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(54) **Coating of fasteners.**

(57) Method and apparatus for coating fasteners with adhesive or sealant, incorporating a rotatable support wheel (12), a stationary reaction member (20) and a stationary applicator head (134), adjustable toward or away from the wheel and parallel to the axis of rotation of the wheel. Fasteners are received between the wheel and the reaction member and are rotated by movement of the wheel relative to the reaction member.

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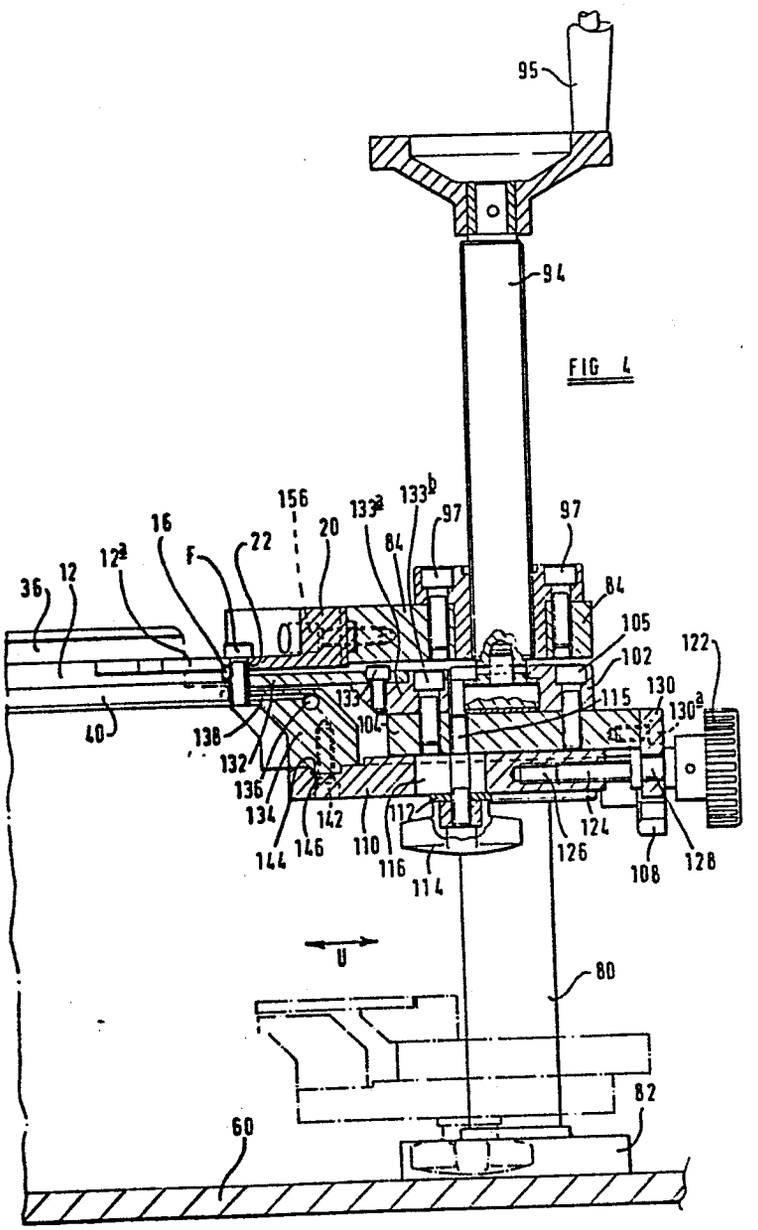

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FIG 4

COATING OF FASTENERS

This invention relates to apparatus for and a method of coating fasteners, such as for example bolts or studs, with a deposit of pasty material.

The known coated fasteners fall generally into two categories, firstly those which are provided with an area of adhesive which only covers a part of the circumference of a selected region of the fastener, the adhesive fulfulling the object of bonding a cooperating member to which the fastener is applied to obviate or inhibit release of the fastener by, for example, vibration. In the second category are fasteners provided with a deposit of adhesive material which coats the full circumference of a selected region of the fastener. Such fasteners coated with adhesive, per se are known in the art but many of the methods used to apply the adhesive around the full circumference of a fastener have been expensive and time consuming and have often involved moving a spray head for the adhesive around the fastener to apply the coating thereto. The adhesive in the second category of coated fasteners acts also as a sealant between the fastener and a cooperating member, as well as to obviate or inhibit release. The adhesive coating is usually applied in liquid or slurry form and may comprise, especially for coated fasteners of the second category, any of the known anaerobic or micro-encapsulated types which, in use, provide the fastener with a coating which acts as an adhesive and/or sealant.

The term 'pasty material' as used herein is intended to cover materials which are principally adhesives and/or sealants but also other materials in the form of flowable compositions and which after application are preferably capable of undergoing complete or partial setting to some degree with or without the agency of heat or other stimulus.

The present invention seeks to provide a new or improved apparatus and method for the application of a coating of pasty material (as hereinbefore described) to a fastener, primarily to produce a coated fastener of the second category but also capable of producing certain coated fasteners of the first category.

The invention provides a method of applying a coating to a fastener characterised by holding successive fasteners between and in frictional contact with a peripheral surface of a rotatable support and a stationary reaction member, causing the fastener to rotate by moving the rotatable support wheel relative to the reaction member, and applying coating material to the rotating fastener at a fixed location from a stationary applicator head.

The invention also provides apparatus for performing the above method, characterised by a rotatable support wheel, a stationary applicator head and, adjacent a peripheral region of the rotatable support wheel, a stationary reaction member, the apparatus being arranged such that fasteners to be coated are successively held in frictional contact with both the rotatable support wheel and the reaction member and are caused to rotate, in use, as a result of the relative movement between the rotatable support wheel and the reaction member, coating material being applied to the circumference of the fasteners by the applicator head as the fasteners move by the head.

The support wheel is preferably arranged to rotate about a vertical axis; and desirably the peripheral surface thereof is circumferential and has a resilient portion such as an insert of plastics material, the gap between the resilient portion and the reaction member being slightly less than the thickness (eg diameter) of the fasteners to be coated. Advantageously there is provided below a peripheral region of the support wheel a support element having a

peripheral (preferably circumferential) surface, in use, contacting a lower portion of the fasteners.

The support element is preferably releasably secured to the support wheel and rotates therewith. Means may be provided for selectively adjusting the spacing between the support wheel and the support element, such means may for example comprise spacing members and screws.

The applicator head is desirably situated below the reaction member, and advantageously there is provided means by which the spacing between the applicator head and the support wheel can be selectively chosen from a plurality of different spacings.

The applicator head is desirably arranged to be movable in a direction parallel to the axis of rotation of the support wheel. Preferably the applicator head is also arranged to be movable in a direction normal to the axis of rotation of the support wheel. The adjustment means for the applicator head may include at least one clamping screw and at least one adjustment screw for each direction of movement.

There may be provided below the reaction member an abutment member, in use contacting a portion of each fastener below that portion of the fastener contacting the reaction member. The abutment member is preferably mounted near the applicator head and desirably is mounted for movement together with the applicator head in a direction parallel to the axis of rotation of the support wheel.

