 84, each ball 86 engaging the outwardly tapering portion of the bore 74 and extending into the bore through the inner tube 76.

The sleeve 68 is supplied to the stacking device from a reel 88 mounted for rotation about a horizontal axis on a bracket 90 mounted on the framework 10. The reel 88 is provided with a pneumatically-operated friction brake 92 which prevents free rotation of the reel 88 but allows the sleeve 68 to be drawn from the reel 88 by pulling on the sleeve 68 thereby rotating the

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reel 88. From the reel 88, the sleeve 68 passes to a pulley 94 which is rotatable about a horizontal axis with its lower portion immersed in lubrication oil contained in an oil tank 96 mounted on a bracket 98 on the table 12. The sleeve 68 makes a complete turn around the pulley 94 so that it receives a thin coating of oil from the tank 98. The purpose of the lubrication oil is to assist movement of rivets R threaded on the sleeve 68 in moving relative to the sleeve 68. From the pulley 94, the sleeve 68 passes to a guide pulley 100 and then descends vertically through the inner tube 76, a vertical bore in the pin 80, between the balls 86 and into a vertical bore 102 in the block 70 (Figure 3).

The operation of the holding means 66 will now be described. The spring 78 urges the inner tube 76 upwardly pulling the balls 86 towards the narrow upper end of the outwardly tapering portion of the bore 74. The balls 86 are thus urged together and grip the sleeve 68 preventing upward movement thereof. However, if the sleeve 68 is pulled downwardly, the balls 86 are drawn towards the wide lower end of the tapering portion, against the action of the spring 78, releasing their grip and allowing movement of the sleeve 68 downwardly. The region 69 (Figure 3 and 5) of the sleeve 68 which the balls 86 grip becomes flattened which, although it does not prevent the sleeve 68 passing through rivets R, acts to prevent rivets R accidentally falling off the sleeve 68.

The lower end of the bore 102 in the block 70 communicates with a slot 104 (Figures 3 and 4) formed between the block 70 and a block 106 mounted on the member 28. The block 106 also has a vertical slot 108 therein which receives the shanks S of rivets R as they leave the guide 14. A knife 110 mounted on a block 112

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carried by the member 30 moves in the slot 104 so that it cuts through the sleeve 68 immediately below the block 70 as the member 30 moves away from the member 28.

A pneumatic piston and cylinder assembly 114 is mounted on a support plate 116 mounted on the framework 10 (Figure 1). The piston rod of the assembly 114 carries a closure member 118 (Figure 4) which is slidable in a slot 120 formed in upper portions of the members 28 and 30 and partially in the block 70. The closure member 118 is movable by the action of the assembly 114 to a forward position in which it closes the upper end of the passage 26 preventing further rivets from falling into the passage 26. The closure member 118 has a vertical bore 122 therethrough in which the sleeve 68 is received and a horizontal bore 124 therein connecting with the bore 122. The piston rod of the assembly 114 also carries a crosshead 121 arranged to operate a pneumatic valve 123 for a purpose to be described.

A pneumatic piston and cylinder assembly 126 (Figure 1) is mounted on a bracket 128 which extends forwardly from the framework 10. The piston rod 130 (Figures 3 and 4) of the assembly 126 carries a plunger 132 arranged, under the action of the assembly 126 to pass through a groove 134 in the end of the guide 14 and enter the bore 124 in the closure member 118 engaging the sleeve 68 in the bore 122 and flattening the sleeve 68 against the member 118 to deform the sleeve 68. The assembly 126 forms deforming means operable to deform an end portion of the sleeve 68 after the sleeve 68 has been threaded through the column of rivets.

The stacking device also comprises air blowing means including three nozzles 136, 138 and 140 (Figure 4) positioned adjacent the guide 14. The nozzles 136 and 138

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enter opposite sides of the guide 14 and the nozzle 140 enters the guide 14 from below. The nozzles 136, 138 and 140 are so positioned that, when air is blown through the nozzles, the rivet R nearest the exit end of the guide 14 is caused to accelerate relative to the other rivets in the guide 14 and is thereby separated from said other fasteners to fall into the passage 26. The air blowing means ensures that rivets R entering the passage 26 do not interfere with one another causing a jam.

