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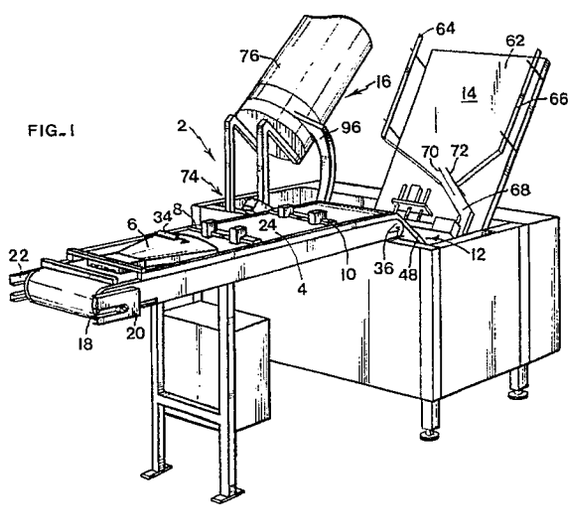
(54) Packaging machine for filling dicoid products into tubes.

(57) The invention relates to a packaging machine (2) for packaging substantially discoid products into tubes. The machine comprises at least one filling station (12) having at least two parallel rotary rolls adapted to rotate an elongate tube which preferably is sealed at one end, said end being located below the other tube end which is open; a tube magazine (14); and a device for intermittently feeding tubes from said tube magazine (14) to said filling station (12). The machine is characterised by a conveyor (4) provided between the filling station (12) and the discharge side of a product-forming machine and supplying, preferably at a constant speed, said products to said filling station (12); an infeed sleeve so arranged between said conveyor (4) and a tube supplied to said filling station (12) that one end of said sleeve connects with the conveyor (4), while the other sleeve end connects with the tube opening; a rotary roll provided below said sleeve and adjustable to different infeed sleeve diameters, said roll supporting said sleeve; and a rotary roll provided below said tube and movable between two end positions, said last-mentioned roll carrying said tube and moving it into or out of the filling position.

FIG. 1



EP 0 414 652 A1

PACKAGING MACHINE

The present invention relates to a packaging machine, more particularly to a machine for packaging substantially discoid products, such as effervescent tablets of various kinds, into tubes.

In recent years, the use of pharmaceutical products in the form of effervescent tablets has increased not only in Sweden, but also in other parts of Europe as well as in Japan and Australia. Although the success of these tablets has not been fully explained, some contributory causes clearly are the exact dosage, the possibility of taking medicines in liquid form, and the hard moisture-repellent package.

The success of pharmaceutical effervescent tablets has given an impulse to manufacture also other products in the form of effervescent tablets. For example, attempts are being made at producing/introducing detergents, plant nutrients and other water-soluble products in the form of effervescent tablets. A suitable packing for effervescent tablets are tubular containers of various types, for example metal, plastic or cardboard tubes. Thus, there is great demand for, in particular, fully automatic packaging machines for filling tablets into tubes.

The prior art technique within this field is represented by SE-B-7705534-1 which discloses a machine for filling tablets into tubes. A distinctive feature of this machine is that it comprises two parallel rotating rolls inclined towards the horizontal plane and carrying a tube that is closed at one end. Furthermore, the machine comprises a feed roll with radially extending feed arms, as well as an inclined path with a chute opening at each filling station. It also appears that the prior art machine, more particularly the inclined path, is arranged for direct connection with a tablet-forming machine with which it is adapted to operate in synchronism.

The prior art machine has a number of shortcomings, only some of which will be mentioned here. The upper part of the machine is connected via a tablet feed table with a tablet-forming machine, the tablets discharged from the forming machine dropping onto the feed table, which, combined with the movement of the feed table, which may be rotary or vibratory, subjects the tablet to heavy mechanical strain. This arrangement, and the inclined path opening at the tubes, functions satisfactorily for packaging tablets having a low diameter/thickness ratio. When this ratio increases, i.e. with other tablet types, the diameters $\gg$ the thickness, these tablets frequently become extremely sensitive to this type of mechanical strain, and the waste will be considerable. Because of the high packaging rates required by the market, this problem is further aggravated. Moreover, ever increasing demands are being placed on the working environment, which means that steps must be taken to reduce noise, vibrations and dust formation in the packaging of tablets. These demands are difficult to satisfy with prior art machines.

One object of this invention is, therefore, to provide a packaging machine which, with less waste, fills each tube more quickly than the prior art machines.

A further object of this invention is to provide a packaging machine which, without the use of a feed table or a funnel-shaped intermediate storage, is directly connectible with the discharge side of a tablet-forming machine.

A third object of this invention is to provide a packaging machine in which the mechanical strain placed on the tablets is reduced to a minimum.

Furthermore, the packaging machine of the present invention must satisfy, with a comfortable margin, the working environment provisions of different countries in respect of noise, vibrations and dust formation in the packaging of tablets.