Preferably the reaction member is of a size such that the fastener is caused by the rotatable support wheel to rotate by at least one complete revolution, and desirably a plurality of revolutions, the applicator head being of such a size that at least the full circumference of the fastener

is coated. This is particularly appropriate where the fasteners to be coated are of small circumference. The size of a fastener whose circumference can be partially coated by the apparatus is governed by the length of a coating part of the applicator head, any fastener which is of small diameter and thus small circumference being very difficult to only partially coat.

Each said fastener may be held in a radially inwardly extending slot at the periphery of the support wheel but most preferably the wheel has an uninterrupted peripheral edge. The reaction member is preferably of arcuate configuration complementary to the curvature of the wheel periphery. Means may also be provided for supporting the lower end of each fastener and this may comprise a plate upon which the fastener rests. This is especially desirable where non-headed fasteners are being coated. The plate may be provided by said abutment member positioned so as to underlie, at least in part, the fasteners, or may be provided by a separate member so positioned.

The above and other features of the invention will become apparent from the following description of an embodiment of the invention, given solely by way of example and not by way of limiting the invention, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic view of a coating line incorporating the apparatus of the present invention;

Figure 2 is a plan view, shown partly cut away, of a portion of apparatus according to the invention, showing a drive arrangement;

Figure 3 is a plan view principally of an applicator head assembly of the apparatus, on an enlarged scale;

Figure 4 is a side elevational view, shown partly in section, on line N - N of Figure 3;

Figure 5 is a front elevational view, shown partly in section, on line O - O of Figure 3;

Figure 6 is a vertical broken cross-sectional view of parts of the apparatus of Figure 2 shown partly cut away;

Figure 7 is a cross-sectional view on line P - P of Figure 2 shown partly cut away;

Figure 8 is a cross sectional view on line Q - Q of Figure 2 shown partly cut away;

Figure 9 is a cross sectional view on line S - S of Figure 6 shown partly cut away, on an enlarged side, and

Figure 10 is a side elevational view in the direction of arrow T of Figure 2 shown partly cut away.

The coating line shown diagrammatically in Figure 1 receives fasteners at the right hand end thereof and progresses them sequentially through the various elements of the line from right to left. The fasteners may be headed externally threaded bolts or unheaded externally threaded studs or unthreaded bolts or studs. The line comprises a hopper A and elevator B at the right hand end of the coating line, a bowl feeder C communicating with guide rails D leading to the coating apparatus E of the invention, which will be described in more detail below. The coating line also comprises a chute F further elevator conveyor G, a spreading mechanism H, a slow conveyor J passing through a curing oven K, and a discharge hopper L.

Brief Description of the Coating Apparatus

The apparatus according to the invention, shown in detail in Figures 2 to 10, has as its principal parts, firstly a wheel shown generally as 10 rotating about a vertical axis and comprising a circular plate 12 of stainless steel having a groove 14 around its vertical peripheral surface within which is received a resilient rubber ring 16 of circular radial cross section. Secondly there is provided a stationary reaction member 20 (see Figure 3) presenting to the wheel 10 an arcuate surface 22 having substantially the same centre of curvature as the axis of the wheel 10. The maximum radius of the ring 16 is less than that of the arcuate surface of the reaction member by an amount slightly less than the diameter of the shank of a fastener (see Figure 2) to be coated so that, when a fastener is received between the ring and the reaction member, the former will be slightly deformed and movement of the wheel relative to the reaction member will cause the fastener to rotate as its centre line progresses in a direction circumferentially of the wheel. During rotation of a series of the fasteners, adhesive is supplied from an applicator head to form a coat encircling a portion of each fastener. The remainder of the apparatus, which will now be described in detail, is provided to drive the moving parts, supply the fasteners for coating and remove coated fasteners, or for adjustment of the apparatus to accommodate various shapes and sizes of fastener.

Detailed Description of the Coating Apparatus

The wheel 10 referred to above and its relationship with other components of the apparatus is shown in Figures 2 and 6 and comprises a rotary part consisting of a sleeve 30 (Figure 6) welded to an annular base 32 to which is secured, by screws 34, a support plate 36. The circular plate 12 is

held in securement beneath the support plate 36 by screws 38, and a further steadying plate 40 is positioned beneath the circular plate 12 by bolts 42, nuts 44, and spacer tubes 46, the latter being chosen so that the steadying plate 40 is at a depth below the circular plate 12 such that it contacts the fastening slightly above or below that region of the fastening which is to be coated.

The support plate 36 rests on and is supported by a shaft 48 journalled within an annular column 50 by conical thrust bearings 52 near upper and lower regions of the shaft, the bearings being accessible through top and bottom end caps 54 provided with seals 56. The upper end cap is secured to the column by bolts and the lower end cap is clamped to the shaft 48. The column 50 is welded at its lower end to an annular flange 58 secured to a base plate 60 by screws 62 and is provided with a spigot end 64 which locates in an aperture in the base plate 60. The lowermost end of shaft 48 is splined and receives a boss 66 to which is secured a sprocket wheel 68 by screws 70, the boss 66 being retained on the splines of the shaft by a keeper plate 72 held in place by a screw 74 in the end of the shaft 48. Grease lubrication is provided for by means of a duct 76 and nipple 78.

The applicator head assembly is shown in Figure 3 (enlarged scale) and in Figures 4 and 5, and comprises a pair of pillars 80 with flanged bases 82 secured in spaced relation to the base plate 60 by screws 83. The pillars 80 are bridged by a beam member 84 having apertures 86 which receive respective spigot ends 84 of the pillars 80 and are secured thereto by screws 90 acting through apertured keeper plates 92. At its central region the beam member 84 mounts a screw adjustment mechanism comprising a screw-threaded rod 94 rotatable by a handwheel 95 and threadingly engaged in a collar 96 secured by screws 97 in an aperture in the beam member 84. The screw-threaded rod has an unthreaded lower

end region 98 to which is attached a larger diameter cylindrical member 100 the latter being received for rotation in a horseshoe-shaped housing 102 attached to a movable beam 104 by screws 105. This beam straddles the pillars 80 which pass through apertures in respective ends thereof each aperture being provided with a split collar 106 secured to the movable beam 104 by bolts 107. The free ends of the collars are clampingly movable relative to one another by respective clamping screws 108 to clamp the sleeves to respective pillars in any position of the movable beam 104, determined by the screwed rod 94, between an upper position, shown, and a lower position shown partly in ghost lines in Figures 4 and 5. Liners 109 between the collars 106 and the pillars 80 obviate lateral play. The movable beam 104 also supports an applicator head (best seen in Figure 4) for sliding horizontal movement (in direction of arrow U in Figure 4) normal to the beam member 84.

