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(71) Applicant: **Bridges, Geoffrey**
16 Hillcrest, Tawd Bridge
Slemersdale, Lancashire WN8 9JZ(GB)

(72) Inventor: **Bridges, Geoffrey**
16 Hillcrest, Tawd Bridge
Slemersdale, Lancashire WN8 9JZ(GB)

(74) Representative: **Lyons, Andrew John et al**
ROYSTONS 531 Tower Building Water Street
Liverpool L3 1BA(GB)

(54) **Improvements in and relating to machines for forming rolls of plastics material.**

(57) A plastics sheet roll forming machine (10) comprises a supporting framework (12) for a shaft 14 rotatable mounted in bearings at each end. At one end of the shaft a hydraulic motor (16) rotates the shaft and hence a beam (18) thereon to bring on of two rotatable mandrels (20) into position to receive plastics sheet from a sheet forming machine to form a roll thereof on the mandrel. The mandrels are collapsible so that a completed roll can be removed therefrom. The machine is powered hydraulically.

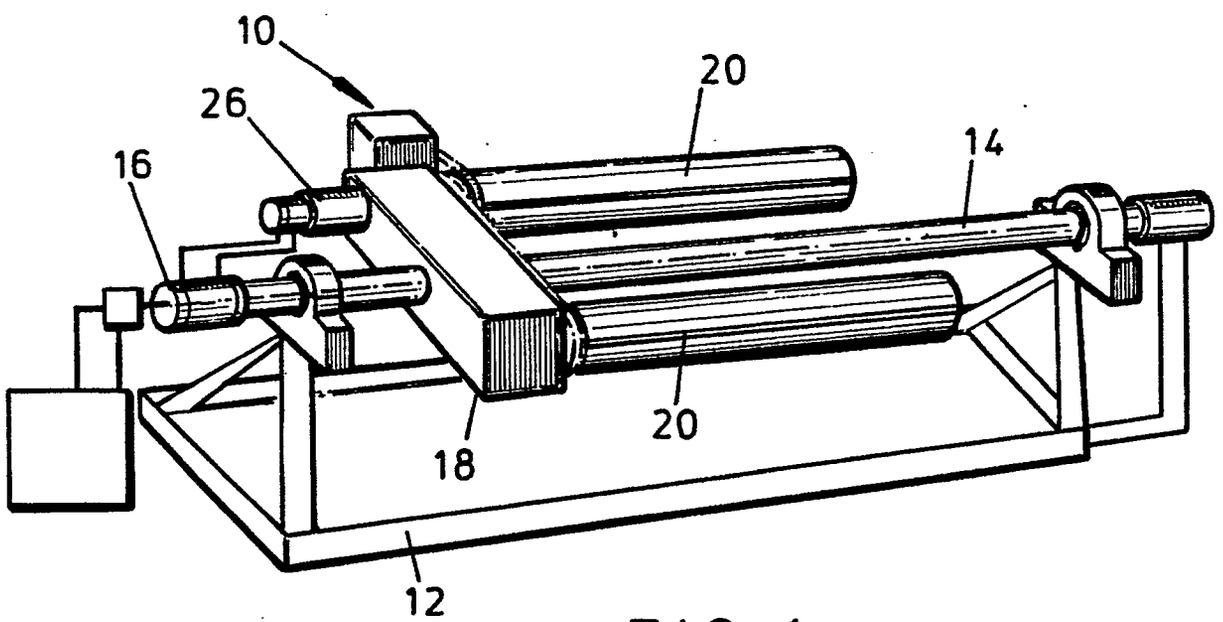

FIG. 1

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IMPROVEMENTS IN AND RELATING TO MACHINES FOR FORMING ROLLS OF PLASTICS MATERIAL

This invention concerns improvements in and relating to machines for forming rolls of plastics material.

Plastics material in sheet form is often required to be formed into rolls for transportation and storage. At present rolls of plastics sheet are formed on a hollow core or tube that is rotated to form the roll. At capacity, the machine has to be stopped for the plastics sheet material to be cut and the formed roll moved to be replaced by another hollow core or tube support. Thus, valuable production time is lost and expense incurred.

An object of this invention is to provide an improved plastics sheet roll forming machine.

According to this invention there is provided a plastics sheet roll forming machine comprising a first rotatable part having locations for at least two rotatable plastics sheet roll supports, such as mandrels or core supports.