These and other objects are achieved by means of a packaging machine for packaging substantially discoid products into tubes, comprising at least one filling station having at least two parallel rotary rolls adapted to rotate an elongate tube which preferably is sealed at one end, said end being located below the other tube end which is open; a tube magazine; and a device for intermittently feeding tubes from said tube magazine to said filling station, said packaging machine being characterised by a conveyor provided between the filling station and the discharge side of a product-forming machine and supplying, preferably at a constant speed, said products to said filling station; an infeed sleeve so arranged between said conveyor and a tube supplied to said filling station that one end of said sleeve connects with the conveyor, while the other sleeve end connects with the tube opening; a rotary roll provided below said sleeve and adjustable to different infeed sleeve diameters, said roll supporting said sleeve; and a rotary roll provided below said tube and movable between two end positions, said last-mentioned roll carrying said tube and moving it into or out of the filling position.

Further characteristic features of the present invention are defined by the subclaims. Thus, it is preferred to make the infeed sleeve rotatable in such a manner that the rotary rolls cause both the tube supplied to the filling station and the infeed sleeve connected with the tube to rotate about substantially the same axis of rotation.

A preferred embodiment of the present invention will be described in more detail hereinafter, reference being had to the accompanying drawings in which

Fig. 1 is a perspective view of a packaging machine according to the invention;

Fig. 2 is a schematic top plan view, partly broken away for better clarity, of a conveyor having a product distributor, in the packaging machine shown in Fig. 1;

Fig. 3 is a partly broken away lateral view of a filling station in the packaging machine shown in Fig. 1;

Fig. 4 is a sectional view taken along line IV-IV in Fig. 3;

Fig. 5 is a front view of a tube magazine in the packaging machine shown in Fig. 1;

Fig. 6 is a sectional view of a cap feeder in the packaging machine shown in Fig. 1; and

Fig. 7 is a sectional view taken along line VII-VII of the cap feeder shown in Fig. 6.

Fig. 1 illustrates, in the form of a schematic perspective view, a packaging machine 2 for packaging substantially circular discoid products, such as effervescent tablets of various kinds, into tubes. The packaging machine 2 substantially comprises a conveyor 4 having a path switching device 6 and stop flaps 8, 10, a filling station 12, a tube magazine 14, and a cap feeder 16.

The conveyor 4 as shown in Figs. 1 and 2 is a substantially horizontal belt conveyor that can be tensioned and adjusted by means of suitable attachments 20, 22 at a guide roller 18 and is connectible with a product-forming machine (not shown), such as a tablet-forming machine, or a circular feed table. Directly above the upper side 24 of the conveyor 4, the path switching device 6 and the stop flaps 8, 10 are provided. The path switching device 6 comprises preferably four downwardly open product channels 26 which, in Fig. 2, are indicated by means of the centre line of the respective channel. The path switching device 6 is pivotable about a vertical pivot pin 28 mounted approximately on the centre line of the path, at that end 30 of the path switching device 6 which faces the guide roller 18. The end 30 connects with the tablet-forming machine or with an inclined product feed path 32, of which but a part is shown in Fig. 2. The product channels 26 diverge from the infeed end 30 towards that end of the path switching device which faces away from the infeed end and at which a control means 34 in the form of a pneumatic or hydraulic piston and cylinder assembly is arranged. By activation of the control means 34, the path switching device 6 can be moved from a first end position in which four product strands 26A are formed on the conveyor, to a second end position in which four further products strands 26B are formed on the conveyor, resulting in a total of eight product strands uniformly distributed on the conveyor. To reduce the turning angle of the path switching device 6, and thus the switching rate (the reasons for this will be described hereinafter), the product channels 26 are spaced apart, at the discharge end of the path switching device 6, a distance such that there are formed, on the conveyor, product strands originating alternatingly from one end position 26A and the other end position 26B of the path switching device 6.

The two stop flaps 8 and 10 are in the form of a beam which can be raised or lowered and is movable in the longitudinal direction of the conveyor. The beam is arranged transversely of the longitudinal direction of the conveyor and, in its lowered position, makes contact with the upper side 24 of the conveyor to prevent the passage of products. In its raised position, the beam allows the products to pass. The relative movements of these stop flaps are described hereinafter. The belt reverses at a second guide roller 36 in direct connection with the filling station 12 which is described below.

Reference is now made, in addition to Fig. 1, also to Figs. 3 and 4. Fig. 3 is a schematic sectional view of the filling station 12 which comprises a plurality of infeed sleeves 40, only one of which is shown in Figs. 3 and 4. Each tubular elongate infeed sleeve 40 is rotatably mounted at one end in an attachment 42, such that the longitudinal sleeve axis forms an angle of about 30° with the horizontal plane. The rotatably mounted end connects with the open end of a tube 44 which is supplied from the tube magazine 14 and whose longitudinal axis coincides, at the moment of filling, with the longitudinal axis of the in feed sleeve. The other sleeve end 46 which preferably is conically widened from the inner surface to the outer surface of the sleeve, connects with an inclined path 48 communicating the conveyor with the filling station 12 and thus permitting product flow to the tubes 44. The infeed sleeve 40 and a tube 44 supplied to said sleeve are rotated about the common longitudinal axis of rolls 56, 58, 60A, 60B (see Fig. 4) parallel to said sleeve and said tube. These rolls are preferably arranged at the corners of an isosceles triangle and are provided with friction rings 50, 52, 54A, 54B fixedly connected with the rolls and making contact with the outer surfaces of the infeed sleeve 40 and the tube 44. In the preferred embodiment of the packaging machine here described, the two rolls 60A and 60B are so arranged directly below the sleeve 40 and the tube 44, respectively, that the longitudinal axes of the rolls coincide, the longitudinal axes of the sleeve and the tube being parallel and spaced apart in a vertical plane which is common to the axes of the rolls 60A, 60B. The friction

rings 54A of the roll 60A carry the sleeve 40, and the friction rings 54B of the roll 60B carry the tube 44. The roll 60A can be adjusted to different diameters of the infeed sleeve 40. The roll 60B is movable from the position shown in Figs. 3 and 4, in which it is in contact with the tube, to a lower position (not shown) in which the tube 44 is moved out of contact with the driving rolls 56, 58 for further conveyance of the filled tube and advance of a new and empty tube which is moved into filling position by the carrying roll 60B when this has resumed its first-mentioned position.