The applicator head comprises a bottom plate 110 supported by a flange 112 of a clamping knob 114, a screwed shank 115 of which passes without engagement through a slot 116 in bottom plate 110 and engages in a threaded bore in the movable beam 104. The bottom plate can thus slide freely relative to the movable beam 104 when the knob 114 is loosened but is securely clamped thereto when the knob 114 is tightened, by the flange 112, a recess 118 in the underside guidingly receiving a projection 120 upstanding from the bottom plate 110 to ensure that the latter can only move fore and aft of the movable beam 104. With the clamping knob loosened, fore and aft movement of the bottom plate 110 is controlled by an adjusting screw comprising a knob 122 having a screw threaded shank 124 which is threadingly engaged in a bore 126 of the bottom plate 110. The adjusting screw is constrained from movement in an axial direction by its location in a journal, shown generally as 128, on a plate 130 depending from the movable beam 104 and secured thereto by screws 130a. The plate 130 has studs

104b engaging in recesses in the movable beam 104 to provide for location of one relative to the other. At a front end of the movable beam 104 there is provided an abutment 132 secured by screws 133 to a mounting block 133a, itself secured to the movable beam 104 by screws 133b. The abutment acts to keep the fastener(s) being coated at coating distance from an applicator box 134. The latter has a chamber 136 comprising a horizontal cylindrical bore closed off at both ends by plugs 137 and outlet ducts 138 for adhesive (see Figures 3 and 4). Adhesive is supplied to the chamber via a conduit 140 (see Figure 5). The applicator box 134 is releasably secured to the bottom plate 110 by screws 142 and is provided with a downward-projection 144 received in a recess 146 in the bottom plate 110, for location purposes.

The beam member 84 also supports the reaction member 20, made of steel and having a forwardly projecting lip with a reaction surface 22 which is arcuate in plan, is disposed opposite the periphery of the circular plate 12 and secured to the beam member 84 by screws 156. It is between the arcuate surface 22 and the ring 16 that the fasteners are trapped and rotated as the circular plate 12 revolves.

Fasteners for coatings are supplied to the gap between circular plate 12 and the reaction member 20 by a small diameter supply wheel 158 (see Figures 2 and 6). The fasteners are received from an inclined chute comprising a pair of spaced rails 60 (in the case of 'headed' fasteners), the shank of each fastener being received in a respective slot 162 in the periphery of the supply wheel 158 (only some of the slots 162 are shown in Figure 2). The fasteners are retained in their slots 162 by an arcuate retaining plate 164, sited alongside the supply wheel 158, and whose purpose is merely to retain the fasteners and not to provide a reaction surface. The fasteners (it should be noted that only their shanks are shown in Figure 2) are directed out of

the slots 162 and into the gap between the circular plate 12 and reaction surface 22 by a leading edge 166 (shown in broken line in Figure 2) of the reaction member 20. The supply wheel 158 is provided with a deep recess in its underside and is secured to an upper end of a shaft 168 having an locating spigot 170 received in the deep recess. The shaft also has at its upper end a projection which is received in a shallow recess in the supply wheel 158. A stud 172 projects from the upper surface of the projection, through an aperture in the supply wheel 158 and a knurled threaded nut 174 secures the supply wheel 158 to the shaft 168 by engagement with the stud 172. The shaft 168 also releasably mounts an annular split support ring 182 (see Figures 6 and 9) which can be clamped to the shaft 168, by tightening a clamping screw 184, at any position between the top and bottom regions of the sleeve 178. This split ring 182 is of larger diameter than the supply wheel 158 and can be positioned as shown in broken line in Figure 6, to support the base of a fastener where appropriate, for example where fasteners having no heads are being coated. The shaft 168 is journalled by bearings 186, at upper and lower regions, in an annular column 188 which receives the shaft and which has a flanged base 190 by which it is releasably secured to the base plate 60 by screws 192.

There is provided a bearing retaining cap 194, at the base of the shaft 168 which in addition has a splined end which receives a sprocket wheel 196 secured thereto by a screw 198 and a keeper plate 200.

The arcuate retaining plate 164 is supported from the base plate 60 by columns 202 (only one of which is shown in Figure 6).

As may be seen in Figure 2 the apparatus is driven by a motor drive through a suitable gearbox 203 and clutch 204 by a motor 205 (see Figure 7) via a power sprocket wheel 206

(see Figure 10) which drives sprocket wheels 68 and 196 by means of a sprocket chain 208 (figure 2), a heavy duty bearing shown generally as 210 being provided to support the end of a drive shaft 212 relative to the base plate 60. A chain tensioner/alignment assembly 214 is also provided. The latter comprises a support mounting member 216 (see Figure 8) to which is journalled a sprocket wheel 218 with a heavy duty bearing, the mounting member 216 being securable to the base plate 60 by bolts 220 passing through respective slots 222 in the base plate. A large slot 224 is provided in the base plate by which movement of the mounting member 216 is constrained to a longitudinal direction relative to the slot 224, the mounting member 216 having a projection 226 slidable along the slot. Movement of the mounting member when the bolts 220 are released is controlled by an adjustment screw 230 (see Figure 7) mounted in a bracket 232 secured to the base plate underside by bolts 234. The screw 230 has a hexagonal head 236 for adjustment by a wrench or spanner and a locking nut 238 which can be tightened against a surface of part of the bracket 232.

Operation of the apparatus is as follows, the apparatus being set up as shown in Figure 4 for a headed bolt with a shank having a threaded end and being about 25 mm long and as shown in Figure 6 for a headed bolt having a length of about 55 mm. The difference in scales of the Figures is to be borne in mind.

Referring firstly to Figure 1, fasteners to be coated are loaded into hopper A which discharges them steadily onto elevator conveyor B from which they are discharged into bowl feeder C comprising a bowl lined with synthetic material having a helical ramp (not shown) up which the fasteners climb under the effect of rotation of the bowl to a discharge point near the rim. A gate (not shown) when opened, allows the fasteners to pass to a pair of guide

rails (indicated as 160 in Figure 2) between which the shanks of the fasteners fall, the heads being too large to pass between the rails. The fasteners fall under gravity to the coating apparatus shown schematically as E. After coating they pass via chute F up a further elevator conveyor G to spreading mechanism H which spaces the fasteners out before they come to rest on slow conveyor J passing through curing oven K. The fasteners then pass to a hopper L as product. The arrangement of conveyor chutes and elevators may be varied to suit the working circumstances and the fasteners to be coated. The gate is controlled by a light beam transmitter/receiver assembly (not shown) which closes the gate when the rails 160 are full of fasteners.

The coating apparatus E previously described is operable as follows:-

Fasteners X are received from the rails 160 and a shank of each is received in a respective slot 162 in the supply wheel 158. Thence they pass between the ring 16 on plate 12 and reaction surface 22 of the reaction member 20. The rotation of the circular plate 12 causes the fasteners to be rotated, and adhesive is applied to the threads thereof in a desired region through the outlet ducts 138, the adhesive being in the form of a paste. At the end of the reaction surface 22 the coated fasteners fall into chute F.

The apparatus may be adjusted to accommodate different diameters and lengths of fasteners, headed and unheaded. For example for longer fasteners the steadying plate 40 is moved to a lower position on the sleeve 30 using longer bolts 42 and spacers 46. The applicator head may be lowered so that adhesive is applied to a desired region of the fastener (generally near its free unheaded end) by releasing the screw clamp knobs 108 then adjusting the hand wheel 95 followed by tightening of the knobs 108. If the fasteners are unheaded the support split ring 182 may be moved to a

position such that the bottom surface of the fasteners can rest thereon. The upper surface of the support split ring 182 may be textured for example with dimples the better to retain the bottom portion of the fasteners. For large diameter fasteners the supply wheel 158 would be exchanged (by unscrewing nut 174) for one having fewer, larger slots 162 and also either the applicator head 134, reaction member 20 and abutment 132 would be exchanged for ones having arcuate surfaces of greater radius of curvature (by unscrewing screws 142, screws 156 and screws 133 respectively), or alternatively the circular plate 12 would be exchanged for one of smaller radius. The supply wheel need not have slots therein but may instead have a resilient band at it periphery in the manner of ring 16, in which case for larger diameter fasteners the arcuate retaining plate 164 would be replaced or one of a selection of supply wheels or different diameters may be chosen as appropriate. The fasteners may be any articles which have a stem which can be gripped between the circular plate and reaction member. The stem need not be cylindrical but could be slightly tapered.