The rotatable mandrels are preferably expandable and contractable between a first position for forming a plastics sheet material roll thereon and a second position for removing a completed roll from the mandrel. Expansion and contraction of the mandrel may be achieved in any suitable way but in one preferred embodiment the mandrel may be formed by loosely connected elongated leaves around a central shaft, the leaves and the shaft having cooperating parts, whereby movement of the shaft within the mandrel, which movement may be longitudinally or rotary, in one direction urges the mandrel leaves apart and in the other direction allows the mandrel to collapse. Preferable said cooperating parts are tapered members and said shaft movement is longitudinally of the mandrel.

The first rotatable part is preferably a beam mounted on a rotatable shaft preferable supported at opposite ends in bearings and is preferable rotatable through 360 degrees.

For the use with cores rather that mandrels, the machine of the invention will preferably have rotatable formations on the first rotatable part, such as cones, to fit into a core end and a retractable part at the opposite end of the machine also having formations, such as cones, to fit into a core end.

The machine of the invention is preferably operated hydraulically and it is particularly desirable that a single power source feed all of the functions of the machine. The preferred power source is an hydraulic power source ideally situated at one end of the machine and having hydraulic feeds for the variations functions of the machine via suitable valves. The hydraulic power source preferably comprises a variable speed pressure compensated pump driven by an electric motor. Such a pump is preferred in order to give variable speeds and variable torque at various hydraulic motors in order to compensate for different plastics materials, sheet thickness and most particularly roll diameter which, is of course, increases as the roll if formed.

The hydraulic pump will preferably feed hydraulic fluid via a valve to a hydraulic motor situated for rotation of said first rotatable part and with a valved feed to said second rotatable part, if present. Rotation of said first rotatable part is for changeover from one mandrel or core to the second mandrel or core when a roll is completed.

Hydraulic fluid feed will also go to hydraulic motors for rotation of the mandrels or cores selectively, ie. to one or other of the mandrels or cores. The mandrels or cores are rotated to draw plastics sheet material from sheet material forming apparatus in a continuous fashion. It is important that as a roll of plastics material is completed, the second mandrel or core can be brought into operation as quickly as possible so as not to disrupt continuous formation of the sheet material by the sheet forming apparatus.

When a core is being used for forming a roll, additional hydraulic fluid feed may be required for a hydraulic cylinder for withdrawal of the core end supporting formation from one end thereof to release the core for removal from the machine and, of course, for pushing said core end supporting formation into the core end for roll formation on the core. The hydraulic cylinder is preferably at the end of the machine remote from the first rotatable part.

Further hydraulic fluid feed may be required for expansion and contraction of the mandrels via suitable hydraulic motors or cylinders depending on the shaft movement required.

All of the various hydraulic functions of the preferred machines of the invention will be valved for selection of an appropriate functions. Preferably controls for such valves will be at one location to enable easy and quick operation of the machine.

The invention will now be further described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic diagram of a plastics sheet roll forming machine with mandrels;

Figure 2 is a schematic diagram of a plastics sheet roll forming machine fitted for use with cores;

Figure 3 is a schematic longitudinal section through a mandrel;

Figure 4 is a schematic front end view of the mandrel of Figure 3;

Figure 5 is a schematic diagram of an hydraulic

system for a plastics sheet roll forming machine.

Figure 6 shows an alternative form of plastics sheet roll forming machine; and

Figure 7 shows an alternative hydraulic system for a plastics sheet roll forming machine.

Referring to Figure 1 of the accompanying drawings, a machine 10 for forming rolls of plastics sheet material comprises a supporting framework 12 for a shaft 14 rotatably mounted in bearings at each end. At one end the shaft 14 has a hydraulic motor 16 for rotating the shaft 14 and hence beam 18 mounted on the shaft. The beam 18 has either mandrels 20 rotatably mounted therefrom or support core cones 22 (see Figure 2). The mandrels 20 are rotated by means of hydraulic motors 26.

The mandrels 20 (Figures 3 and 4) are able to expand and contract being formed of leaves 30 loosely held together, which leaves have on their inner surface tapered formations 32 that cooperate with oppositely tapered formations 34 on shaft 36 through the centre of each mandrel. The shafts 36 are each coupled to a hydraulic cylinder 38 whereby longitudinal movement of the shaft 36 in one direction urges the leaves 30 apart and in the other direction allows the leaves to collapse toward each other.