All tubes to be filled are stored in and supplied from the tube magazine 14 which is shown in Figs. 1 and 5 and which substantially consists of an inclined bottom or supporting plate 62 with funnel-shaped lower walls 64, 66 which at their lowest point merge into a tube channel 68. The tubes 44 which are open at least at one end, are positioned with their closed end facing the supporting plate 62. When tubes are used which are open at both ends, it is immaterial how the tubes are positioned in the tube magazine, and one or the other of the tube ends may be positioned to face the supporting plate 62. To prevent a bridging effect in the tube magazine 14 so that an empty space is formed underneath a plurality of tubes somewhere in the tube magazine, whereby filling may be interrupted because no tubes are supplied if the bridge is formed at the tube channel 68, there is provided a bridge-breaking member in the form of two plates 70, 72 extending outwardly from the supporting plate 62 and movable diagonally thereof between two end positions, the distance between these end positions preferably being selected on the basis of the diameter of the tubes 44. The tube channel 68 leads to a tube conveyor (not shown) intermittently supplying the tubes through the different stations of the packaging machine.

After the filling operation, the above-mentioned tube conveyor supplies each of the tubes to a checking station (not described in detail) at which it is checked that the correct number of tablets have been filled into the tube. If an error is indicated, the faulty tube is removed from the tube conveyor by means of a suitable device.

The accepted tubes are finally fed to a capping or sealing station 44 (see Fig. 1) in which caps, plugs or other closure members are disposed in the tube opening to close the tube. The capping station 74 comprises a special cap feeder 16 (see Figs. 1, 6 and 7) and a cap holder and applicator movable between two end positions. The actual cap feeder 16 comprises a cylindrical casing 76 whose longitudinal axis forms an angle of about 30° with the horizontal plane. The upper part of the casing forms an upwardly open cap magazine 78 holding a number of randomly oriented caps (plugs, or the like). The lower part of the cap feeder 16 comprises two vertically spaced-apart, substantially circular plates 80, 82. The upper plate 80 is attached to the inner surface of the casing 76 and forms the bottom of the magazine 78. The plate has a recess 84 extending along the periphery of the plate 80 which also is inclined. Directly below the plate 80, there is provided an L-shaped arm 86, 88 operable by a control means 92, such as a pneumatic or hydraulic piston and cylinder assembly, one leg 86 of said arm being movably attached to the plate 80 and connected, at a distance from its point of attachment 90, with the control means 92. The leg 86 is parallel to the lower side of the plate 80 and extended towards the recess 84. The other leg 88 of the arm, which faces away from the point of attachment 90, is connected at right angles with the end of the leg 86, and extends along the casing towards the opening of the cap magazine 78. The movability of the arm about the point of attachment 90 is restricted to the peripheral length of the recess, such that the arm swings in pendulum fashion.

The lower plate 82 is rotatably mounted at a distance from the upper plate 80 and is operated by a motor (not shown). Near the periphery of the plate 82, at least one finger 94 is mounted. The number of fingers, and the finger form required to give the desired technical effect, are chosen on the basis of the closure member at issue. The finger 94 orients the closure members in a given direction and supplies them to a channel 96 which preferably is divided into two part channels 98, 100 conducting the closure members to the above-mentioned cap holder and applicator.

After the cap, i.e. the closure member, has been applied, the tube is conducted to a labelling and/or packing station which need not be described in detail since such arrangements are well known in the art.

Before the packaging machine 2 is set into operation, the tube magazine 14 is filled with empty tubes 44, and if necessary regard must be paid at this moment to the tube orientation, while the cap magazine 78 is filled with caps or other closure members fitting the tubes 44 and the fingers 94.

The packaging machine 2 according to the invention, which is linked up with the product-forming machine, is preferably started synchronously with the product-forming machine. The belt conveyor 4 starts, and at the same time tubes 44 are supplied by the tube feeder from the tube magazine 14, i.e. from the outlet end of the channel 68, to the filling station 12, and the cap feeder 16 supplies correctly oriented caps via the channel 96 to the cap holder and applicator. The tubes 44 are advanced intermittently, two at a time, until eight tubes parallel to one another are in the position

shown in Fig. 4. The path switching device 6 assumes the first of the two available positions, the first stop flap 8 has been raised and allows tablets to pass, while the second stop flap 10 has been lowered and prevents the passage of tablets to the filling station 12. By the continuous movement of the conveyor, the tablets discharged from the product-forming machine are distributed on the belt or in two downwardly open channels to form the first four product strands 26A. Photodetectors mounted at the path switching device 6 detect when the correct preset number of tablets have passed the path switching device, and produce a signal which activates the control means 34 to move the path switching device 6 into the second one of the two available positions. The tablets discharged from the product-forming machine are distributed on the belt to form the other four product strands 26B. When the photodetectors detect the correct number of tablets also in the other end position of the path switching device, a second signal is produced to make the first stop flap 8 assume its lower position preventing the passage of tablets, and to make the other stop flap 10 assume its raised position allowing the tablets to pass.