The thickness of the adhesive coat applied can be adjusted by fore or aft movement of the applicator head 134 by unscrewing clamp knob 114 adjusting screw knob 122 to give the desired distance of the end of outlets 138 from the fastener and then tightening clamp knob 114.

As will be seen in Figure 4 the circular plate 12 may be recessed and have a removable annular ring 12a receivable on the plate, the ring 16 being disposed between clips provided on the plate 16 and the annular ring 12a.

The apparatus is preferably made substantially of steel, preferably of stainless steel where corrosion resistance is desired i.e. for those parts liable to come into contact with the adhesive, or where appropriate of plastics.

It will be realised that the apparatus does not rely on the fasteners having heads for its operation.

CLAIMS

1. A method of applying a coating to a fastener (F) characterised by holding successive fasteners between, and in frictional contact with, a peripheral surface of a rotatable support wheel (12) and a stationary reaction member (20), causing the fastener to rotate by moving the rotatable support wheel relative to the reaction member and applying coating material at a fixed location from a stationary applicator (134).

2. Apparatus for performing the method according to Claim 1 characterised by a rotatable support wheel (12), a stationary applicator head (134) and, adjacent a peripheral region of the rotatable support wheel, a stationary reaction member (20), the apparatus being arranged such that fasteners (F) to be coated are successively held in frictional contact with both the rotatable support wheel (12) and the reaction member (20) and are caused to rotate, in use, as a result of relative movement between the rotatable support wheel (12) and the reaction member (20), coating material being applied by the applicator head as the fasteners move by the applicator head.

3. Apparatus according to Claim 1 characterised in that the rotatable support wheel (12) is arranged to rotate about a vertical axis.

4. Apparatus according to Claim 2 or Claim 3 characterised in that the peripheral surface of the rotatable support wheel (12) has a resilient portion (16), the distance between this resilient portion (16) and the reaction member (20) being arranged to be slightly less than the thickness of a fastener (F) to be coated.

5. Apparatus according to any one of Claims 2 to 4 characterised in that there is provided below the peripheral

region of the rotatable support wheel (12) a support element (40) having a peripheral surface arranged, in use, to contact a lower portion of a fastener (F) to be coated.

6. Apparatus according to Claim 5 characterised in that the support element (40) is releasably secured (42,44) to the rotatable support wheel (12) and rotates therewith.

7. Apparatus according to Claim 6 characterised by means (42,44,46) for selectively adjusting the spacing between the support element (40) and the rotatable support wheel (12).

8. Apparatus according to any one of Claims 2 to 7 characterised in that the applicator head (134) is situated below the reaction member (20).

9. Apparatus according to any one of Claims 2 to 8 characterised by adjustment means (84,94,104; 104,110,114,124) by which the spacing between the applicator head (134) and the rotatable support wheel (12) can be selectively chosen from a plurality of different spacings.

10. Apparatus according to Claim 9 characterised in that the applicator head (134) is adjustably moveable by said adjustment means (84,94,104) in a direction (V) parallel to the axis of rotation of the rotatable support wheel (12).

11. Apparatus according to Claims 9 or 10 characterised in that the applicator head (134) is adjustably movable by said adjustment means (104,110,114,124) in a direction (U) normal to the axis of rotation of the rotatable support wheel (12).

12. Apparatus according to any one of Claims 9 to 11 characterised in that the adjuster means (84,94,104; 104,110,114,124) include at least one clamping element (108;114) and at least one adjustment screw (94;124).

13. Apparatus according to any one of Claims 2 to 12 characterised in that there is provided, below the reaction member (20) an abutment member 132 which, in use, contacts a portion of the fastener (F) below that portion of the fastener (F) contacting the reaction member (20).

14. Apparatus according to Claim 13 characterised in that the abutment member (132) is mounted near the applicator head (134).

15. Apparatus according to Claims 13 or 14 characterised in that the abutment member (132) is mounted (133,133a,104) for movement together with the applicator head (134) in a direction (V) parallel to the axis of the rotatable support wheel (12).

16. Apparatus according to any preceding Claim characterised by a supply wheel (158) arranged to supply Fasteners (F) successively to the support wheel (12) for coating.

17. Apparatus according to Claim 16 characterised in that the supply wheel (158) has recesses (162) within which Fasteners (F) are received and moved to the support wheel (12).

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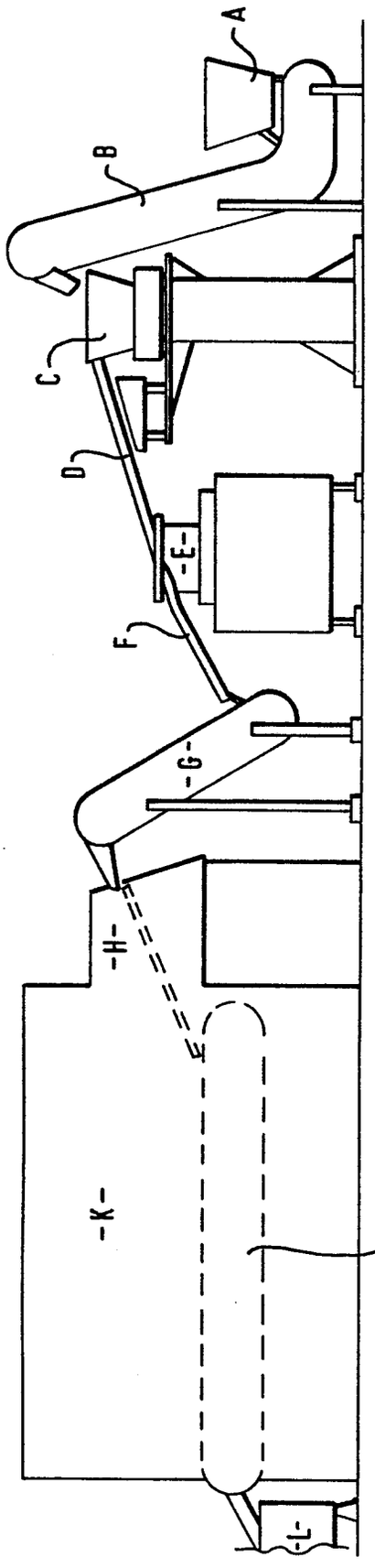