The illustrative machine also comprises ejecting means comprising a nozzle 142 (Figure 5) positioned to the side of the collector 24 and arranged to direct air on to a package of rivets R in the collector 24, when the collector is in its open condition, to eject the package from the collector 24.

The operation of the illustrative machine will now be described starting from the condition shown in Figure 1. In this condition, the guide 14 and the raceway 20 contain rivets R which have previously been fed from the hopper 16 by operation of the vibrating means 18. The collector 24 is in its closed condition and the holding means 66 is holding the open end of the sleeve 68 above the passage 26. The piston and cylinder assemblies 46 and 114 are respectively holding the mandrel 42 and the closure member 118 clear of the passage 26.

In the operation of the illustrative machine, the air blowing means is operated blowing air through the nozzles 136, 138 and 140 thereby causing rivets to fall one at a time into the passage 26 and, at the same time, the vibrating means 18 is operated to ensure a continuous supply of rivets to the guide 14. The first rivet which falls into the passage 26 comes to rest with its head on the catcher 37 and subsequent rivets pile up on the first rivet to form a column one-above-the-other

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with their shanks substantially in alignment.

When the column of rivets in the passage 26 reaches the photo-electric cell 38, the cell 38 creates a signal which causes the vibrating means 18 and the air blowing means to be turned off thereby cutting off the feed of rivets to the passage 26. The signal also causes the assembly 114 to move the closure member 118 forwardly into a position in which it prevents rivets from falling into the passage 26. The signal also causes the assembly 46 to move the mandrel 42 upwardly, in a series of jerks as aforesaid, so that the mandrel 42 passes upwardly through the column of rivets and its reduced end portion 54 enters the sleeve 68 held by the holding means 66 so that the sleeve 68 grips the portion 54. As the portion 54 is gripped by the sleeve 68, the crosshead 58 operates the valve 64 which causes the assembly 46 to reverse its direction of movement.

The assembly 46 now withdraws the mandrel 42 from the column of rivets thereby drawing the sleeve 68 through the column. When the sleeve 68 reaches the tube 41 at the lower end of the passage 26, the sleeve 68 is stripped off the mandrel 42 by the upper end of the tube 41 as the reduced end portion 54 withdraws into the bore 43 in the tube 41. The crosshead 58 now operates the valves 60 and 62 with the valve 60 being operated before the valve 62.

Operation of the valve 60 causes the assembly 126 to operate sending the plunger 132 through the bore 124 into contact with the sleeve 68 in the passage. The plunger 132 deforms the sleeve 68 leaving it with a flattened region (not shown) which acts to prevent the rivets R from accidentally falling off the sleeve 68. The plunger 132 is returned when the crosshead 58 releases the valve 60 which it does immediately before

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operating the valve 62.

Operation of the valve 62, causes operation of the assembly 34 to move the collector 24 to its open condition. As the member 30 moves, the knife 110 cuts off the sleeve 68 and the hook 45 draws the lower end of the sleeve 68 out of the opening 39 in the catcher 37. The movement of the member 30 continues until the valve 36 is operated thereby whereupon a blast of air from the nozzle 142 ejects the rivet package from the passage 26. The operation of the valve 36 also causes the assembly 34 to reverse its movement so that the collector 24 is returned to its closed condition ready for a further operation of the machine. When the collector 24 again reaches its closed condition, the photo-electric cell 38 again receives light from the lamp 40 and produces a signal which causes operation of the assembly 114 to withdraw the closure member 118 from the passage 26, the vibrating means 18 to re-start, and also air to be supplied to the air blowing means so that air is blown through the nozzles 136, 138 and 140. The illustrative machine can now repeat its operation to make another rivet package.