All tablets of the strands 26A, 26B slide in succession down the inclined plane 48 (see Fig. 3), and at the lower end of this plane the tablets come into contact with the conical opening 46 of the rotating infeed sleeve 40. By centrifugal action, each tablet is raised to assume a position in which an essentially planar surface of the tablet faces the tube opening. Owing to the inclination of both the infeed sleeve 40 and the tube 44, in combination with the rotary movement, each tablet is now moved in a helical path through the infeed sleeve and into the tube.

When the last tablet of each strand has passed underneath the second stop flap 10, this flap is again lowered, whereupon the first stop flap 8 is raised to permit the tablets that have meanwhile collected in the path switching device 6 to pass.

The eight tubes that have been filled at the same time are supplied two at a time past the checking station in which a transducer senses the level of tablets in each tube and, on the basis of this result, produces signals for the removal of an incorrectly filled tube from the tube conveyor, or for further conveyance of an accepted tube to the capping station 74. At the same time as two filled tubes leave the filling station 12, two empty tubes 44 are supplied to the filling station. Independently of the tube conveyor, the bridge-breaking members 70, 72 are moved a short distance in the diagonal direction of the supporting plate 62 (see Fig. 5) and then return directly to their respective starting positions. During this movement, a few tubes 44 are moved in some degree in the tube magazine 14, whereby any bridging effect in the magazine 14 is effectively prevented.

When all eight tubes that have first been filled have left the filling station, eight empty tubes 44 have thus been positioned therein, and the above-mentioned filling sequence is repeated.

Caps randomly stored in the cap magazine 78 of the capping station 74 are caused by the L-shaped arm 86, 88 (see Figs. 6 and 7) to drop onto the rotating lower plate 82 with the fingers 94. The fingers 94 now engage the caps which assume the desired orientation. At an end of the channel 96, which is open towards the interior of the cap feeder 16, the correctly oriented cap is disengaged from the finger 94 and, while retaining this orientation, is supplied down through the channel 96 or 100 to the cap holder and applicator which attaches a cap to each of two filled and accepted tubes supplied simultaneously to the capping station 74, and the open tube end is closed.

Finally, the closed tubes are conducted to a labelling and/or packing station.

The gentle and careful handling of the tablets that is achieved by using a conveyor which cooperates with a path switching device, and inclined rotary infeed sleeves having a conical opening, makes it possible to fill a number of tubes, in the case here described eight tubes, far more quickly and with less total waste. The photodetectors arranged at the path switching device guarantee accurate counting of a desired number of tablets to be filled into each tube, by comparison of a predetermined number and the detected number, it being especially advantageous that the stop flaps are displaceable in the longitudinal direction of the conveyor. As a result, the packaging machine according to the present invention is highly efficient and adapted to the high-capacity tablet forming machines available on the market.

Although the packaging machine according to the invention as described above constitutes a preferred embodiment, it will be appreciated that the expert can find other means and modifications to achieve the same technical effect. All such changes and modifications that fall within the scope of the inventive concept must therefore be interpreted as comprised by the appended claims. Thus, also oval discoid products could be packed by suitable adaptation of the components of the packaging machine according to the invention. In addition, the term "cap" should be interpreted to comprise also other closure members, such as plugs, lids etc.

Claims

1. A packaging machine for packaging substantially discoid products into tubes, comprising at least one filling station (12) having at least two parallel rotary rolls (56, 58) adapted to rotate an elongate tube (44) which preferably is sealed at one end, said end being located below the other tube end which is open; a tube magazine (14); and a device for intermittently feeding tubes from said tube magazine (14) to said filling station (12), **characterised** by a conveyor (4) provided between the filling station (12) and the discharge side of a product-forming machine and supplying, preferably at a constant speed, said products to said filling station (12); an infeed sleeve (40) so arranged between said conveyor (4) and a tube (44) supplied to said filling station (12) that one end (46) of said sleeve connects with the conveyor (4), while the other sleeve end connects with the tube opening; a rotary roll (60A) provided below said sleeve (40) and adjustable to different infeed sleeve diameters, said roll supporting said sleeve (40); and a rotary roll (60B) provided below said tube (44) and movable between two end positions, said last-mentioned roll (60B) carrying said tube (44) and moving it into or out of the filling position.

2. Packaging machine as claimed in claim 1, **characterised** in that the infeed sleeve (40) is rotatably arranged; that the inner diameter of the sleeve substantially corresponds to the outer diameter of the product; and that the end (46) of the sleeve (40), which faces the conveyor (4), is conically widened, whereby a product supplied to said infeed sleeve (40), when the product periphery comes into contact with the inner surface of said sleeve, is rotated and raised such that a substantially planar surface of the product faces the tube open ing at the transition between said sleeve (40) and said tube (44).