Turning to Figure 2 of the accompanying drawings, instead of mandrels cone formations 22 are provided at opposite ends of the machine, which are to fit into opposite end of a roll core 40. The cone formation 22A is coupled to the hydraulic motor 26 for rotating the cone 22A and hence the core 40, whereas the cone formation 22B is coupled to an hydraulic cylinder 46 for movement into and out of engagement with roll core 40.

Finally in Figure 5 of the accompanying drawings shows an hydraulic system for operating a machine as shown in any of or all of the drawings. The hydraulic system comprises an electric motor 50 for driving a pressure compensated variable volume pump 52 to give variable speeds and variable torque at the hydraulic motors depending on the product being rolled and roll diameter.

The hydraulic pump 52 supplies hydraulic fluid via main feed line 54 and branch line 56 to rotary motor 16 for rotating the shaft 18. The branch line 56 includes valve means 58 for controlling supply of hydraulic fluid to the motor 16.

Beyond branch line 56, the main feed line 54 enters a rotary valve 60 which direct hydraulic fluid supply to one or other sides of the machine. The hydraulic system for each side of the machine is identical and includes off a feed line 62, valve means 64 and rotary motor 26 for rotating the mandrels 20 or roll support core cones 22A, off a feed line 70 via a valve 72 hydraulic cylinder 38 for expansion and contraction of the mandrels 20 and finally off a feed line 80 via valve means 82, hydraulic cylinder 42 for withdrawal from or insertion into a core 40 core support cone 22B.

The illustrated machine operates by picking up the end of a sheet of plastics material from a sheet forming machine onto a rotating mandrel or core and forming a roll thereof on the mandrel or core. When the mandrel or core is full, the machine then rotates on its central axis to bring the vacant mandrel or core into a working position. The sheet material is cut and the sheet material wound onto the vacant mandrel or core to give continuous production. Whilst the second roll is forming, the first roll is unloaded, which from a mandrel requires contraction thereof so that the roll can be slid off the mandrel and for a core requires withdrawal of cone 22B. During the rotating procedure the machine remains under constant torque required to wind the product.

Referring now to Figure 6 of the accompanying drawings, a machine 200 for forming rolls of plastics sheet material as it comes off a production sheet comprises a frame 202 on wheels 204. The frame 202 has upstanding ends 206 that support in bearings 208 a rotatable shaft 210. Near one end the shaft 210 carries a fixed crosspiece 212 from which extend parallel to the shaft a pair of rotatable mandrels 214 diametrically opposed relative to the shaft. Adjacent the free ends of the mandrels on the shaft 210 are retractable support arms 216.

Each mandrel 214 comprises an expansion shaft 218 and outer leaves 220 that are movable towards and away from the core by means of expansion pins 222 that are tapered and which contact oppositely tapered members on the leaves, whereby longitudinal movement thereof relative to the core will cause the leaves to move towards and away from the core as desired.

The machine 200 is operated hydraulically and the frame carries at one end an hydraulic fluid tank 224 and an electric motor 226. Hydraulic fluid under pressure is supplied to the main shaft and each of the mandrels via hydraulic piping as shown (see also Figure 7 below). The main shaft requires hydraulic power for motor 228 for rotation thereof via sprockets 229 to swop mandrels when a completed roll has been formed on the one mandrel. The swap over has to be quick so that the plastics sheet production machine can be operated continuously. The main shaft also requires hydraulic power for the retractable support arms 216 which are operated by means of double acting rams 230. The end of each mandrel has a bearing 232 which fits into the end of the support arm to support the mandrel and to allow it to rotate as a roll of plastics material is formed thereon.

Hydraulic fluid is also used to operate a disc brake 234 at one end of the main shaft.

The mandrels require hydraulic power for their

respective motors 250 for rotating same and for their respective double acting cylinders 252 for causing longitudinal movement of the expansion shaft 218 to expand or collapse the mandrel.

In Figure 7 of the accompanying drawings which shows on alternative hydraulic system for apparatus of the invention particularly the machine of Figure 6 an electric motor 100 for driving a pressure compensated variable volume pump 102 gives variable speed and variable torque at hydraulic motors of the system depending on the product being rolled and roll diameter.

The pump 102 supplies hydraulic fluid under pressure to valves 104, 106 and 108 for operating each rolling mandrel and the main shaft respectively. A single feed line 110 branches to form separate feed lines 112,114 and 116 to those valves.