In a modification of the illustrative machine, instead of the holding means 66, the machine may comprise sleeve feeding means operable to feed a sleeve 68 around the mandrel 42 while the mandrel 42 is threaded through the column of rivets so that the sleeve 68 becomes threaded through the column. The mandrel 42 is then withdrawn leaving the sleeve 68 threaded through the column.

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Claims:

1. A machine for use in packaging headed hollow rivets characterised in that it comprises a collector (24) for supporting a column of rivets (R) in axial alignment one on top of another head lowermost, means (90, 92) for supporting a coil of flexible plastics tube (68) with an end portion disposed above and in axial alignment with a column of rivets in the collector, a mandrel (42) comprising a stem having transverse dimensions such that it can pass through the rivets, means (46) for moving the mandrel upwardly to project its stem through the column of rivets and into gripping engagement with the end portion of flexible tube aligned therewith and to withdraw it downwardly to thread the tube through the rivets, means (110) for cutting the threaded tube from the coil, means (126) whereby the end portions of the tube projecting from the ends of the column of rivets are provided with deformations to restrain the rivets from falling off, and means (142) whereby the pack consisting of the rivets on the tube is discharged from the collector.

2. A machine according to claim 1 wherein the means (46) for moving the mandrel (42) upwardly causes the mandrel to rise in a series of jerks.

3. A machine according to either one of claims 1 and 2 wherein the mandrel (42) has an uppermost free end portion which has transverse dimensions such that it can enter the plastics tube (68) causing the tube to expand and grip the free end portion of the mandrel so that, upon descent of the mandrel, the tube is pulled through the column of rivets.

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4. A machine according to claim 3 in which the uppermost free end portion of the mandrel (42) is of reduced transverse dimensions compared with the remainder of its stem.

5. A machine according to either one of claims 3 and 4 also comprising deforming means (126) operable to deform an end portion of the tube after it has been threaded through the column.

6. A machine according to either one of claims 2 and 3 comprising means (66) arranged to resist movement of the tube (68) away from the collector (24) so that, after passing up through the column of rivets, the free end portion of the mandrel (42) enters the tube and is gripped thereby as it begins to descend.

7. A machine according to any one of the preceding claims comprising rivet feeding means (16, 20) including a substantially horizontal guide (14) to which the rivets (R) are advanced one after another with their heads lowermost and shanks (S) vertical to an exit adjacent the upper end of the collector (24) so that rivets leaving the guide fall head first into the collector, and air blowing means including at least one nozzle (136, 138, 140) positioned adjacent the guide (14) so that, when air is blown through the nozzle, the rivet nearest the exit end of the guide is caused to accelerate relative to the other rivets in the guide and is thereby separated from said other rivets to fall into the collector.

8. A machine according to claim 6 wherein the collector (24) comprises two passage-defining

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members (28, 30) mounted for relative movement between a closed condition in which the two members co-operate to define a passage (26) for the column of rivets and an open condition in which a column of rivets stacked in the passage can be removed therefrom.

9. A machine according to claim 6 wherein the collector (24) comprises detecting means (38, 46) operable to detect when a predetermined number of rivets have been stacked in the collector and thereupon to render the air blowing means (136, 138, 140) inoperative.