3. Packaging machine as claimed in claim 2, **characterised** in that said sleeve (40) and said tube (44) are arranged to form an angle of about 30° with the horizontal plane.

4. Packaging machine as claimed in any one of claims 1-3, **characterised** by a separator provided at that end of the conveyor (4) which faces the product-forming machine, for separating product waste from products acceptable for packing.

5. Packaging machine as claimed in any one of claims 1-4, **characterised** by a path switching device (6) arranged directly above the conveyor (4) and controlling the product flow for distributing the products on the upper side (24) of the conveyor.

6. Packaging machine as claimed in claim 5, **characterised** in that said path switching device (6) is rotatable about a pivot pin (28) arranged at that end (30) of the path switching device (6) which faces the product-forming machine, said pivot pin being at right angles to the upper side (24) of the conveyor, and that said path switching device (6) comprises a plurality of downwardly open product channels (26) diverging from the infeed end (30) of said path switching device (6) towards that end of said path switching device (6) which faces away from said infeed end (30).

7. Packaging machine as claimed in any one of claims 1-6, **characterised** by two vertically movable stop flaps (8, 10) which are arranged, as seen in the product flow direction, after the path switching device (6) across the conveyor (4) and are displaceable in the longitudinal direction of said conveyor, said stop flaps, when in their raised condition, allowing the passage of advanced products and, when in their lowered condition, making contact with the upper side (24) of said conveyor, thus preventing the passage of advanced products.

8. Packaging machine as claimed in any one of claims 1-7, **characterised** by transducers arranged at the path switching device (6) and adapted, in response of the result of a comparison between a preset desired number of product units and a detected number of product units, to produce signals for controlling said stop flaps (8, 10).

9. Packaging machine as claimed in any one of claims 1-8, **characterised** by at least one bridge-breaking member (70, 72) movable between two end positions and arranged at a discharge channel (68) of the tube magazine (14), said bridge-breaking member being adapted to prevent a bridge formation of tubes (44) in the tube magazine (14), thereby to obviate shut-down and/or erroneous indication.

10. Packaging machine as claimed in any one of claims 1-9, **characterised** by a checking station arranged, as seen in the tube feeding direction, between the feeding station (12) and a capping station (74), said checking station comprising a transducer insertable in the filled tube for checking the tube filling level, and an ejector for the removal of a rejected tube from the tube conveyor.