FIG 1

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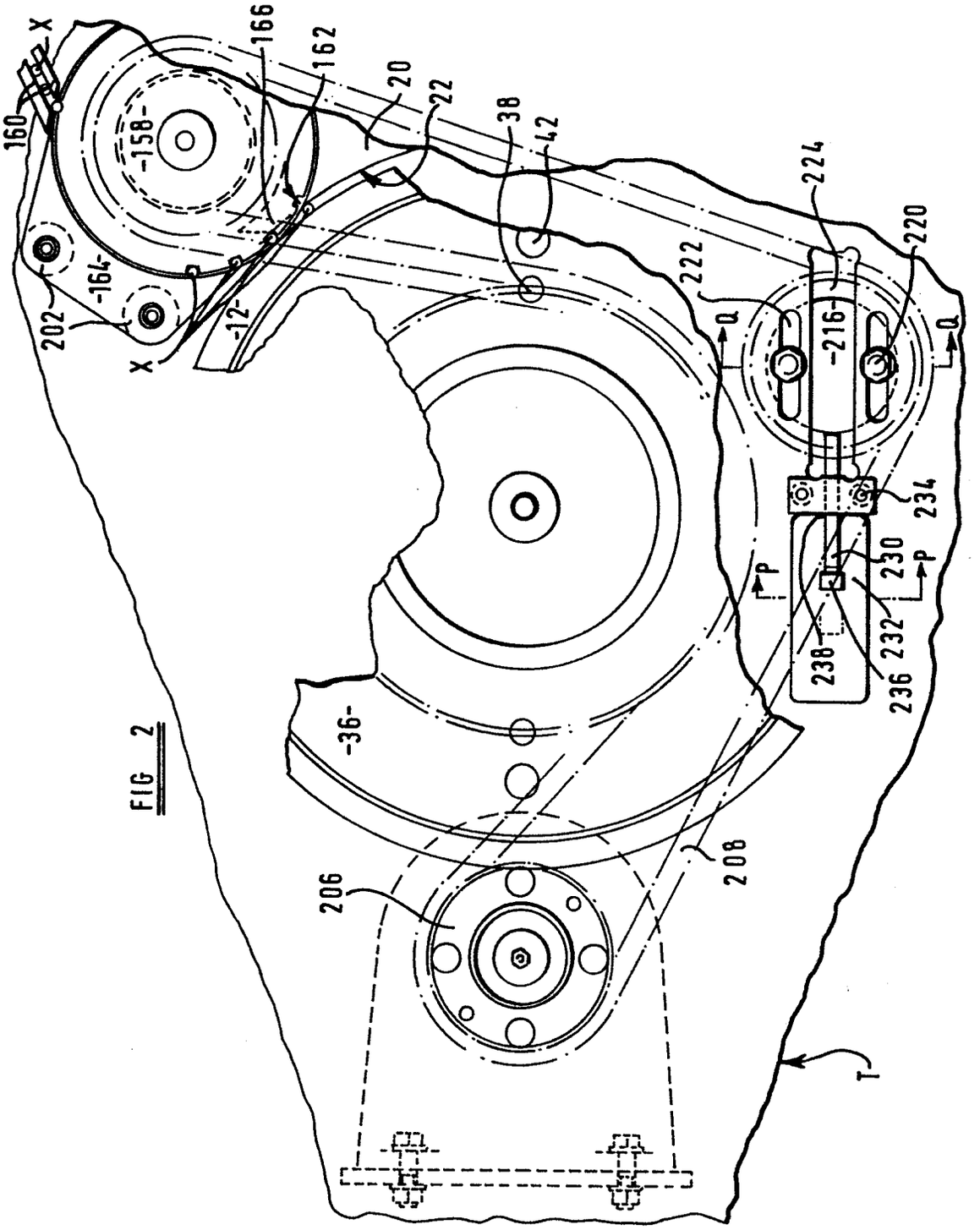


FIG 2

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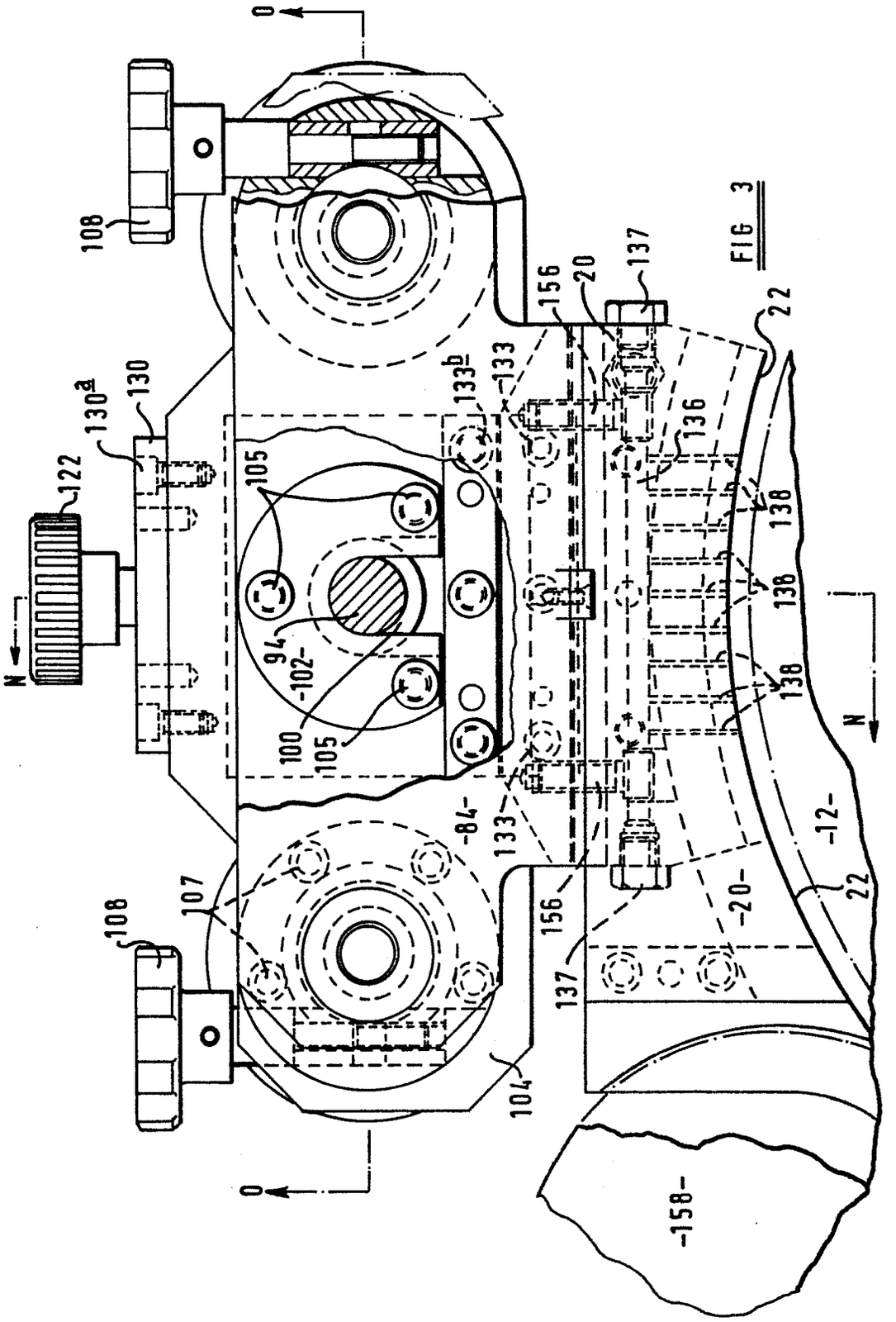


