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(54) Improvement to rectilinear chamber capping machines.

(57) A rectilinear-chamber capping described in which the jars (28) to be closed are fed, already filled with the packed product, continuously and at high speed, supported on a conveyor belt (12) on which they move forward, gripped laterally by two side retaining devices, to a point under a closing unit (14) which fits the caps, said capping machine being characterised in that a primary motor (18) drives said conveyor belt (12) and said side retaining devices, while a secondary motor (36) drives said closing unit (14) for the application of the caps.

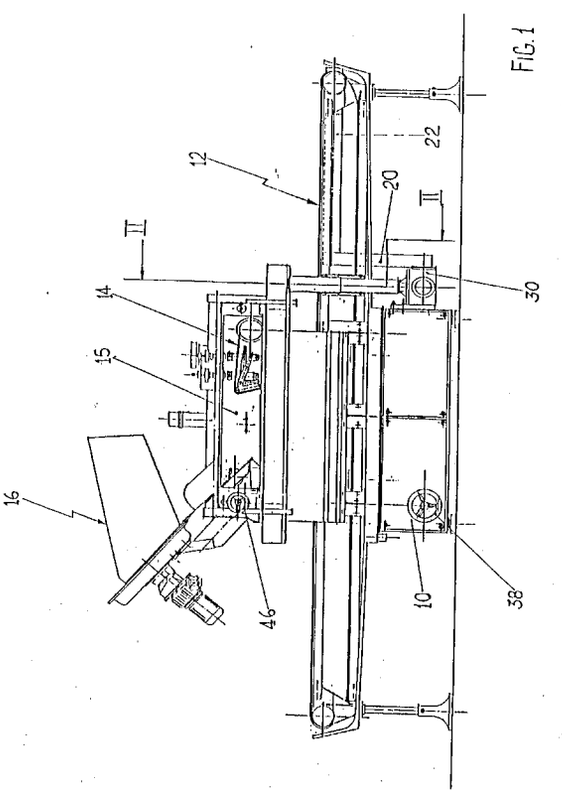

FIG. 1

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The present invention relates to the field of the technology of foodstuff package closure; more particularly it refers to an improvement made to rectilinear-chamber capping machines, in which the containers, jars or cans to be closed are fed, already filled with the packed product, continuously and at high speed to the inlet zone of the capping machine and are there closed by the application, generally under vacuum and usually by screwing, of metal or plastics caps at high speed so as to form the sealed package which will subsequently be put on sale.

In United States Patent 3,274,748, for example, a rectilinear-chamber capping machine is described in which jars to be closed under vacuum are fed in any grouped form on a conveyor belt, on which they move forward gripped laterally by two belts moving parallel to the conveyor belt at a certain distance from the latter, to a point under a closing unit which fits the metal or plastics caps by a screwing action in an atmosphere at a high temperature which, after cooling, produces a negative pressure and therefore effects vacuum closure.

In such machines there are therefore three moving parts which are in close contact with the jar and with the cap: a first group of parts driving the jar comprises the conveyor belt and the side belts which grip the jar laterally, thus bringing about its forward movement, generally at constant speed; a second group of parts situated in the closing or screwing unit or head effects the turning of the cap relative to the jar, on which it has already been positioned, while said jar is moving forward under the screwing head, thus effecting the application of the cap to the jar.

Since the jars to be capped may have, and in fact do have the most diverse shapes and dimensions, depending on the capacity of the jar and aesthetic requirements, the two side belts must be mounted in such a manner as to be able to be set further apart or closer to one another in order to be able to receive jars of various diameters. In addition, said side belts must be mounted so as to be able to be moved away from or brought closer to the conveyor belt by a movement at right angles to that of the adjustment just described, for the purpose of gripping or holding the jars at a suitable height, both in relation to the total height of the jar and in relation to the shape of its side surface, since obviously the action of the side belts will be the more effective, the more the zone of the side surface of the jar touched by the belt approximates to a cylindrical surface and the nearer it is to the mouth of the jar.

The closing unit or head for screwing on the cap must also be mounted in such a manner as to be able to be brought close to or moved away from the conveyor belt for the purpose of receiving jars of different heights. In addition, the closing head must be adapted to handle caps of various diameters in accordance with the use of jars having filling mouths of various diameters.

The components of the first group, such as the conveyor belt and the lateral retaining and feed belts, must in addition all move at strictly identical speeds at all times, since even a very slight difference in speed and even a very slight phase displacement, even temporary, between the components, for example as the result of irregular stressing, will allow the jar to become inclined on the conveyor belt, thus giving rise to a whole series of short-comings, such as failure to close the jar, partial or complete loss of the contents of the jar with consequent soiling of the machine and the environment, and even the breakdown of the machine if the tilted jar cannot be ejected automatically but becomes jammed in the capping machine.

To understand more readily the frequency of such irregular stressing, it is sufficient to consider that any jar which arrives while it is imperfectly aligned both horizontally and vertically at the inlet of the capping machine must at that point be perfectly aligned and centred by the conveyor belt itself and above all by the side retaining belts, and, in doing so, said belts are obviously subjected to sudden stresses and, generally, to moments in opposite directions.

The movement of the three main components in close contact with the jar and with the cap is usually derived from a single electric motor by way of gearboxes which effect the synchronisation of the movements of the various components. This motor is in some cases a fixed speed motor and in other cases a variable speed motor, in which case the variation of the speed is achieved either mechanically, for example by means of a variable speed gear unit, or simply electronically.

However, synchronising gearboxes are complicated, cumbersome and certainly expensive.

For convenience of adjustment, use is sometimes made of two motors, one for driving the conveyor belt and one for driving the side belts and the closing head. However, it has not been found possible in such cases to obtain synchronisation of the movements of the various components such as to achieve acceptable operation of the capping machine.