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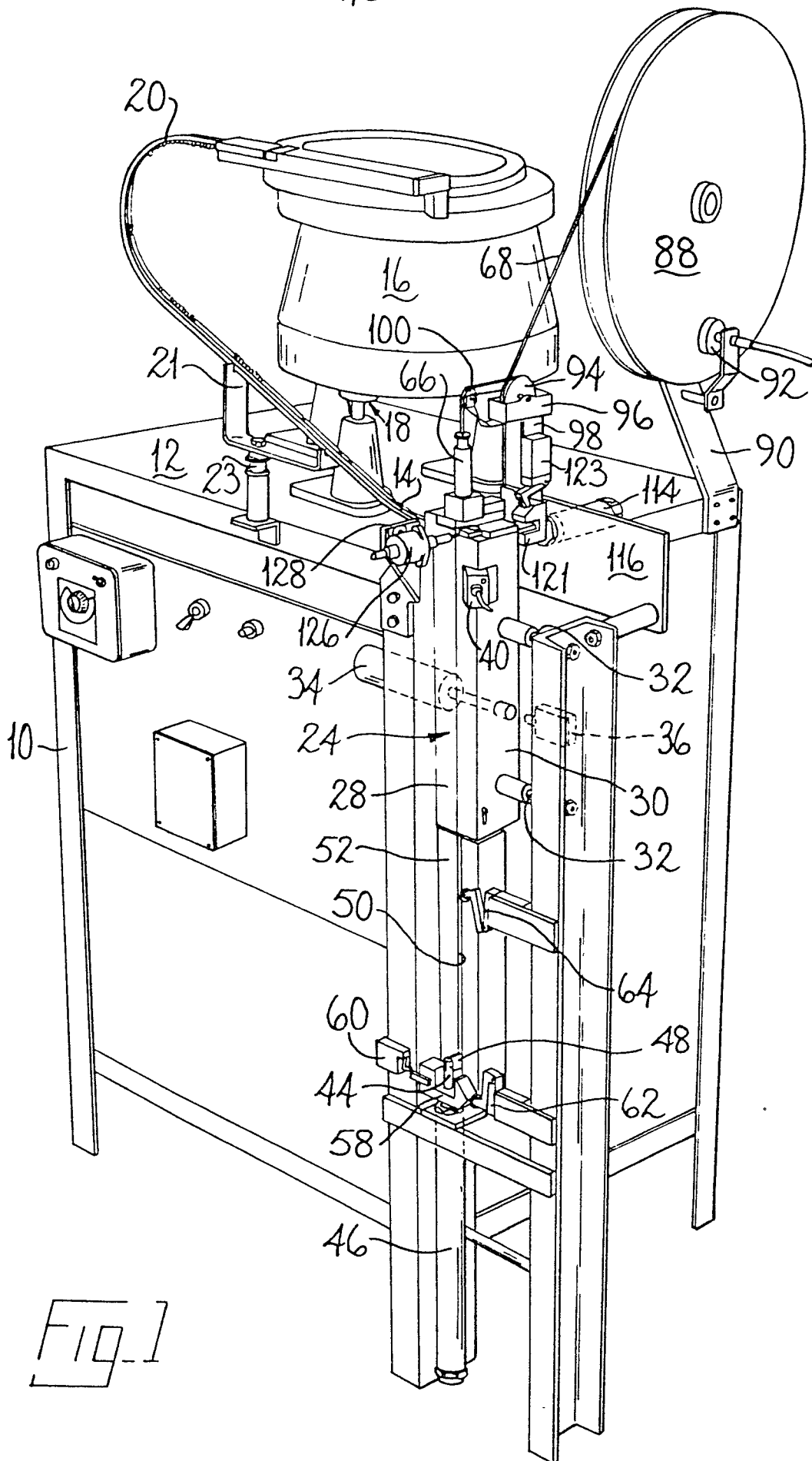
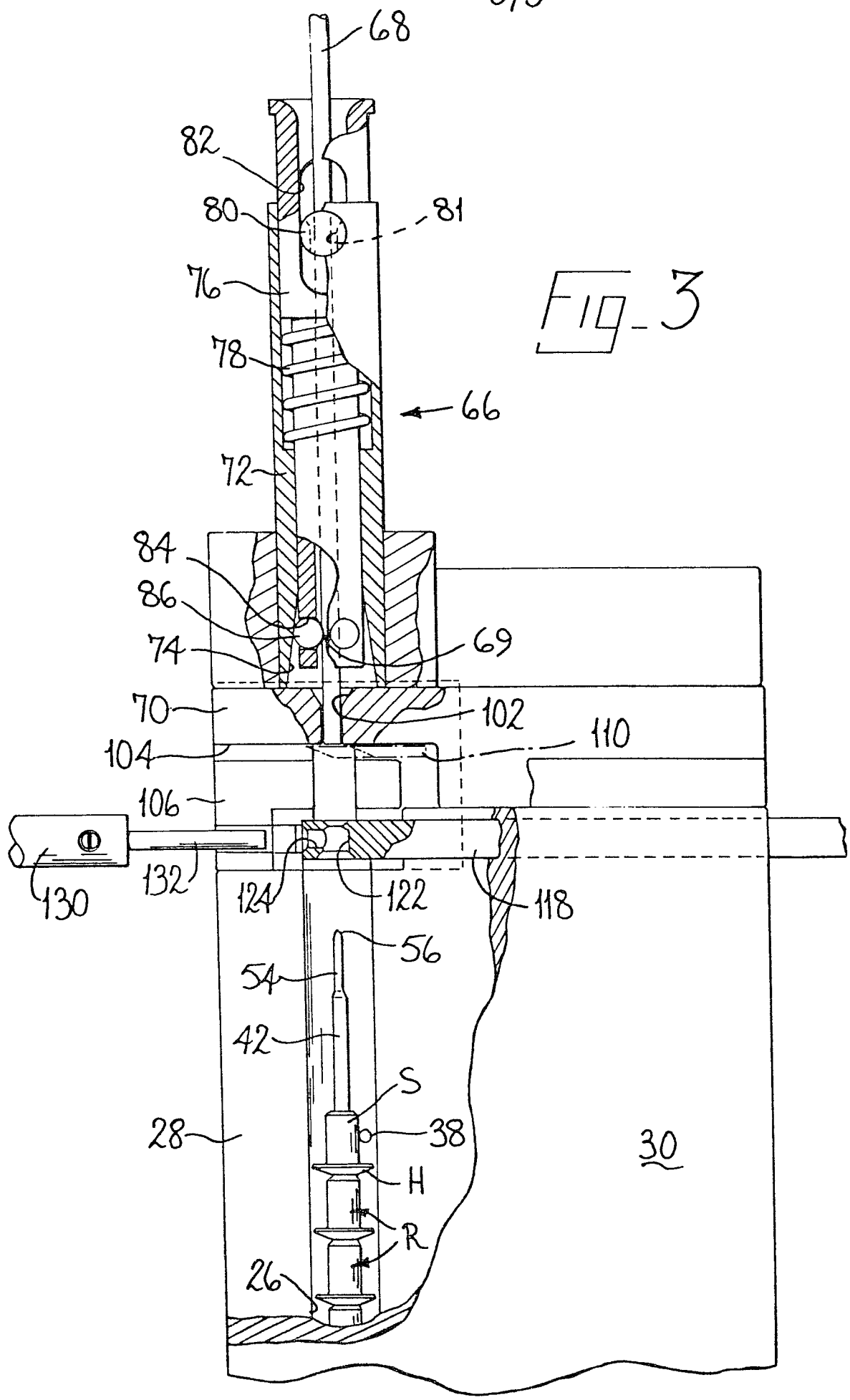
