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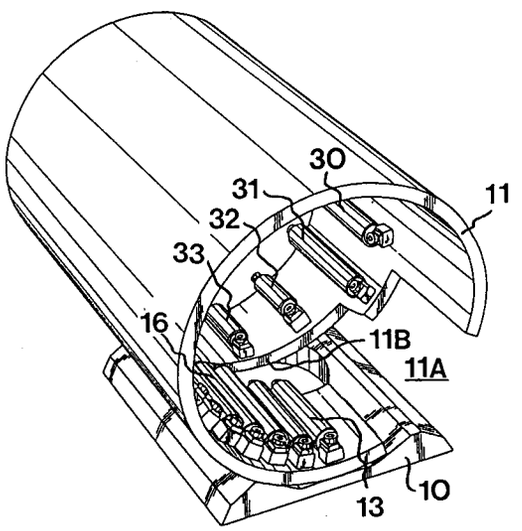
(54) Forming head for the production of helically wound tubing.

(57) A forming head for incorporation in a machine for the production of helically wound lock-seam tubing comprises a cylindrical outer shell (11) having mounted therein an array anti-friction dyed rollers (13-40) arranged to guide a metal strip along a helically path within the shell (11) during clinching together of mating flanges of the metal strip to form the lock-seam tubing.

FIG. 4



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This invention concerns a forming head for use in the production of helically wound tubing, and more especially to an improved forming head for incorporation in a machine of the kind used for the production of helically wound lock-seam tubing. The invention also provides a tube forming machine incorporating such a forming head.

A known forming head of this kind comprises a generally cylindrical shell adapted to receive and guide a flanged metal strip fed thereto, in such a manner that the strip is constrained to follow a helical path whereby mating margins of the strip are brought into engagement with one another for seaming together by clinching rollers associated with the forming head and engaging the mating margins of the strip.

Such a forming head, in use, forms part of a complete machine for the manufacture of helically wound lock-seam tubing, such a machine being illustrated diagrammatically in Fig.1, wherein the reference numeral 1 illustrates a strip of flat sheet metal fed from a coil, not shown, the reference numeral 2 illustrates pairs of cooperating forming rollers that serve to form flanges on the opposite margins of the strip 1, and the reference numerals 3 indicate drive rollers that serve to draw the strip 1 through the forming rollers 2 and to advance the flanged strip through the forming head, which is illustrated diagrammatically at 4.

The longitudinal axis of the strip 1 is at an oblique angle to the central axis of the forming head 4, and thus as the strip 1 is advanced by the rollers 3 it is guided by the forming head 4 into a helically wound form, finished tubing issuing from the forming head 4 in the direction of the arrow A, as shown in broken lines.

Such machines are very well known in the art and will not be described in greater detail. Suffice it to say that the forming head 4 is associated with internal and external clinching rollers that engage mating flanges of the strip 1 to form the lock-seam and the strip 1 is guided from the rollers 3 to the forming head 4 by means of upper and lower guide plates 5 that support the strip against buckling.

Machines of the general type illustrated in Fig.1 have been used for many years in the production of helically wound lock-seam tubing for use, for example, in ducting for ventilation and central heating systems.

In such a machine the metal strip makes sliding engagement with the guide plates 5 and the internal surface of the forming head 4, and in view of the relatively high surface friction that occurs between the metal strip and the working surfaces of the machine, it is necessary for a continuous supply of lubricating oil to be fed between the sliding surfaces. This has a disadvantage not only that the machine must be provided with an oil recirculation system, but that undesirable deposits of oil accumulate in the vicinity of the machine and also that there is residual oil that becomes trapped within the lock-seam of the tubing.

Although the requirement for the use of lubricating oil in such a machine has hitherto proved acceptable, it has recently become apparent that contamination of the ducting by lubricating oil should be avoided. This is particularly the case where the ducting is to be used for ventilation and central heating systems and such contamination is unacceptable for health and safety reasons.

There has also been proposed, see for example GB-A-1168179, an apparatus for making helically seamed tubing wherein the metal strip is constrained by rollers rather than by a forming head.

Such machines have technical disadvantages, however, and have not proved successful in practice.