FIG 3

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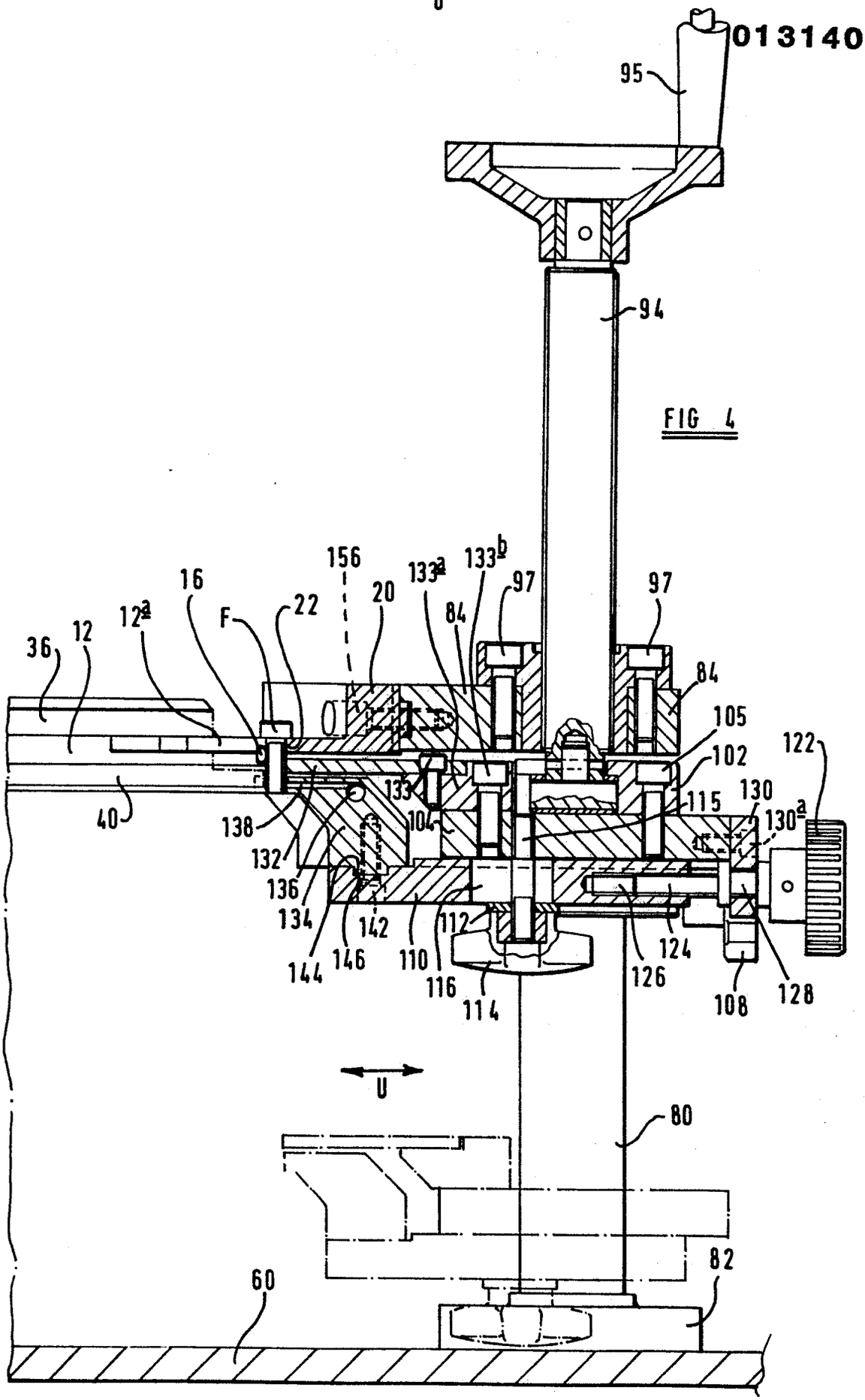


FIG 4

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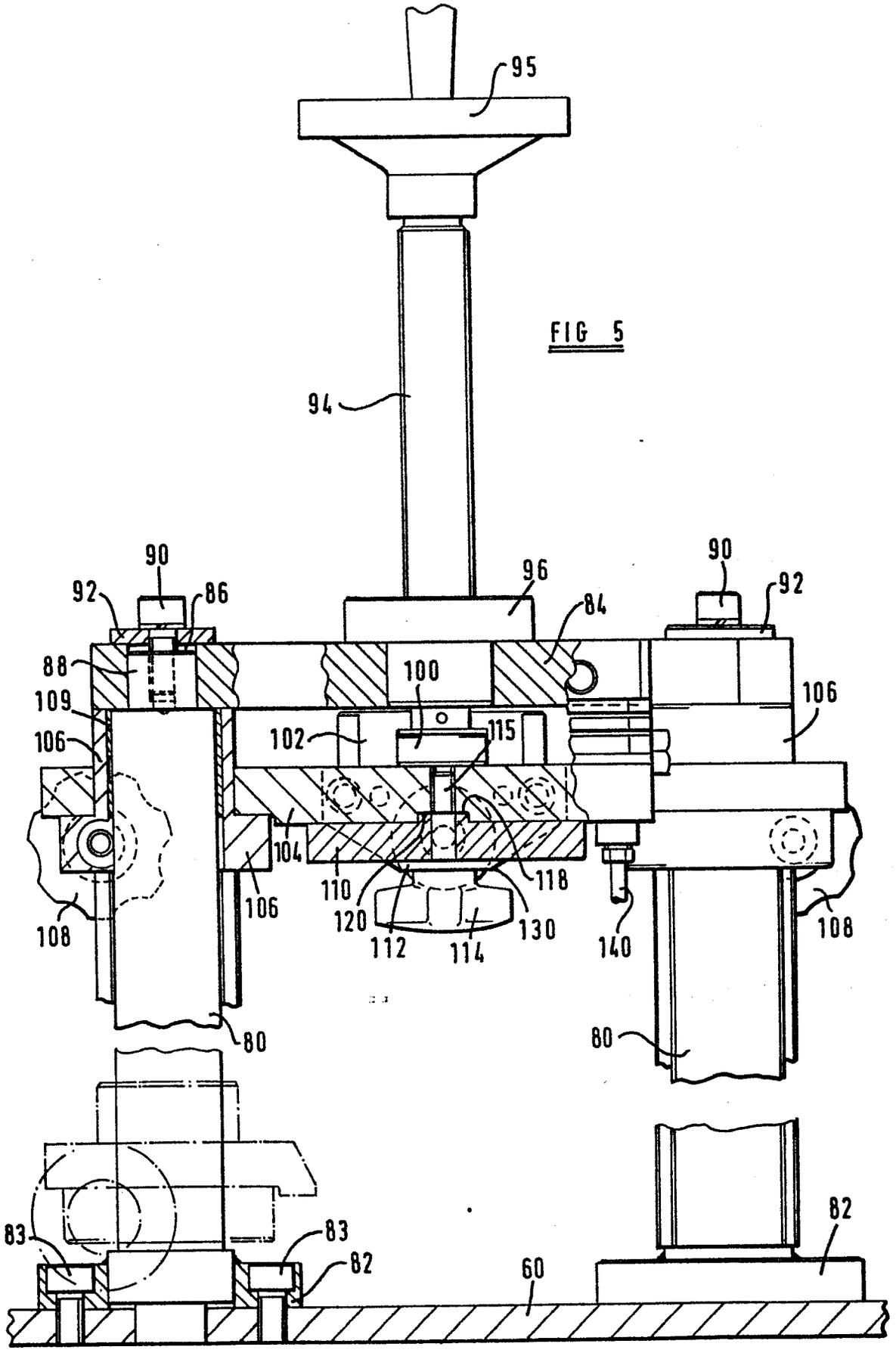