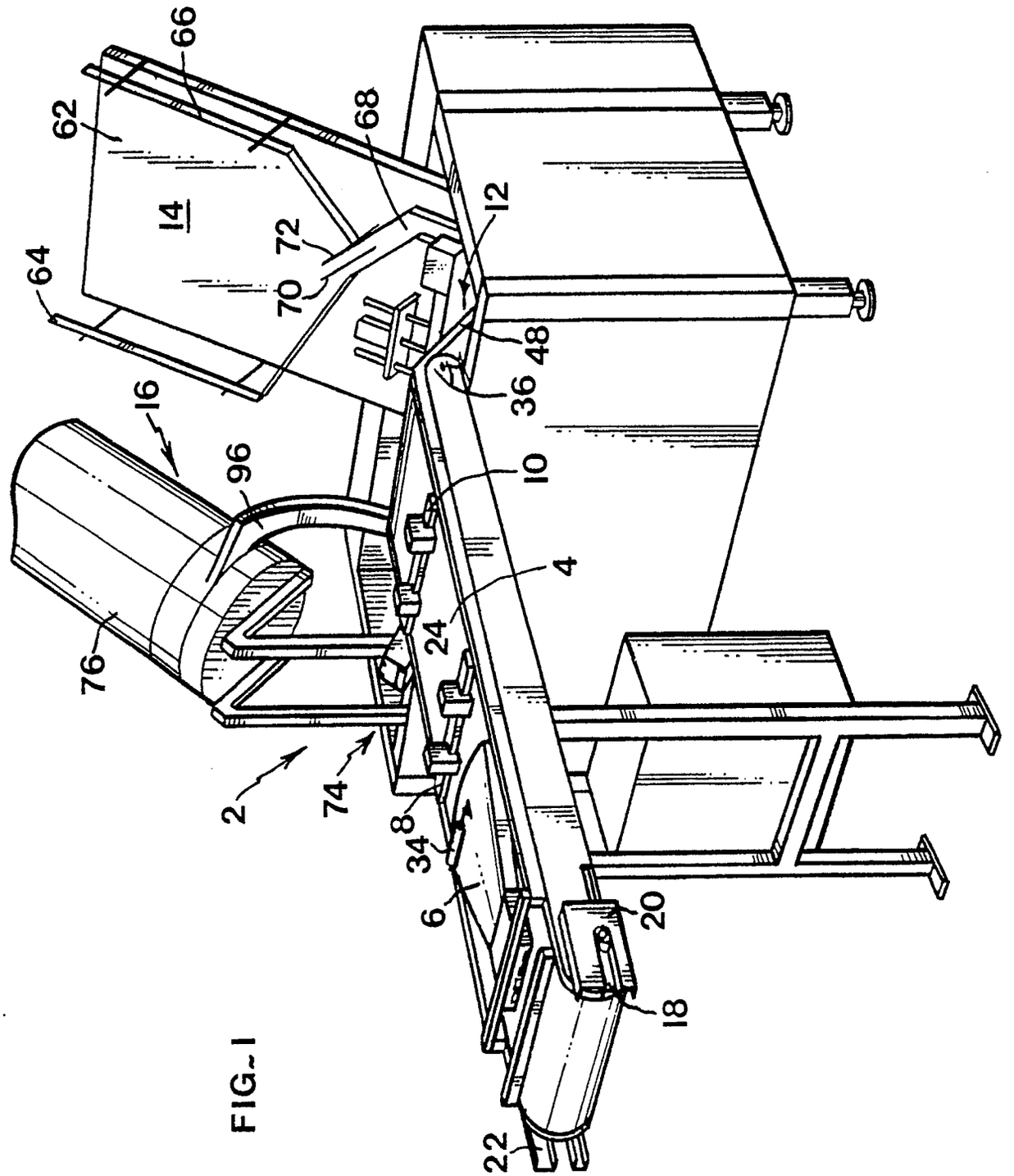


FIG-1

FIG-2

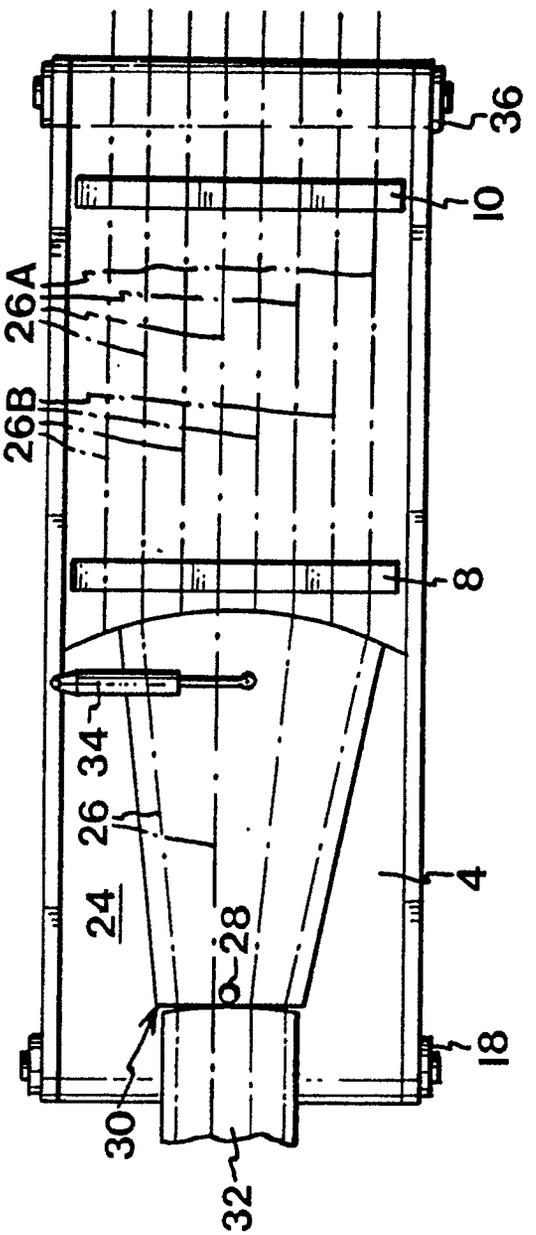


FIG_3

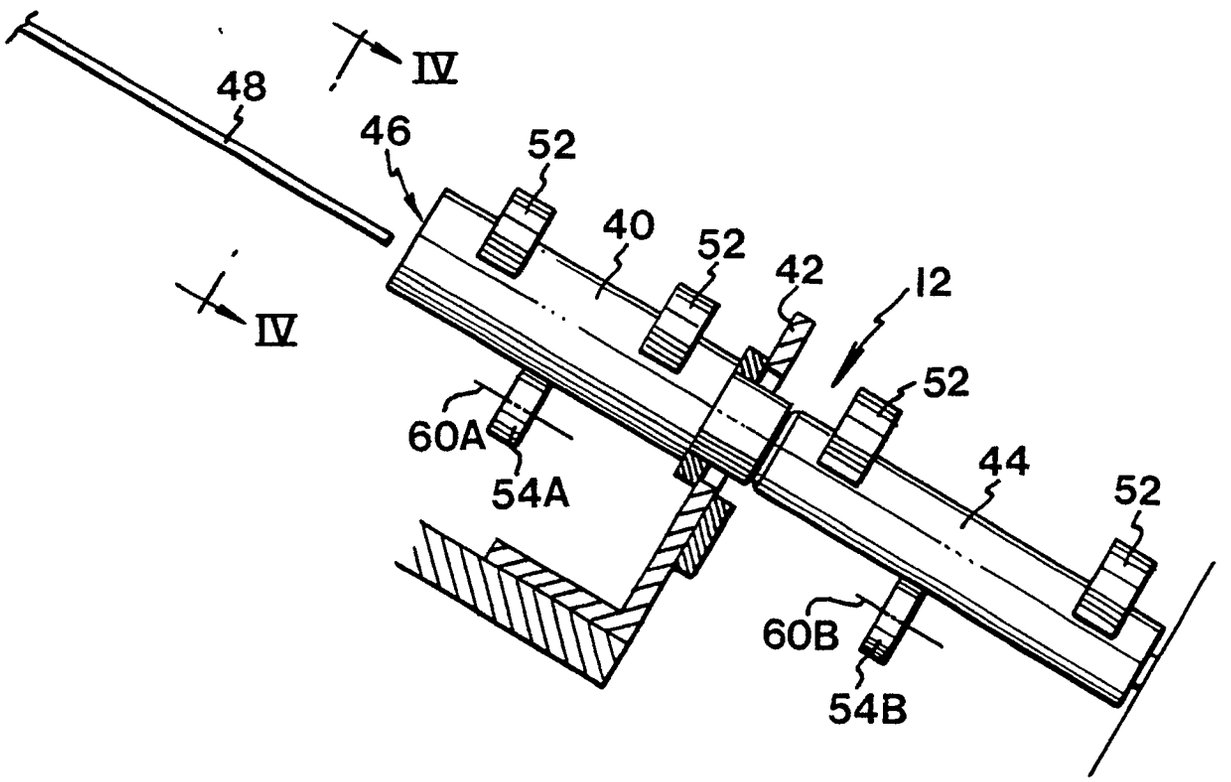

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FIG_4