The valves 104 and 106 for the mandrels each control supply of hydraulic fluid to a double acting support arm piston 120, a mandrel rotate motor 122 and a double acting mandrel expand/contract piston 124. The valves and the feed/return lines therefrom are arranged so that in one valve state the mandrel, expands the mandrel rotates and the support arm engages the free end of the mandrel, and in its other state, the mandrel stops rotating, the mandrel contracts and the support arm is disengaged. To control the speed of rotation of the mandrel, the return line from the mandrel motor includes a variable flow restrictor valve 130.

The third branch 116 from the pump 102 leads to the valve 108 which directs hydraulic fluid either to a disc brake 136 for the main shaft or a motor 138 for rotating the main shaft. A variable flow restrictor valve 140 is provided beyond the motor 138 in order to control its speed.

With the above described system only three control valves are needed for controlling full operation of a machine for forming rolls of plastics material.

Operation of the machine of Figure 6 and 7 is substantially the same as for the other illustrated embodiments.

Claims

1. A plastics sheet roll forming machine comprising a first rotatable part, having locations for at least two rotatable plastics sheet roll supports.

2. A machine as claimed in claim 1, wherein said supports are rotatable mandrels.

3. A machine as claimed in claim 2, wherein the mandrels are expandable and contractable between a first position for forming a plastics sheet roll thereon and a second position for removing a completed roll therefrom.

4. A machine as claimed in claim 3, wherein a mandrel comprises loosely connected elongated leaves around a central shaft the leaves and shaft having cooperating parts, whereby movement of the shaft within the mandrel in one direction urges the mandrel leaves apart and in the other direction causes the mandrel to collapse.

5. A machine as claimed in claim 4, wherein said shaft moves longitudinally.

6. A machine as claimed in claim 5, wherein said shaft moves rotationally.

7. A machine as claimed in claim 4 or 5, wherein cooperating parts are tapered members.

8. A machine as claimed in any one of claims 2 to 7, further comprising a retractable support for a free mandrel end.

9. A machine as claimed in claim 1, wherein said supports are plastics sheet roll cores and said first rotatable part has rotatable formations to fit said core ends.