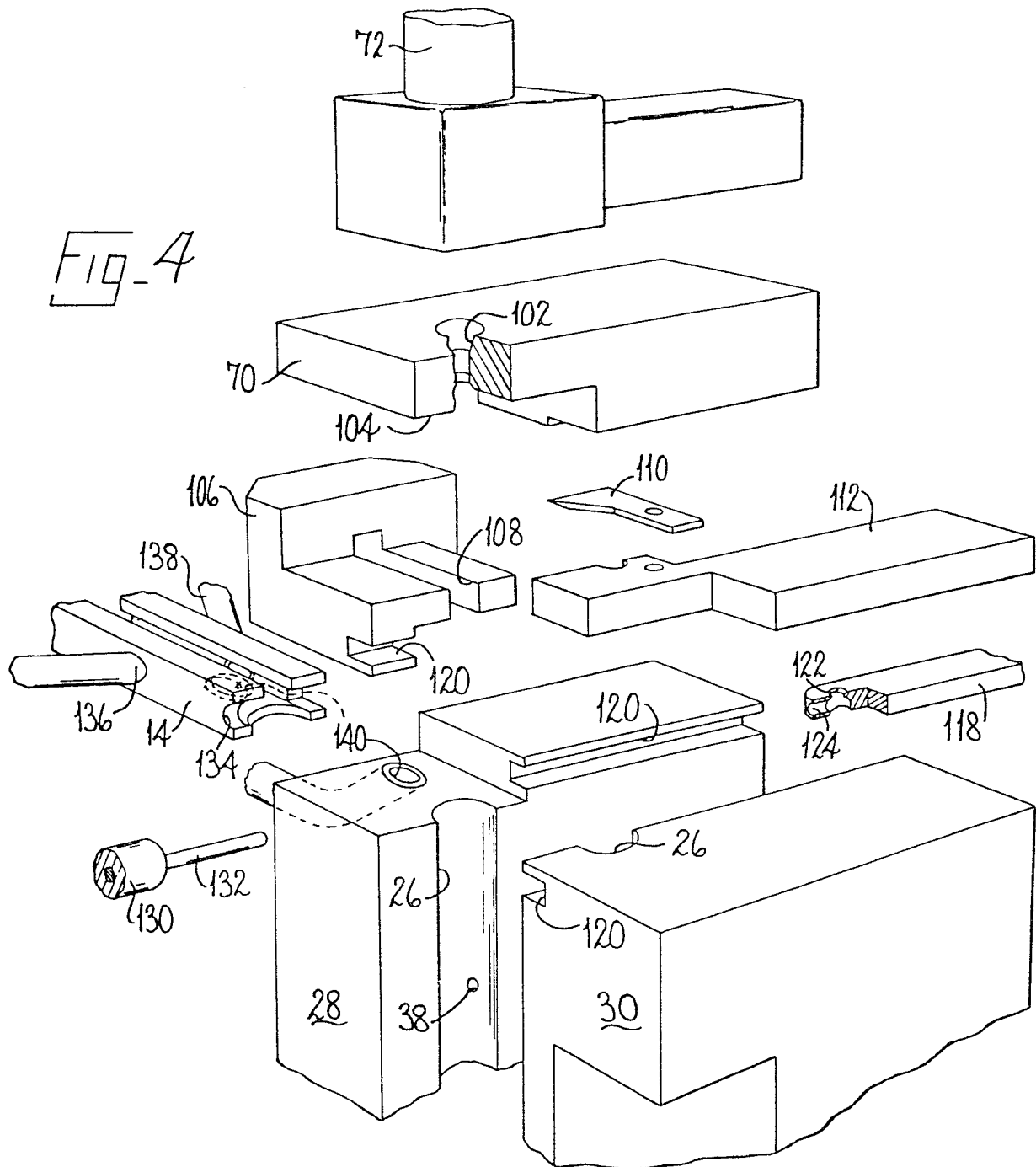