FIG 5

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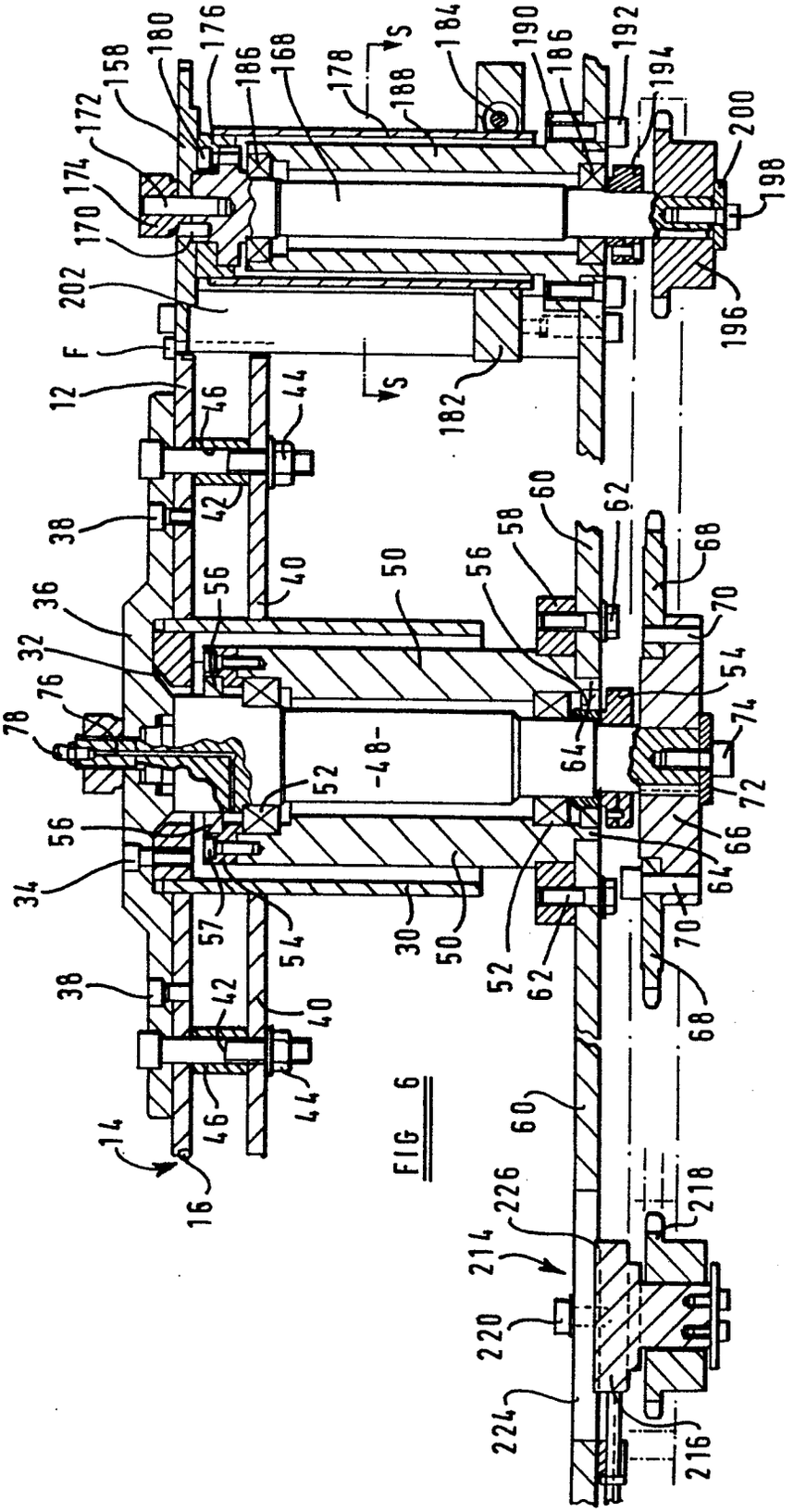