10. A machine as claimed in claim 9, wherein said rotatable formations are retractable.

11. A machine as claimed in claim 10, wherein said formations comprise cones.

12. A machine as claimed in any one of claims 1 to 11, wherein the first rotatable part comprises a beam.

13. A machine as claimed in any one of claims 1 to 11, wherein operation thereof is hydraulic.

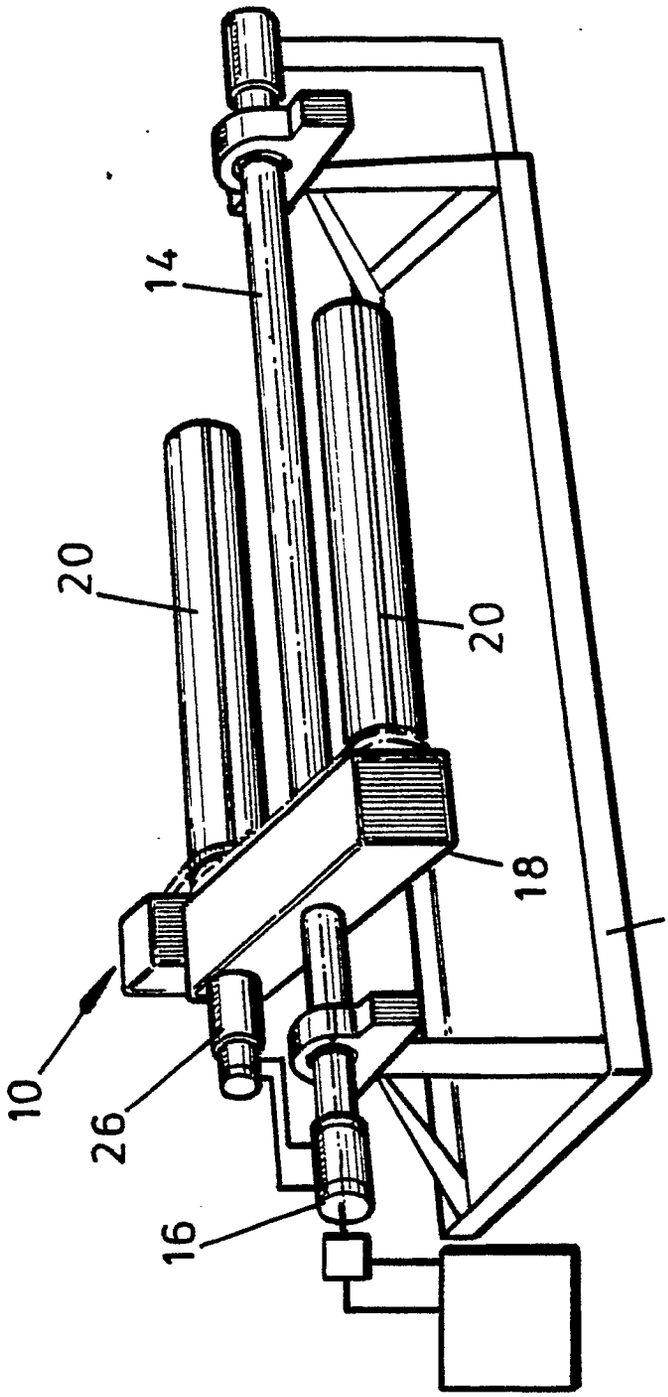

FIG.1

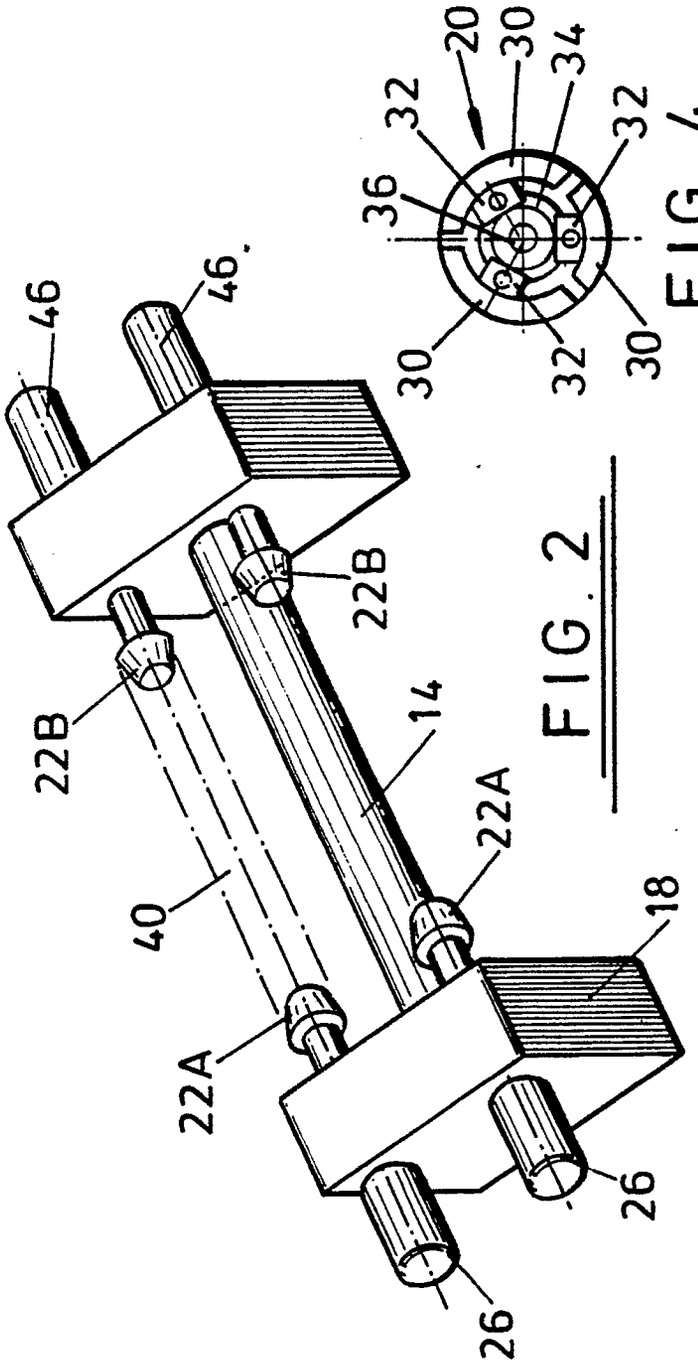