It is accordingly an object of the invention to provide a means whereby friction on a metal strip can be reduced in a forming head of the kind initially referred to above, whereby the requirement for the use of lubricating oil on the surface of the metal strip can be eliminated.

In accordance with the invention, the above-mentioned object is achieved in a forming head of the kind initially referred to, by the characterising features of Claim 1.

Further preferred features and advantages of the invention will become apparent from the subordinate claims taken in conjunction with the following description and the accompanying drawings, in which:

Figure 1 is a diagrammatic perspective view of a known apparatus for the manufacture of helically wound lock-seam tubing;

Figure 2 is a sectional side elevation, partly in diagrammatic form, showing a forming head in accordance with the present invention;

Figure 3 is a diagrammatic plan view corresponding to Fig. 2, with the upper half of the forming head removed to show the arrangement of rollers within the forming head;

Figure 4 is perspective view of the forming head of Figs. 2 and 3 taken in the direction of the arrow X in Fig. 3;

Figure 5 is perspective view of the forming head of Figs. 2 and 3 taken in the direction of the arrow Y in Fig. 3;

Figure 6 is an enlarged cross-sectional view illustrating the construction and mounting of an individual roller of the forming head of Figs. 2 and 3, and

Figure 7 is a view similar to Fig. 6 showing a modified arrangement.

Referring to Figs. 2-6 of the drawings, there is shown a forming head that can be used as a direct replacement for the forming head 4 of a known machine of the kind already described above with reference to Fig. 1.

The forming head comprises a base 10 adapted to be secured to the frame of the machine, to which is secured a cylindrical shell 11 formed from a heavy gauge section of steel tube.

Around the internal periphery of the tube 11 are mounted a series of twenty eight guide rollers that define a guide path extending through a helix angle of 570°. Since Fig. 2 shows an arc of only 360°, the angular positions of the rollers are indicated by numbering the rollers consecutively in a clock-wise direction with the rollers that are visible directly in Fig. 2 being numbered 13-32, and the remaining rollers being numbered 33-40. Where any one of the rollers 33-40 is not directly visible in the drawings, its relative position, or that of its axis, is indicated by reference numerals with broken leading lines.

As shown in Fig. 6, each of the rollers supported within the shell 11 comprises an outer sleeve 50 that is rotatably supported on a shaft 51 by means of needle roller bearings 52 which are lubricated and sealed by shaft seals 53. Ends 51A of the shaft 51 are machined flat and bored to receive machine screws 54 which engage in the outer shell 11 to clamp the shaft 51 in place against spacing tubes 55 that are radiused to match the curvature of the internal surface of the shell 11. Spacing washers 56 can, if desired, be interposed between the spacers 55 and the shaft 51 to enable adjustment of the positions of the shaft 51 in order to vary the effective internal diameter of the roller guide path in accordance with, for example, the thickness of metal strip to be fed to the forming head. These mountings are shown diagrammatically in Fig. 2 for the roller 13 but are otherwise omitted for clarity.

The shell 11 has a generally L-shaped cut out with limbs 11A,11B. A metal strip can be fed along an oblique axis indicated at 60 to pass through the portion 11A of the slot. The rollers 13-40 can support the metal strip as it moves through a helical path which is indicated diagrammatically by the sinusoidal lines 61 and 62 in Fig. 3,and the circumference of which is indicated by the broken line 63 in Fig. 2. The broken line 64 indicates a cylindrical plane within which all of the rotary axes of the rollers 13-40 are located. The rollers 13 to 26 are located immediately adjacent one another and have a diameter such that the axes of adjacent rollers subtend an angle of less than 12° to the central axis of the shell 11, whereas the axes of the remaining rollers are more widely spaced such that adjacent axes subtend angles of 30° to the central axis.

The general arrangement of the rollers 13-40 can be seen from Figs. 4 and 5, and by comparison with Figs. 2 and 3 in which the roller mountings are indicated only diagrammatically. It will be noted that the lower-most rollers 13, 14, 15 and 16 on the on hand and 32, 33 and 34 on the other hand are axially shortened to terminate at the edges of the portion 11B of the aforementioned cut out in the shell 11. This portion 11B is intended to receive a lower clinching roller of the associated machine, not shown. The rollers 32, 33 and 34 are also axially shortened so that their right hand ends as viewed in Fig.3 terminate flush with an axial cut out 11C that is provided to enable a tube cutting attachment to gain access the internal and external surfaces of the formed tube as in known machines. Only the lower portion of the cut out 11C is visible in Fig. 3, its upper edge terminates above the plane of the drawing.