The main object of the present invention is therefore that of providing a capping machine in which the procedure necessary for adapting the machine to the closing of jars of different dimensions is considerably simplified.

Another object of the present invention is that of providing a capping machine equipped with mechanisms for operating the drive units for the jar and for operating the closing head which are substantially simplified and consequently easy to service and economical to manufacture.

A further object of the present invention is that of providing an improved capping machine of simple, economical construction which is suitable for mass

production.

According to the present invention a rectilinear chamber capping machine is characterised in that a primary motor drives the conveyor belt and the side retaining devices, while a secondary motor drives the closing unit for the application of the caps.

The principal advantage obtained with the improved capping machine according to the present invention consists of a substantial simplification of the mechanisms for transmitting the movement to the drive units for the jar and to the closing head unit.

Another advantage consists of an appreciable reduction of the costs of manufacture, construction and assembly of the present capping machine.

Finally, yet another advantage consists of the drastic reduction of the time required for maintenance, both with regard to adaptation to various dimensions of the jars and with regard to repairs and routine overhaul.

The present invention will be further explained below and other advantages will emerge from the description of one practical embodiment of the improved capping machine according to the present invention, this description being given solely by way of example and without limitation, with reference to the accompanying drawings, in which:

Figure 1 is a front view showing a rectilinear-chamber capping machine according to the present invention;

Figure 2 is a partial section on a larger scale than Figure 1 and with parts omitted, this section being taken on the line II-II in Figure 1;

Figure 3 is a similar view to Figure 1 and shows, on a larger scale than the latter, details of the components driving the jars;

Figure 4 is a partial section, with parts omitted, taken on the line IV-IV in Figure 3;

Figure 5 is a plan view partly in section, showing the units for the lateral retention of the jars;

Figures 6a and 6b are views in section on the line VI-VI in Figure 5 and show the operating components of the side retaining units in the case of chains provided with rubber shoes and of V-belts respectively;

Figures 7a and 7b are views in section taken on the line VII-VII in Figure 5 and show the guide members of the side retaining units in the case of chains provided with rubber shoes and of V-belts respectively; and

Figures 8a and 8b are views in section taken on the line VIII-VIII in Figure 5 and show the return idlers of the side retaining units in the case of chains provided with rubber shoes and of V-belts respectively.

Referring to the accompanying drawings, and in particular to Figure 1 thereof, it can be seen that the present rectilinear-chamber capping machine comprises a main frame 10 which carries the support members of a conveyor belt 12; the jars which are to be closed in a closing unit 14 are fed onto and transported on said conveyor belt.

The closure caps for the jars are fed to the capping machine by means of a hopper 16, which delivers them to the closing unit 14.

A primary electric motor 18 drives the conveyor belt 12 by means of a transmission system comprising shafts 20 and 22 and their appropriate angle drive means.

As is shown more clearly in Figures 2 and 3, the present capping machine also contains two side retaining units 24 and 26 for the jars 28 which are transported on the conveyor belt 12. The side retaining units 24 and 26 are driven by the primary electric motor 18 with the aid of a transmission system comprising a power distributor gearbox 30 and two transmission shafts 32 and 34, one for each side unit.

As shown more clearly in Figure 2, the present capping machine also includes a secondary electric motor 36, on which is fastened the primary pulley 37 of the closing unit 14.

The primary electric motor 18 and the secondary electric motor 36 are electrically synchronised with one another.

The end of the cap feed hopper 16, the closing unit 14 and the two side retaining units 24 and 26 are supported and enclosed by a working chamber 15 (see Figures 3 and 4), in which the containers are closed under vacuum.

Since during the use of the present capping machine it is often necessary to change the type of jar 28 which is to be closed, it is extremely important for the functioning of the capping machine that the adjustments for adapting it for working on jars of different dimensions and shapes should be facilitated in order to be able to be made by not particularly skilled personnel and without it being necessary to change any components.

For this purpose, in the capping machine according to the present invention three fundamental adjustments can be made.

The first adjustment consists of the ability to raise or lower the working chamber 15, including the side guides 24 and 26 and the closing unit 14.

This adjustment is made by the action of threaded shafts driven by means of a handwheel 38 (see Figure 1) and acting in the usual manner on respective pillars (not shown) which lower or raise the working chamber 15.

This adjustment makes it possible to adapt the capping machine to match the height of the jar 28 which has to be closed, by adjusting the distance between the conveyor belt 12 and the closing unit 14.

A second adjustment makes it possible to move the two side retaining units 24 and 26 symmetrically to the sides of the jar 28, in such a manner as to receive jars of different diameters and at the same time

maintain the centring of the jar 28 relative to the conveyor belt 12.

As is shown more clearly in Figure 4, for this purpose the side units 24 and 26 can be moved away from or closer to one another, between the maximum open position shown in solid lines in Figure 4 and the maximum closed position shown in dot-dash lines likewise in Figure 4.

As already stated, the two side units 24 and 26 are moved simultaneously so as to bring them simultaneously farther away from or closer to the axis 44 of the conveyor belt 12 (see Figure 4). This movement is made with the aid of a handwheel 46, which rotates one or more shafts 48 having two zones provided with oppositely directed screw threads, each of which meshes with a respective block 50 or 52 fastened to the side unit 24 or 26 respectively.

A third adjustment makes it possible to raise or lower the side units 24 and 26 as complete units. This adjustment is made by interposing spacer blocks 54 (see Figure 4) of suitable height between the side retaining units 24 and 26 and the threaded blocks 50 and 52 respectively, which, during their movement, thus maintain a constant height in relation to the working chamber 15.

In this way the side retaining units 24 and 26 can be lowered as required from their highest position shown in Figure 4.

By means of this third adjustment the side retaining units 24 and 26 are brought to a height such that their belts make contact with the jars 28 in an appropriate zone of their side surface, in dependence on the shape of the sides of the jars which are to be closed.