FIG. 2

FIG. 4

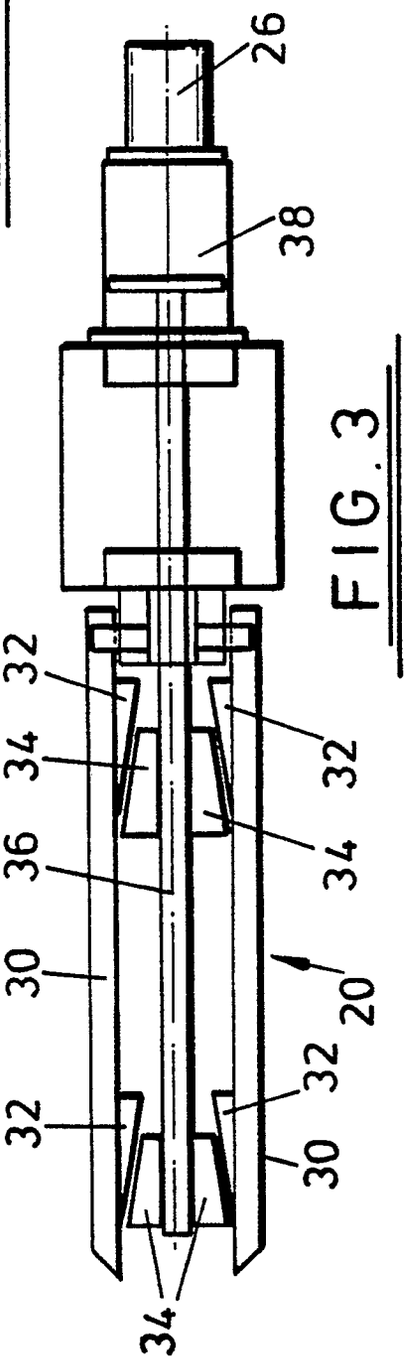

FIG. 3

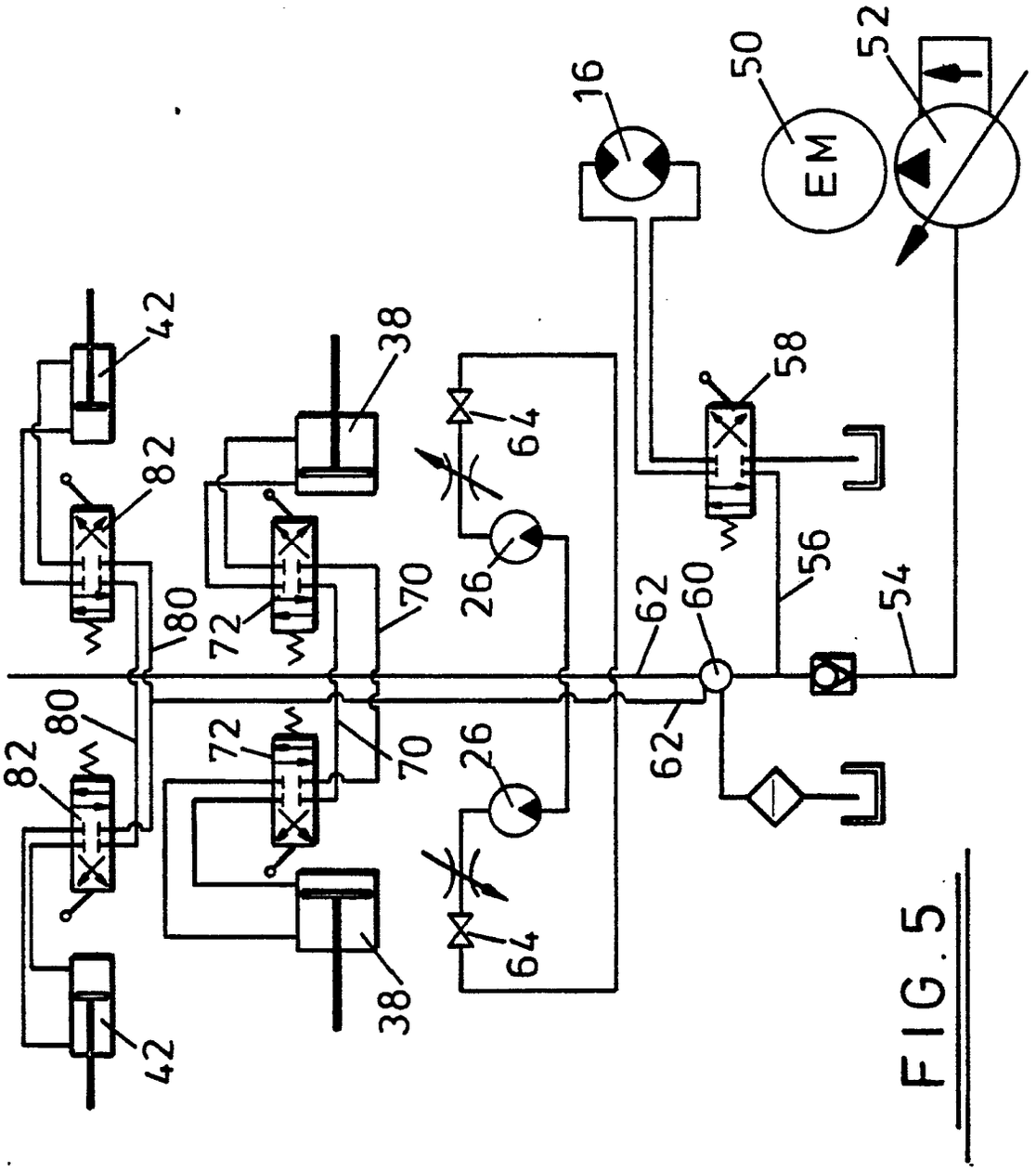

FIG. 5

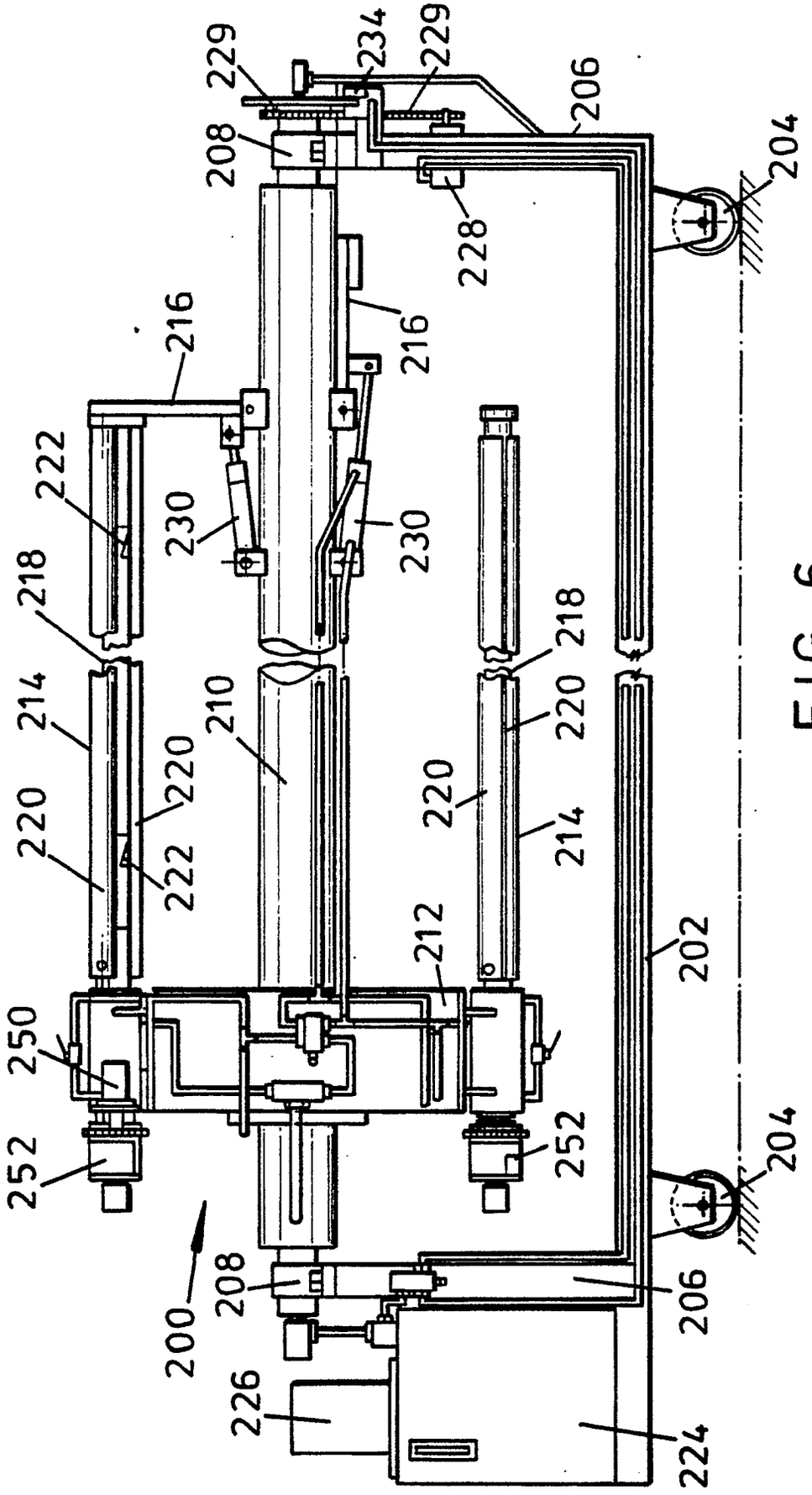
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FIG. 6