In operation of the forming head described above, metal strip is advanced along the axis 60, and is forced to follow the curvature of the closely spaced rollers 13-26 so that an initial bend is formed in the strip about an arc of the circumference 63. The arcuate strip subsequently passes over the more widely spaced rollers 27-32 to return between clinching rollers located between the respective sets of rollers 13-16 and 32-34. The clinching rollers are engaged with one another to compress and seam mating flanged edges of the strip, in well known manner that will not be further described.

The margins of the metal strip entering the forming head along the central axis 60 are indicated diagrammatically at 65 and 66, and the flanges on the metal strip lie outside the helical area of support indicated by the lines 61 and 62, so that the mating flanges and the formed lock-seam of the finished tubing pass between the ends of axially adjacent rollers. Thus there is no requirement for additional guide means in the forming head to receive the flanges or the lock-seam, as in conventional forming heads such as shown in Fig. 1. Neither is it necessary for the rollers themselves to be specially machined or shaped to provide clearance for the flanges and the lock-seam, as in other known arrangements.

It will be seen that a forming head in accordance with the invention provides a novel arrangement wherein accurate and rigid guidance is' provided over the helical path of a metal strip whilst enabling friction to be reduced to the extent that lubrication of the forming head is no longer required.

Fig. 7 shows a modified arrangement of guide roller wherein the single supporting shaft 51 is replaced by stub shafts 51' engaging in bearings

52' within axial recesses at the end of each roller 50. This arrangement enables standard stub shafts 51' to be used for all rollers, thus reducing manufacturing costs. The remaining components are as already described with reference to Fig. 4 and are indicated with the same reference numerals.

It will be appreciated that the present invention is not concerned with features of the associated tube forming machine which will follow the general construction of the known machine as shown in Fig. 1. In order to enable the machine also to operate without the oil lubrication referred to above modification of the known machine may be appropriate in any manner that will occur to one skilled in the art, for example by the replacement of the existing guide plates 5 of Fig. 1 with trains of advancing rollers.

Claims

1. A forming head for use in the production of helically wound lock-seam tubing, comprising a generally cylindrical shell adapted to receive and guide a flanged metal strip fed thereto, in such a manner that the strip is constrained to follow a helical path whereby mating margins of the strip are brought into engagement with one another for seaming together by clinching rollers associated with the forming head and engaging the mating margins of the strip, characterised in that the said generally cylindrical shell supports from its internal surface an array of guide rollers that are relatively laterally displaced in a direction parallel to the central axis of the said shell in order to follow the helical path of the metal strip, each guide roller being contained within the lateral boundaries of the path of the said strip and the surfaces of the rollers collectively providing the constraint required to maintain the helical form of the metal strip.

2. A forming head as claimed in claim 1, characterised in that each roller is mounted with its rotary axis parallel to the central axis of the cylindrical shell.

3. A forming head as claimed in Claim 1 or 2, characterised in that a plurality of adjacent rollers of said array are each arranged so that in use they extend over the major part of the transverse dimension of the said strip.

4. A forming head as claimed in any one of Claims 1-3, characterised in that rollers in the region of the entry to the forming head are arranged more closely adjacent to one another than following rollers on the path of the said strip.

5. A forming head as claimed in any one of Claims 1-4, characterised in that each of said guide rollers is supported upon a fixed shaft the ends of which are secured via mounting pillars directly to the cylindrical shell.

6. A forming head as claimed in Claim 5, characterised in that said mounting pillars comprise tubular spacers receiving fastening screws passing through the ends of said shaft and screw threaded in bores formed in said shell.

7. A forming head as claimed in Claim 6, characterised in that adjusting shim washers are located between said shaft and each of said pillars.

8. A machine for the formation of helically wound lock-seam tubing, characterised in that it comprises a forming head as claimed in any one of Claims 1-7.