It is in fact important that the belts of the side retaining units 24 and 26 should be applied against vertical side surfaces in order to achieve correct lateral retention of the jars.

For the correct achievement of each of these three adjustments, the shafts 32 and 34 are made in the form of two grooved parts partly slidable in one another and therefore telescopically movable relative to each other. In addition, at both ends of the shafts 32 and 34 connecting universal joints are provided for the transmission of the motion.

In rectilinear-chamber capping machines use is generally made at the present time of two different types of devices for side retention and for driving, that is to say for retaining the jars during the application and then the closing of the cap.

One type of these devices utilises V-belts, while the second type makes use of chains which normally carry pads or shoes of elastic material.

Because of the considerable differences between the members of the two types of retaining devices of this kind, and because of their constructional complexity, capping machines specially designed to accept a single type of such devices have been in use up to the present time.

According to the present invention, as is better illustrated in Figure 5, the two side retaining units 24 and 26 are each assembled on their own secondary frames 56 and 58, respectively.

Each of the side retaining units comprises, as the case may be, the driving sprocket or pulley, the chain or belt, the tensioning idlers and the wearing guides for the forward and return strands of the chain or belt. These members are better shown in Figures 6a, 7a and 8a in the case of chain devices, and in Figures 6b, 7b and 8b in the case of belt devices.

Each of these side retaining units 24 and 26 also forms a self-contained sub-unit which, in addition to allowing the movement and adjustment of all its parts as a whole, as already described above, can also be replaced as a single component simply by acting on bolts 60 fastening it to the respective threaded blocks 50 or 52 (see Figure 4).

This solution is very important, because it enables the side retaining units 24 and 26 to be completely assembled on the workbench, and therefore to be mounted in a simple manner on the capping machine when an overhaul is required.

It should in fact be noted that the components of the side retaining units are the parts subject to the greatest wear in capping machines.

It is in addition possible in a simple and inexpensive manner to change over from the belt type to the chain type by simply replacing the entire side retaining sub-unit.

With the side retaining devices preassembled as self-contained interchangeable sub-units according to the present invention, the additional advantage is also obtained that the belt or chain in each sub-unit can be so disposed as to move over an optimum path in order to reduce the wear to which is it subjected, and this path is maintained whatever the adjustment made for adaptation to the size of the jar.

In the present capping machine the retaining units are in fact adjusted by moving the entire sub-unit, as already stated, and therefore the paths followed by the belts or chains are not changed when the retaining units are adjusted, whereas in the capping machines used hitherto the adjustment was made by moving only some of the guide components of the belts or chains, which therefore in some situations assumed path configurations which gave rise to considerable wear.

Although reference has throughout been made to jars as the objects which are to be closed by the capping machine of the present invention, it is clear that the same inventive principles and the same capping machine can be used for handling containers of any type, made of any material.

Therefore, although reference has been made throughout to container caps as the objects used in the capping machine of the present invention for clos-

ing such containers, it is clear that closure devices of any kind and of any material can equally well be used for closing such containers with the present capping machine.

Despite the fact that a screw type closing head has throughout been mentioned as the operating member of the closing unit, it is naturally also possible in the present capping machine to use closing heads of other types, for example pressure closing heads, in which the caps are fitted by exerting pressure, for example downward pressure, on the cap.

Although only a preferred embodiment of the improved rectilinear-chamber capping machine has been specifically illustrated and described herein, it is to be understood that minor variations may be made in the machine construction without departing from the spirit and scope of the invention as defined by the appended claims.

Claims

1. Rectilinear-chamber capping machine in which the jars (28) to be closed are fed, already filled with the packed product, continuously and at high speed, supported on a conveyor belt (12) on which they move forward, gripped laterally by two side retaining devices, to a point under a closing unit (14) which fits the caps, said capping machine being characterised in that a primary motor (18) drives said conveyor belt (12) and said side retaining devices, while a secondary motor (36) drives said closing unit (14) for the application of the caps.

2. Capping machine according to Claim 1, characterised in that each of the side retaining devices for the jars has a secondary frame which supports at least one drive pulley, an idler tensioner and the wearing guides for the forward and return strands of a side retaining belt.

3. Capping machine according to Claim 1, characterised in that each of said side retaining devices for the jars has a secondary frame which supports at least one toothed drive wheel, an idler tensioner and the wearing guides for the forward and return strands of a side retaining chain provided with pads.

4. Capping machine according to Claim 1, characterised in that it comprises in combination:

a main frame (10);

a primary electric motor (18) fastened to said main frame (10);

a conveyor belt (12) driven by said primary electric motor (18) with the aid of shafts (20 and 22) and appropriate angle drive means;

two side retaining units (24 and 26) for the jars (28) to be closed, said units being driven by said primary electric motor (18) with the aid of a power distributor gearbox (30) and two transmission shafts (32 and 34), one for each side unit;

a closing unit (14) applying the caps;

a secondary electric motor (36) for driving the closing unit (14); and

a working chamber (15) supporting and containing said two side units (24 and 26) and said closing unit (14).

5. Capping machine according to Claim 4, characterised in that said primary electric motor (18) and said secondary electric motor (36) are electrically synchronised.

6. Capping machine according to Claim 4 or 5, characterised in that each of said two side retaining units (24 and 26) for the jars (28) has a secondary frame which supports at least one drive pulley, an idler tensioner and the wearing guides for the forward and return strands of a side retaining belt.

7. Capping machine according to Claim 4 or 5, characterised in that each of said two side retaining units (24 and 26) for the jars (28) has a secondary frame which supports at least one toothed drive wheel, an idler tensioner and the wearing guides for the forward and return strands of a side retaining chain provided with pads.

8. Capping machine according to any of Claims 4 to 7, characterised in that said side units (24 and 26) can be moved away from or nearer to one another by means of one or more threaded shafts (48) having two zones provided with oppositely directed screw threads and driven by means of a handwheel (46) for adapting the machine to the width of the jar (28) to be closed.