FIG. 1

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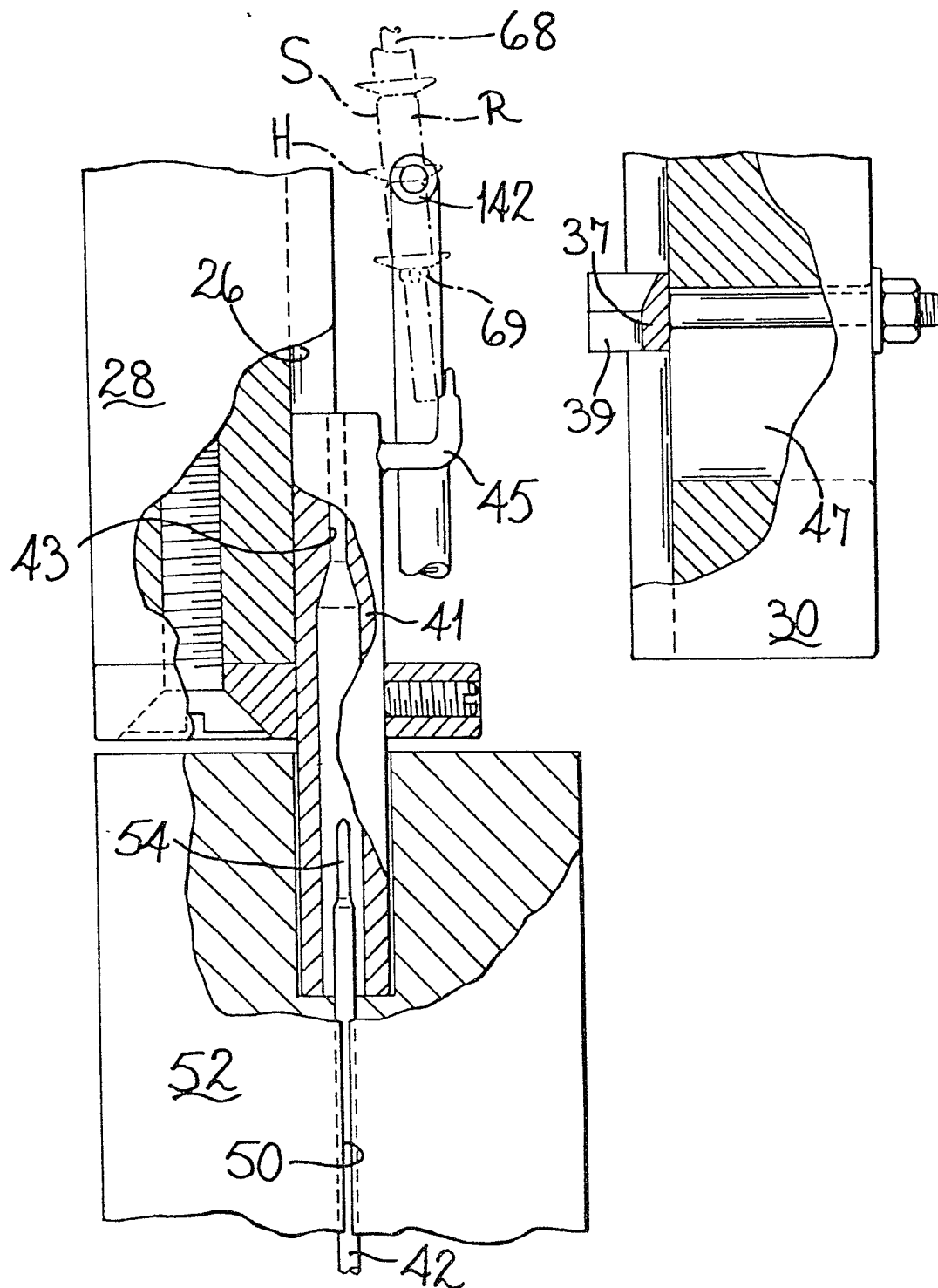


Fig. 5



European Patent
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EUROPEAN SEARCH REPORT

0022316

Application number

EP 80301941.3

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
D	EP - A1 - 0 001 343 (USM CORPORATION/TUCKER F. LTD) --	1	B 65 B 19/00
A	US - A - 2 752 742 (AVIATION DEVELOPMENTS, INC.) + Totality + --		
A	US - A - 2 844 924 (J.F. HAMLIN & L. NEWMAN) + Totality + --		
A	US - A - 3 611 671 (AERPAT AG.) + Column 1; fig. 1,4 + ----		
			TECHNICAL FIELDS SEARCHED (Int.Cl. 3)
			B 65 B 19/00 B 65 B 35/00 B 65 B 37/00 B 65 B 57/00
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family. corresponding document
☒ The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 05-09-1980	Examiner MELZER