9. A machine as claimed in Claim 8, further comprising drive means for drawing a metal strip from a supply reel and advancing it to said forming head along an axis oblique to the central axis of the cylindrical shell, whereby the strip is constrained to follow a helical path defined by the rollers of the forming head, means associated with said drive means for forming mating flanges at the margins of said strip, and clinching rollers associated with said forming head for clinching together said mating flanges to form a lock-seam.

10. A machine as claimed in Claim 8 or 9, characterised in that an outer one of said clinching rollers is arranged to extend through an aperture in said cylindrical shell between axially adjacent ends of guide rollers respectively located on adjacent helical turns of said guide path.

11. A machine as claimed in any one of Claims 8-10, characterised in that trains of guide rollers are provided for advancing said metal strip from said drive means to said forming head.

FIG.I

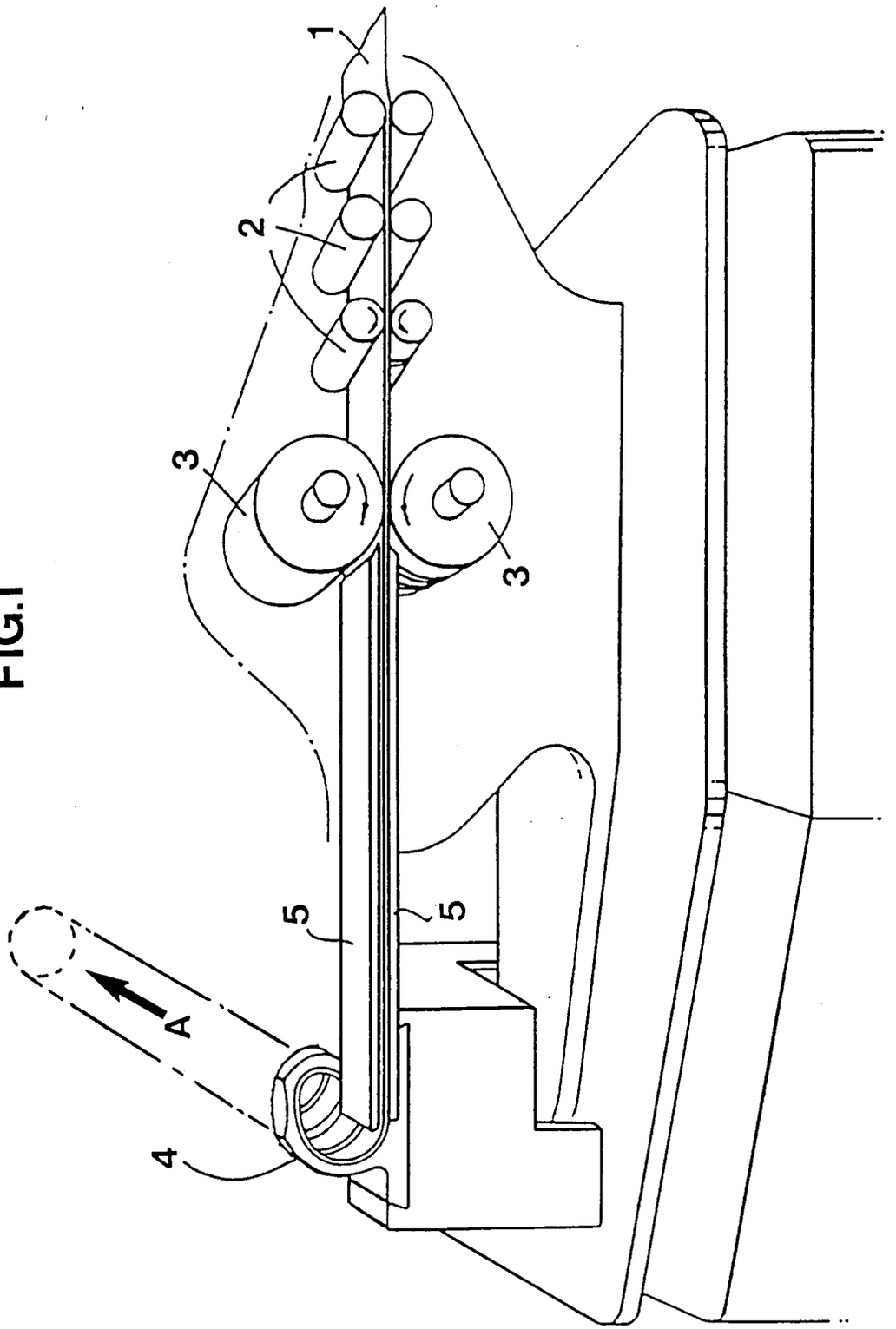

FIG.2

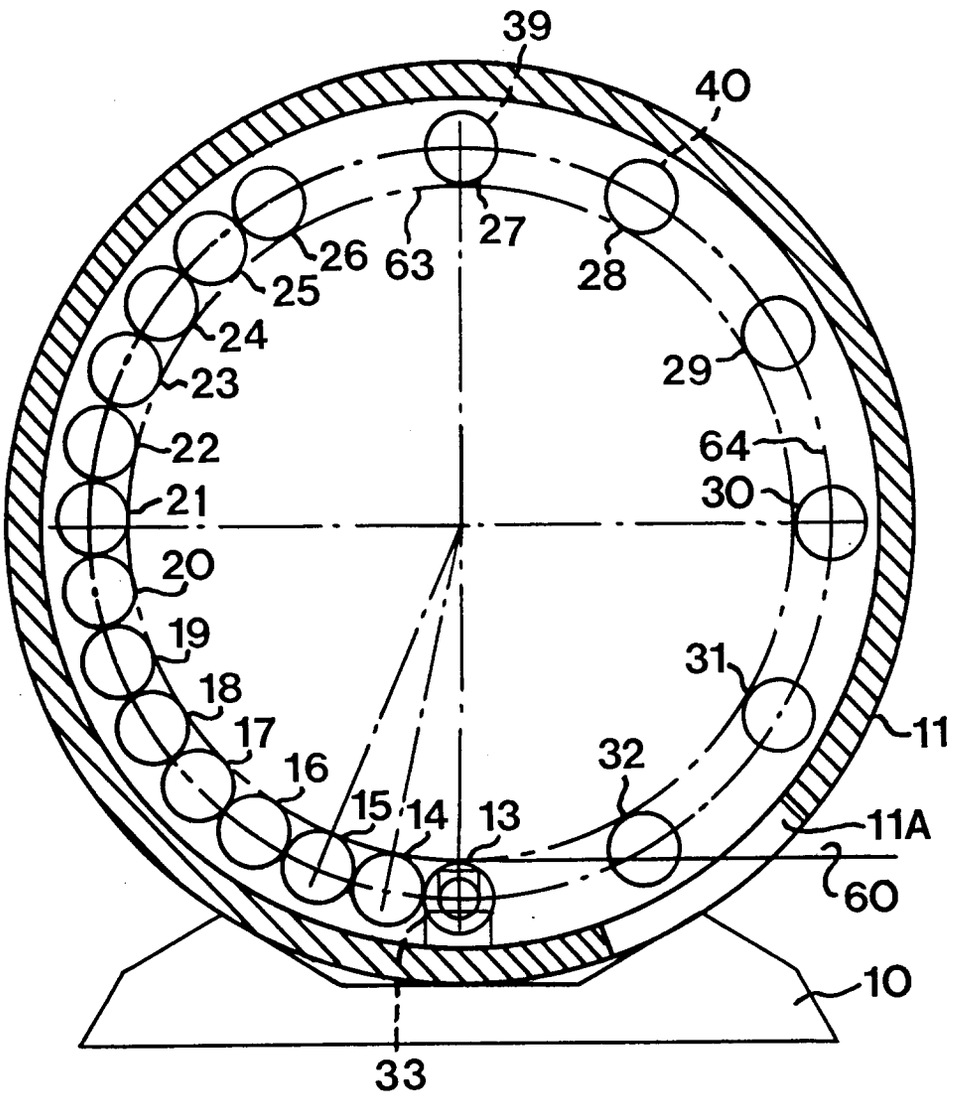
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FIG.3