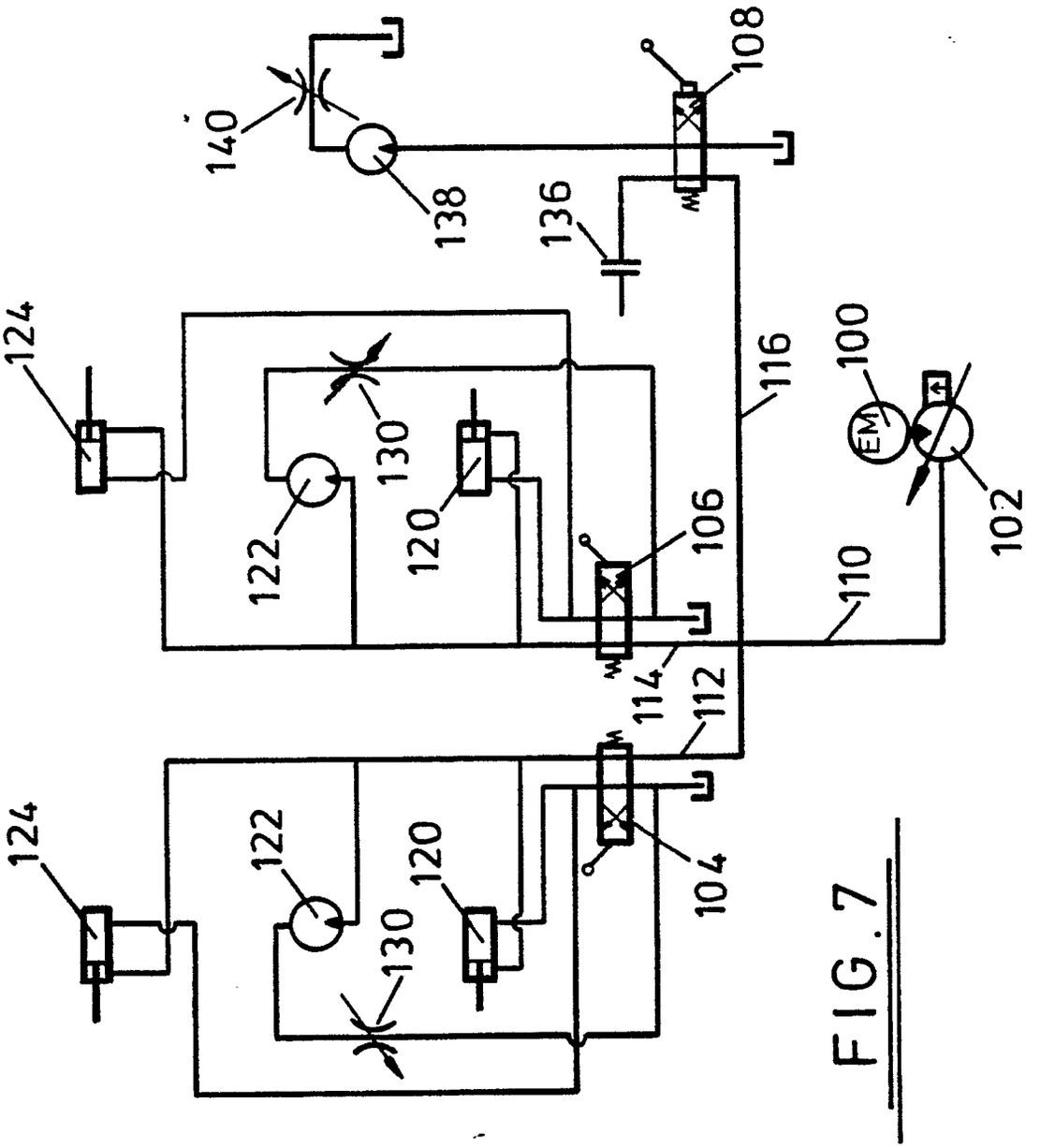
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FIG. 7