9. Capping machine according to any of Claims 4 to 8, characterised in that said side units (24 and 26) can be raised or lowered relative to said working chamber (15) and to the closing unit (14) fastened thereto, through the interposition of appropriate spacer blocks (54), for the adaptation of the machine to the external shape of the sides of the jar (28) to be closed.

10. Capping machine according to any of Claims 4 to 9, characterised in that said working chamber (15) can be raised or lowered vertically by means of threaded shafts driven by a handwheel (38) in order to adapt the machine to the height of the jar (28) to be closed.

11. Capping machine according to any of Claims 8 to

10, characterised in that said shafts (32 and 34) driving said two side units (24 and 26) are made in the form of two grooved parts partly slidable in one another and therefore telescopically movable relative to each other, while at both ends of these drive shafts (32 and 34) connecting universal joints are provided for the transmission of the motion.

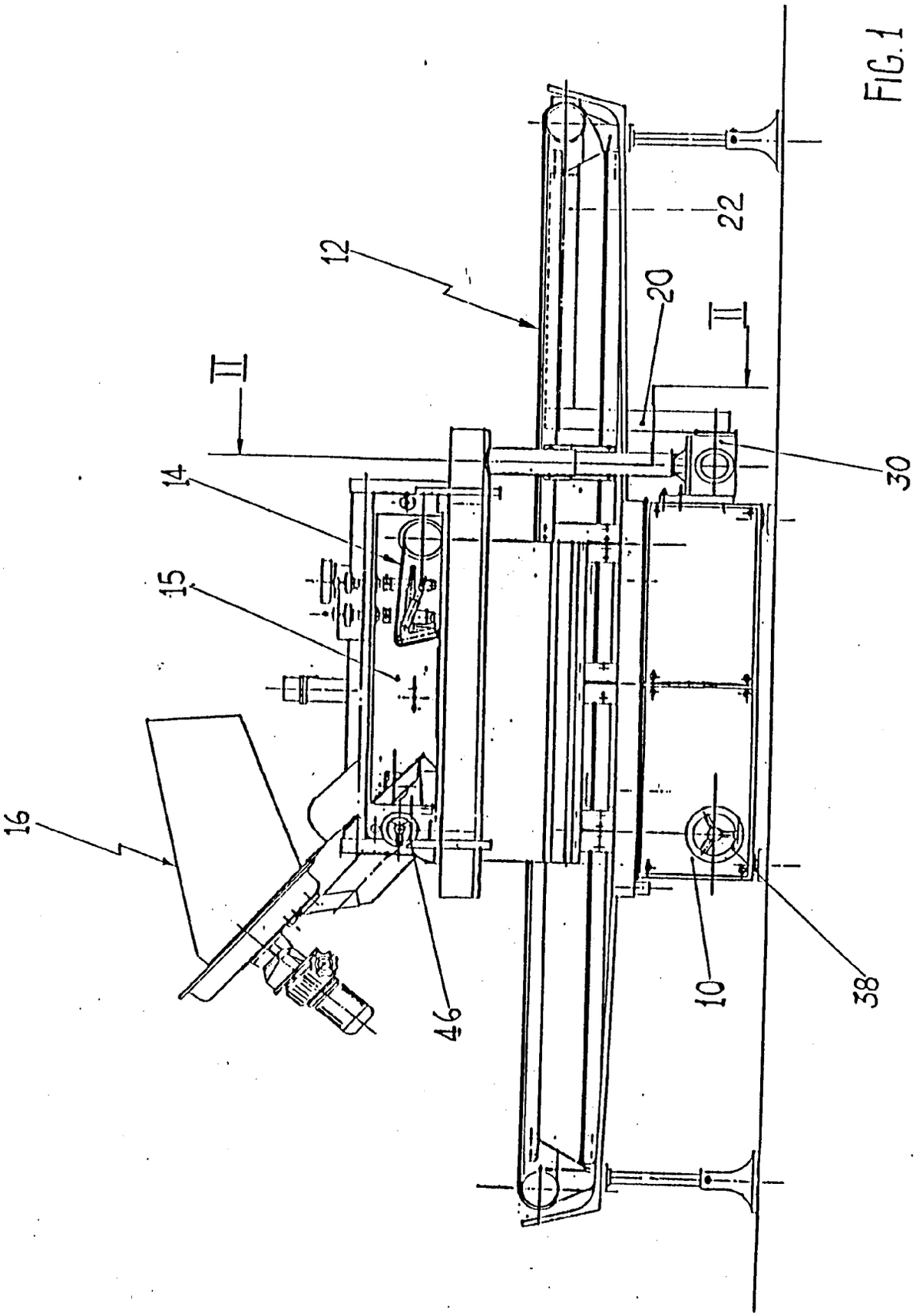

FIG.1

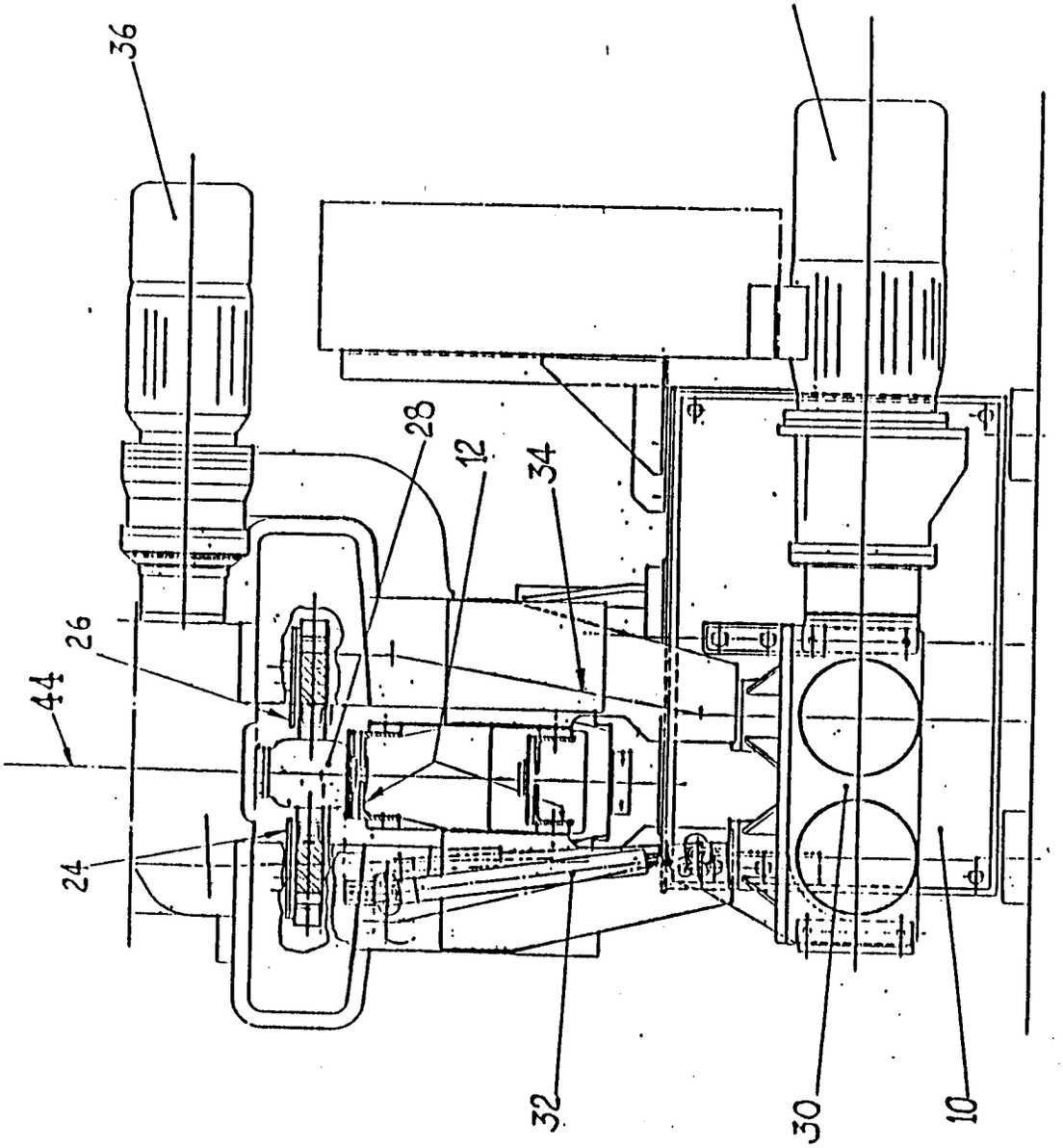

FIG.2

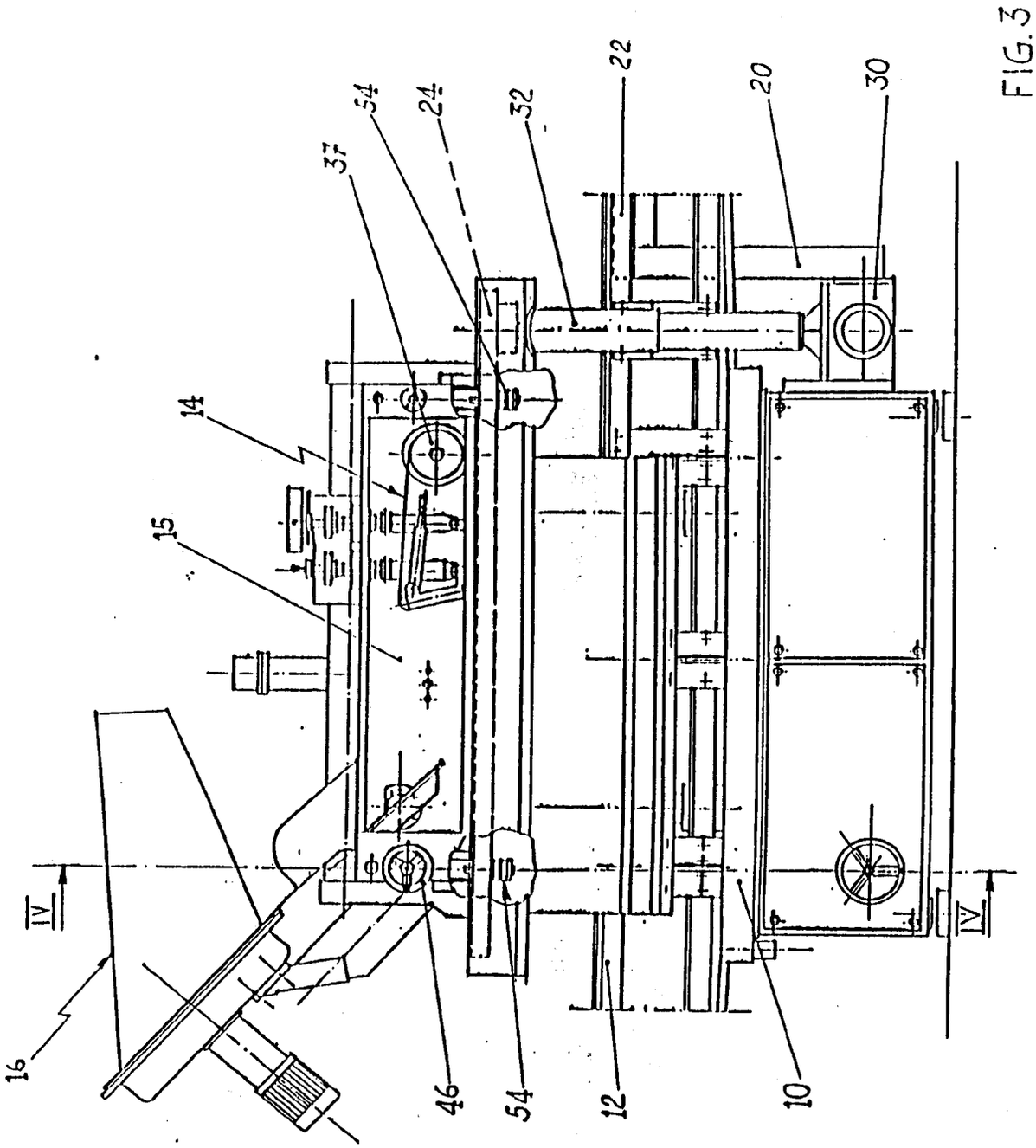

FIG.3

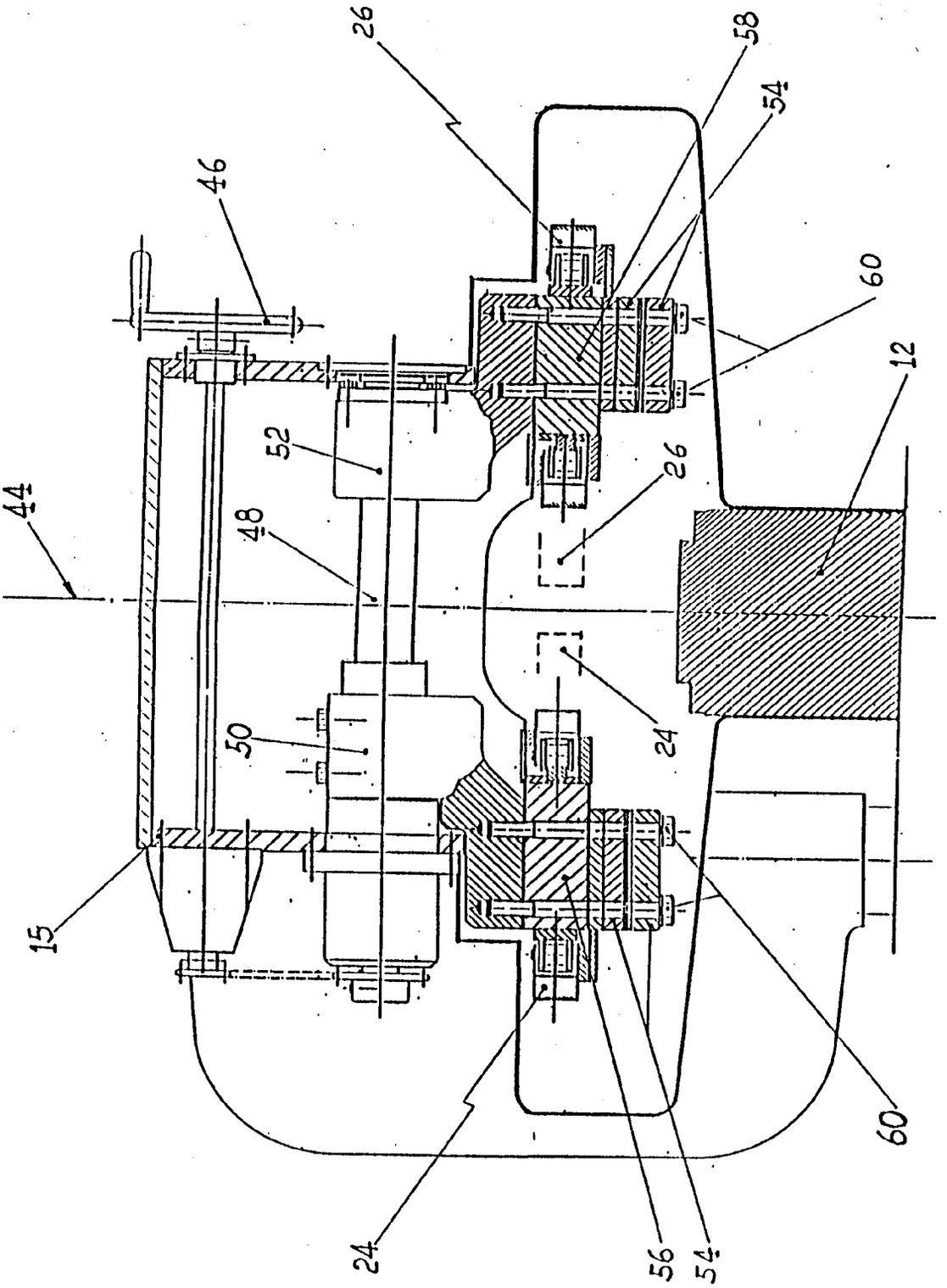

FIG.4

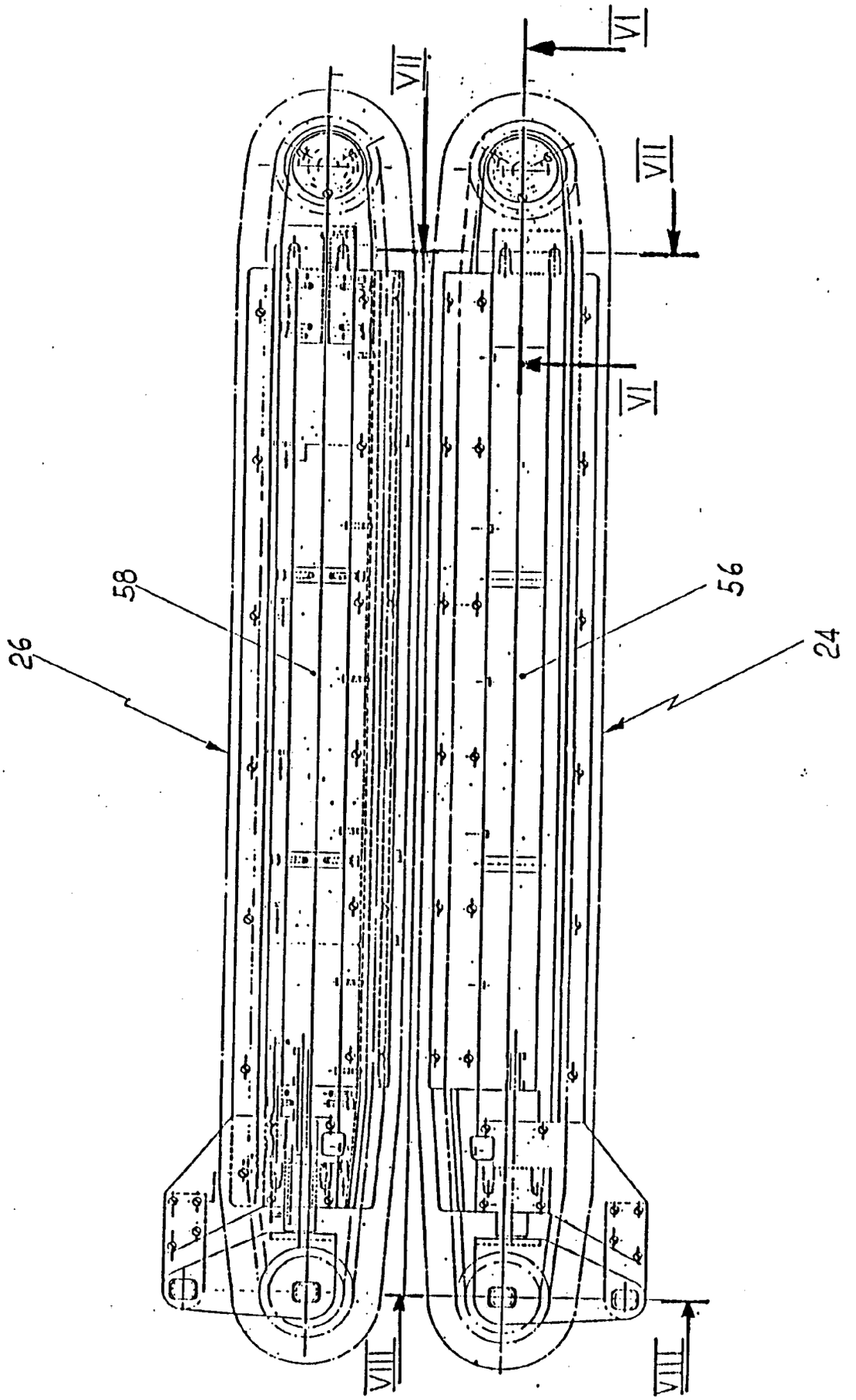

FIG. 5

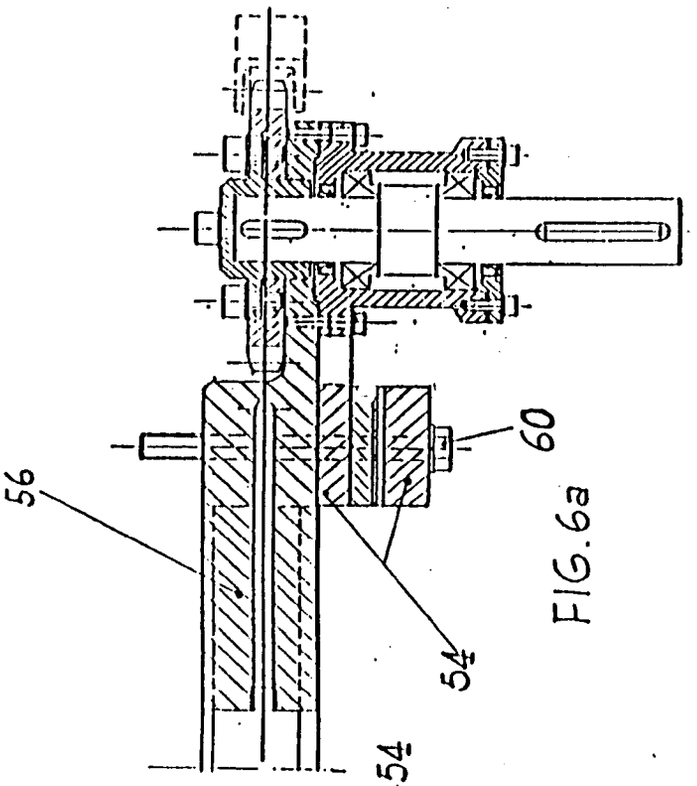

FIG.6a

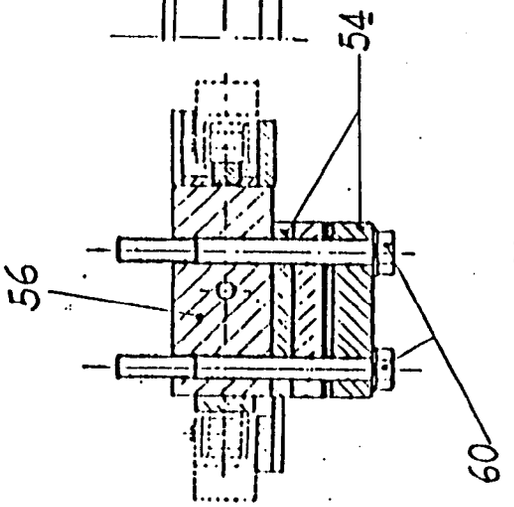

FIG.7a

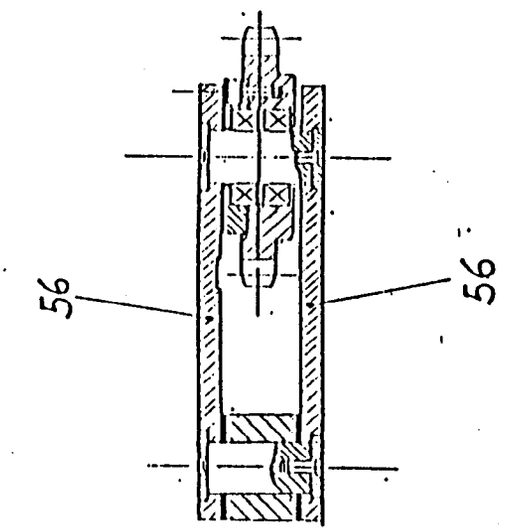

FIG.8a

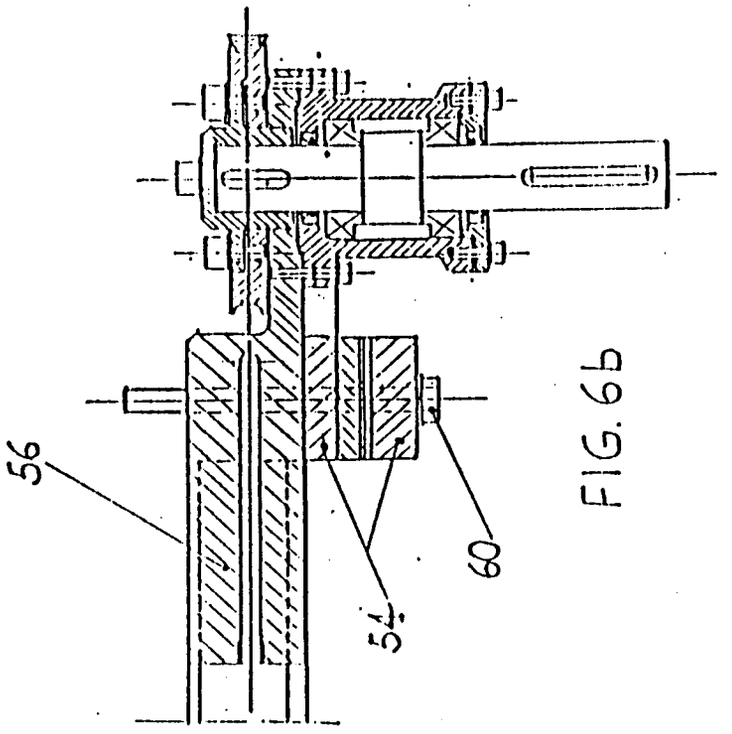

FIG. 6b

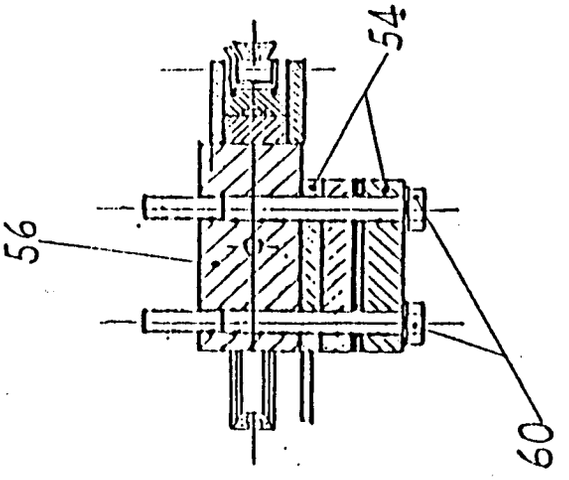

FIG. 7b

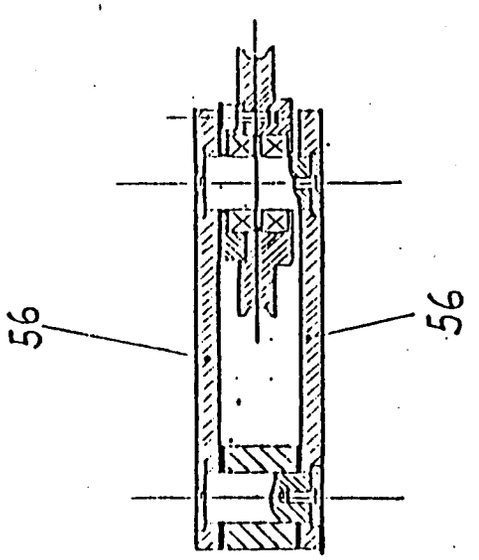

FIG. 8b

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 83 0567

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.5)
X	US-A-3 054 234 (H. STOVER) * column 2, line 41 - column 3, line 44 * * column 6, line 37 - line 59; figures 1-4 * ---	1,2,4,6, 8,9	B65B7/28 B67B3/20
Y		3,5,7,10	
X	US-A-2 909 879 (J. HOHL) * column 2, line 24 - line 64; figures * ---	1,2	
A		4,6	
Y	US-A-3 365 856 (S. HARMON) * column 1, line 63 - column 2, line 34; figures * ---	3,7	
Y	BE-A-668 816 (ANCHOR HOCKING) * page 9, line 5 - page 11, line 12; figures 1-5 * ---	5	
A		1,2,4,6, 8,9,10	
Y	FR-A-2 169 214 (E. ZETTERBERG) * page 2, line 26 - page 3, line 9 * * page 5, line 13 - line 26; figures * ---	10	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B65B B67B
A		2,4,6	
A	US-A-3 012 388 (H. STOVER) * column 4, line 7 - line 43 * * column 4, line 71 - column 5, line 17; figures 1-6 * -----	1,2,4,6, 8,9	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 FEBRUARY 1993	JAGUSIAK A.H.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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