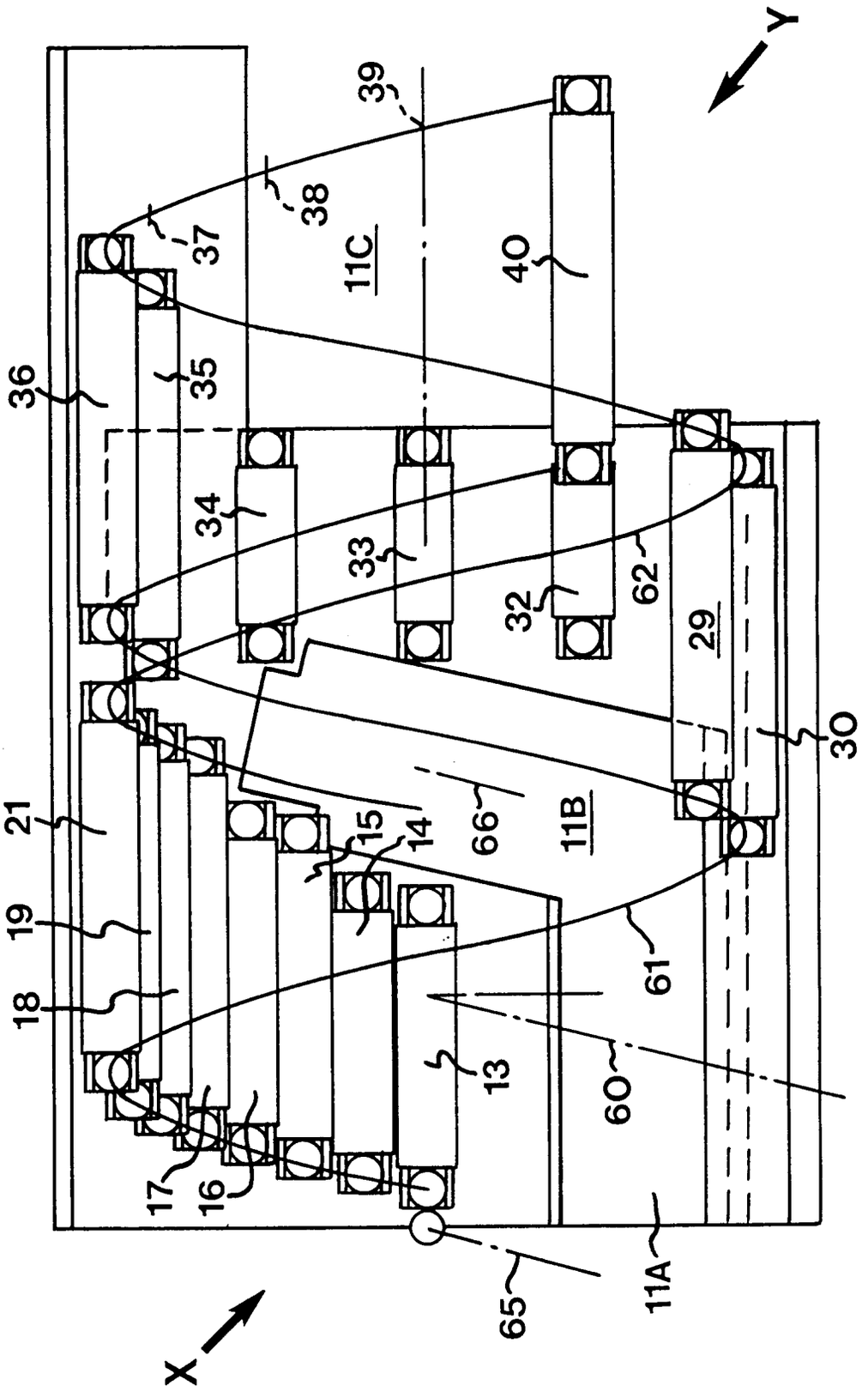
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FIG. 4