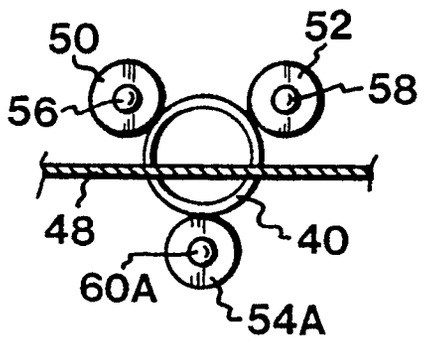
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FIG-5

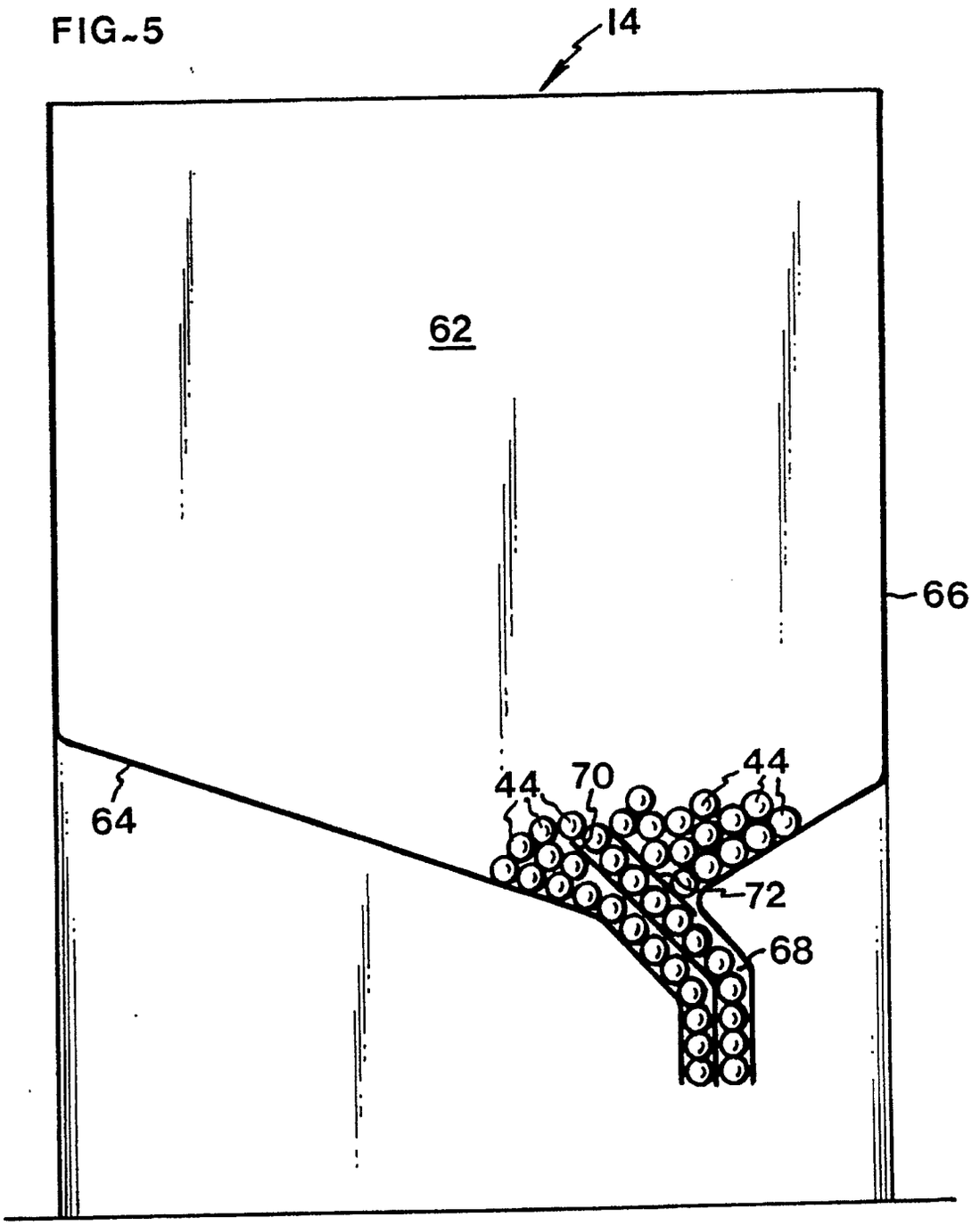
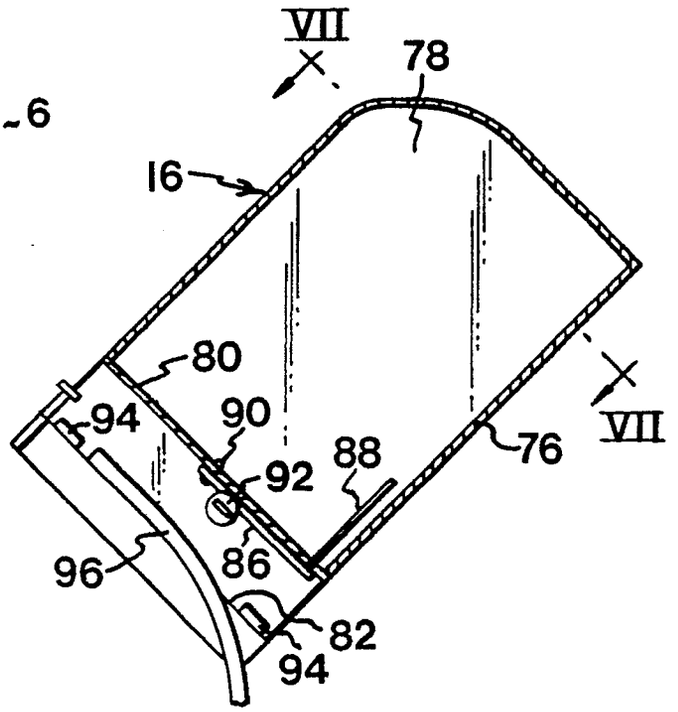