FIG 6

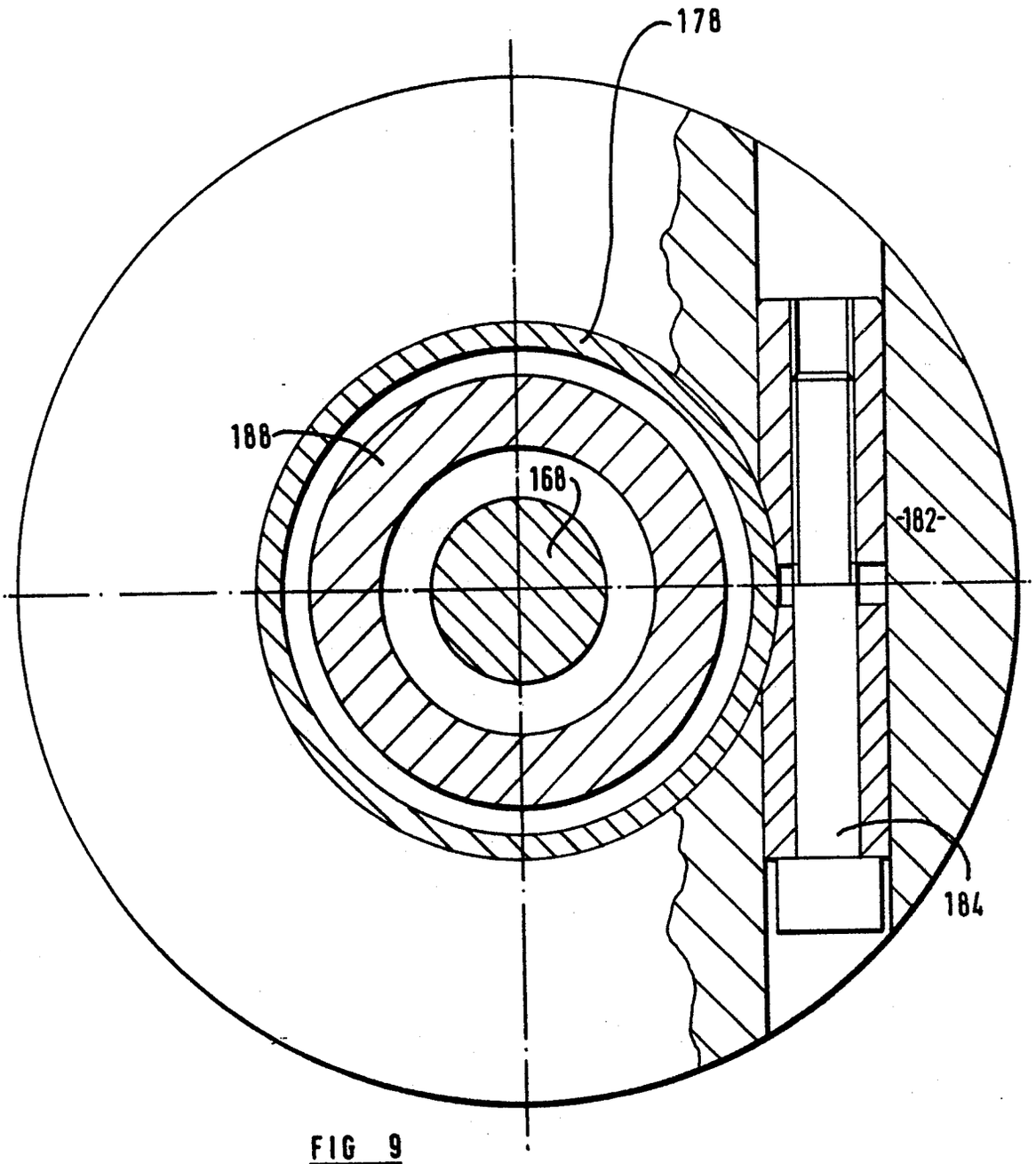


FIG 9

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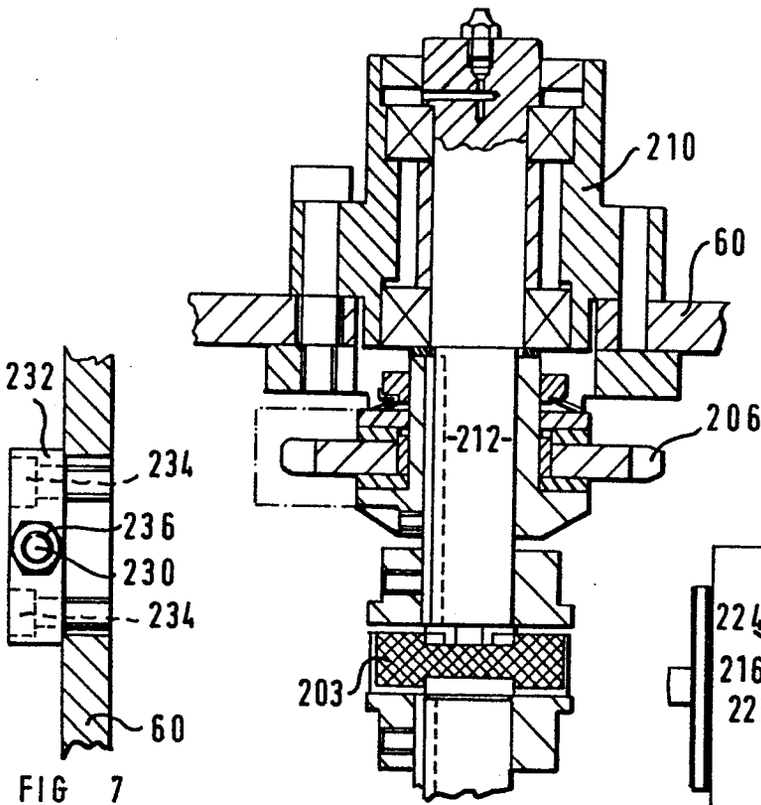


FIG 7

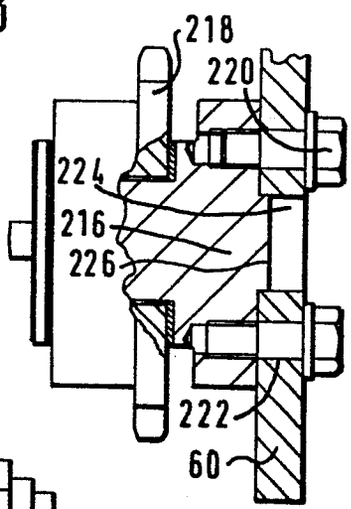


FIG 8

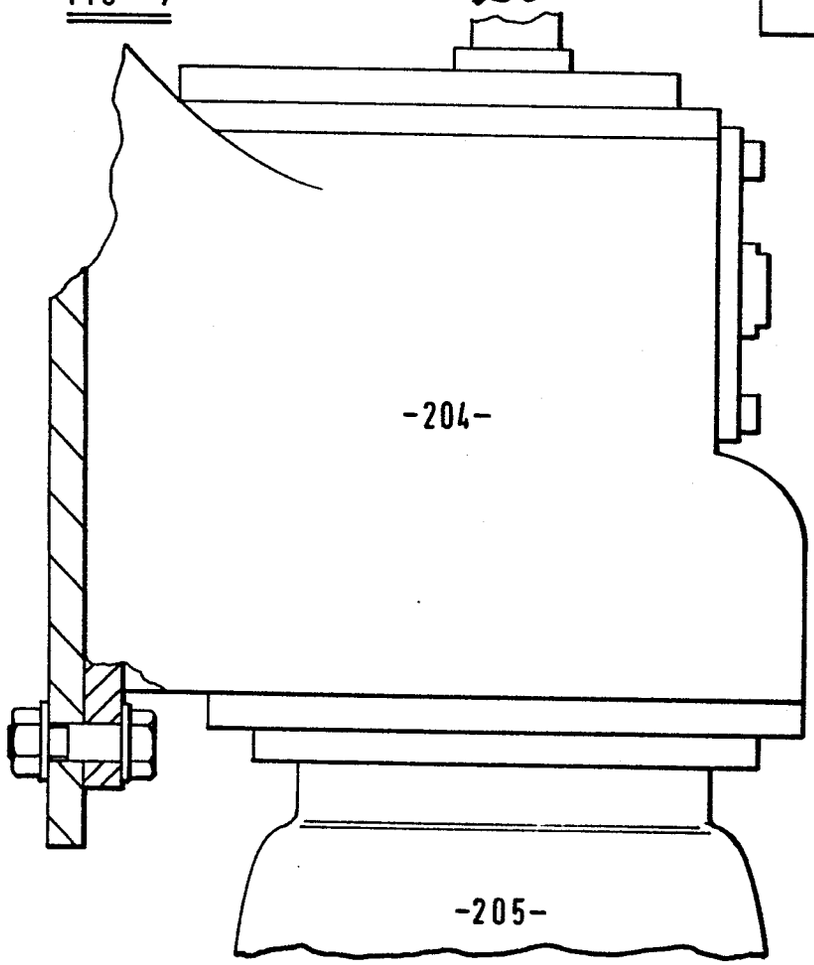


FIG 10

European Patent Office

EUROPEAN SEARCH REPORT

0131408
Application number

EP 84 30 4295

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	FR-A-2 172 696 (LOCTITE) * page 2, lines 22-33 *	1,2	B 05 D 1/26 B 05 C 5/02 B 05 C 13/02
A	EP-A-0 076 021 (LOCTITE) * page 2, lines 11-32; page 5, lines 20-29; page 9, line 1 - page 10, line 17 *	1-3,9, 10,16	
A	FR-A-2 323 456 (OMNITECHNIC GmbH) * page 16, lines 7-22 *	1,2	
A	GB-A-2 019 252 (THE OAKLAND CORP.) * page 2, lines 56-83 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

B 05 D
B 05 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-09-1984	FRIDEN N.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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