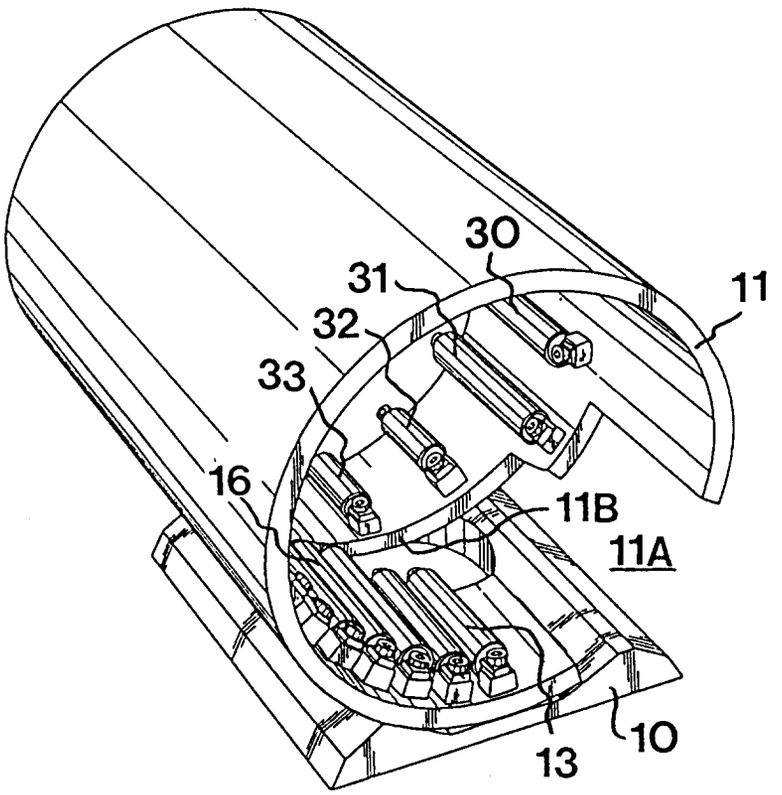


FIG. 5

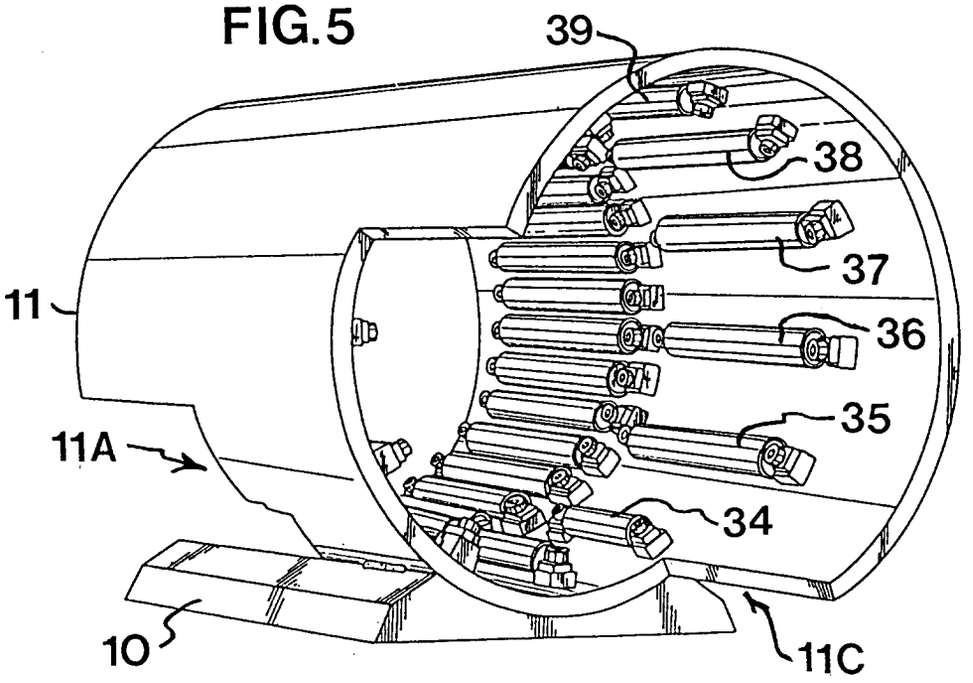


FIG.6

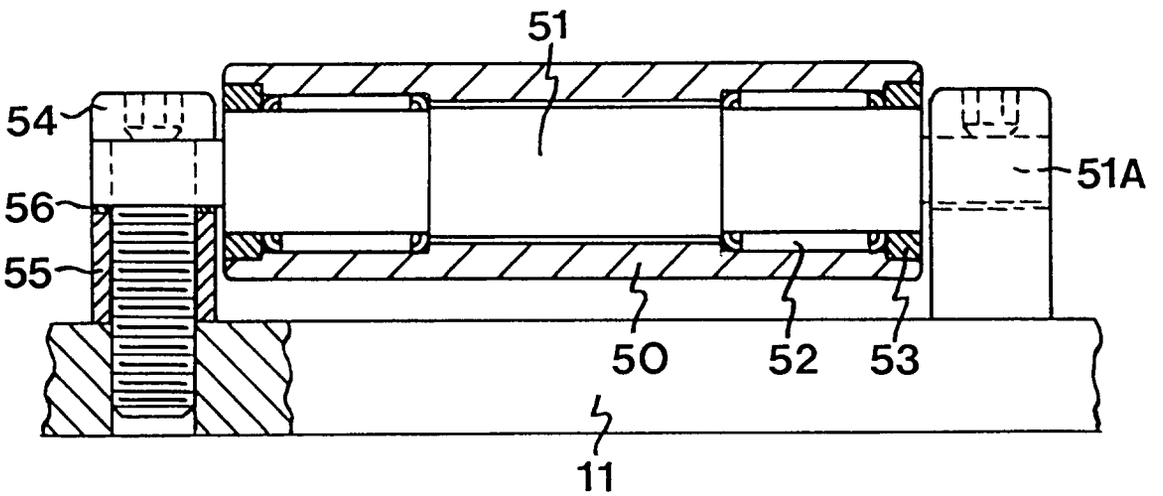
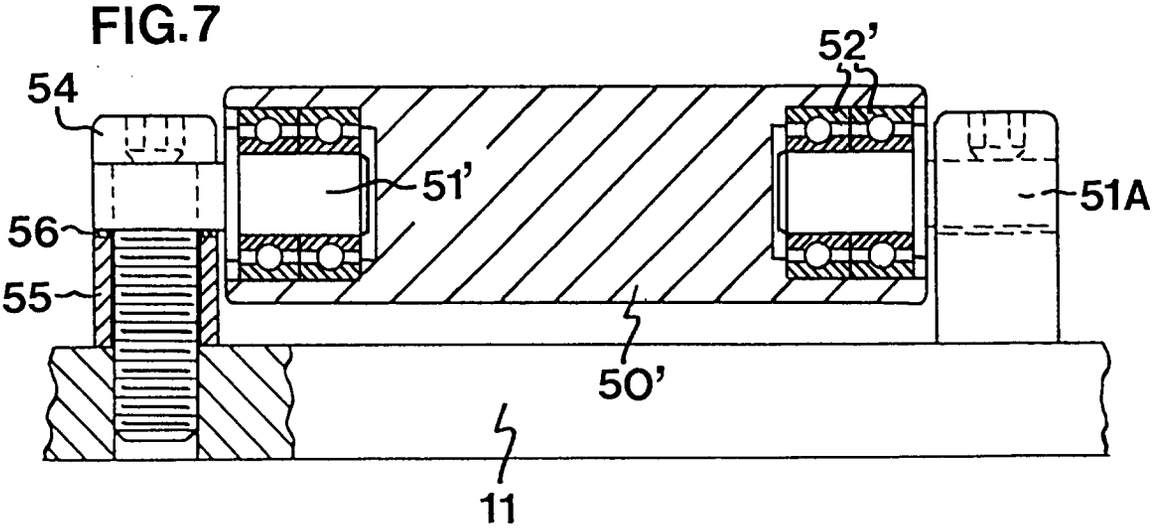


FIG.7



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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 2644

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.6)
X	AT-B-208 682 (DE WENDEL & CIE.) * the whole document *	1-3,5,6,8,10	B21C37/12
X	DE-C-972 771 (PHOENIX - RHEINROHR AKTIENGESELLSCHAFT) * the whole document *	1-3,8	
X	WO-A-83 04196 (RIB LOC HONG KONG LIMITED) * claims 1-16; figures 1,4 *	1-3,5,7,8	
X	EP-A-0 222 285 (FRITZ HAHN KG) * column 3, line 32 - line 50; figure 1 *	1-4,8-11	
A,D	GB-A-1 168 179 (EINO KALERVO MALKKI ET AL.) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B21C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	7 September 1994	Cuny, J-M

CATEGORY OF CITED DOCUMENTS

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