FIG.-6


VII
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80
94
90
92
88
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VII
96
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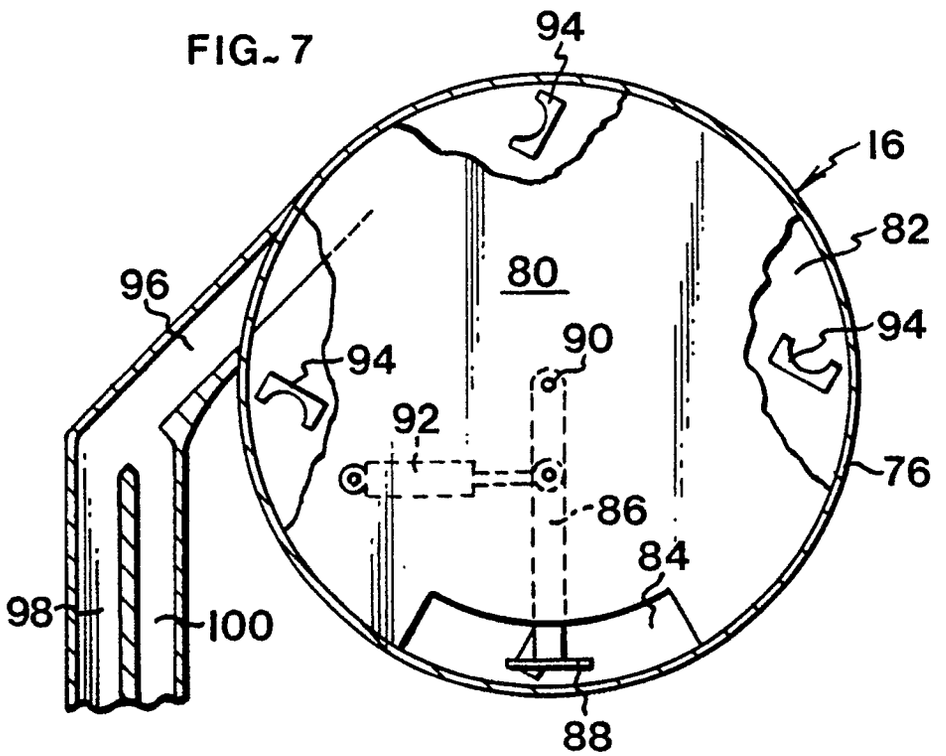
FIG.-7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European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 90850267.7

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)
D	SE, B, 406 065 (G.I. FRANSSON) 22 January 1979 - - -		B 65 B 5/10, 35/30
A	DE, B, 1 277 739 (ASTA-WERKE AKTIEN-GESELLSCHAFT CHEMISCHE FABRIK) 12 September 1968 *See figure 3* - - -		
A	FR, A, 662 565 (I.G. FARBENINDUSTRIE AKTIENGESELLSCHAFT) 8 August 1929 *See figure 1* - - -		
A	SE, B, 194 556 (FIRMAN WILHELM FETTE) 16 February 1965 & DE, 1 072 186 (WOLFGANG MÜLLER ET AL) 24 December 1958 - - -		TECHNICAL FIELDS SEARCHED (Int Cl 5) B 65 B
A	Derwent's Abstract 88-189427/27 of SU, A, 1 359 207 (MOLCHANOV AG), 14 December 1987 - - -		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	10.10.1990	A-L- ÅHS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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