



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.04.2022 Bulletin 2022/15

(51) International Patent Classification (IPC):
B31C 3/00 (2006.01) B31D 5/00 (2017.01)

(21) Application number: **20201336.3**

(52) Cooperative Patent Classification (CPC):
B31C 3/00; B31D 5/0095

(22) Date of filing: **12.10.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **SOTOWSKI, Krzysztof**
26-600 Radom (PL)
• **DRAPATA, Krzysztof**
26-600 Radom (PL)

(74) Representative: **Markieta, Jaroslaw Franciszek**
Kancelaria Rzeczników Patentowych
J. Markieta, M. Zielinska-Lazarowicz Sp. p.
Bukowinska 2 lok 160
02-703 Warszawa (PL)

(71) Applicant: **International Tobacco Machinery**
Poland SP. Z O.O.
26-600 Radom (PL)

(54) **DRIVE UNIT AND APPARATUS FOR MANUFACTURING OF SPIRAL TUBES**

(57) The object of the application is a drive unit (8, 8', 8", 8") of a forming unit (6) of an apparatus (1) for manufacturing of spiral tubes (2) having at least two layers, provided with rollers (16, 17, 18) for a forming strip (14), said drive unit being provided with a symmetrical movement mechanism (9, 9') adapted to synchronously move the rollers (16, 17, 18) of the forming strip (14) in such a way as to move the rollers (16, 17, 18) towards or away from each other. The object of the application is also an apparatus (1) comprising a drive unit (8, 8', 8", 8").

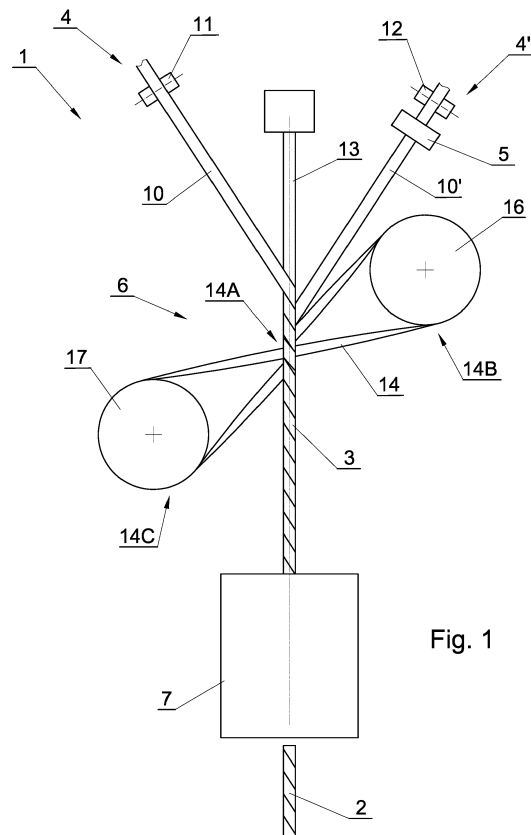


Fig. 1

Description

[0001] The object of this invention is a drive unit and an apparatus for manufacturing of spiral tubes.

[0002] In many branches of the food industry, there are used spiral tubes manufactured by winding material strands which after winding constitute tube layers. The spiral tubes may have multiple layers, but at least two layers of material are needed to produce a tube having a stable shape. Spiral tube forming apparatuses are known, among others, from documents DE1786551A1, EP1631425B1, US3150575A, US4378966A, US3942418A, WO2020099360A1, WO2020099361A1. Apparatuses for forming spiral tubes both vertically and horizontally are known, whereas individual tubes are cut off by means of usually circular knives, arranged to slide in the direction of movement of the tube being formed.

[0003] In known apparatuses, spiral tubes are manufactured in winding devices for spiral winding of paper strips around a rod to form a base tube. During winding, at least one of the strips is placed with the contact side in direct contact with the rod. Furthermore, the tube manufacturing systems comprise devices for feeding the strips to the winding device, and cutting devices for cutting the finished tube to predetermined lengths to form tube sections. The system may comprise a lubricating device along which at least one selected strip is moved so that a layer of lubricating material is applied on the contact side of at least one strip before at least one strip is wound around the pin. The lubricating device may comprise at least one lubricating element with a cylindrical external surface made of lubricating material.

[0004] From publications WO2020099360A1, WO2020099361A1 it is also known to use a forming strip that winds around a pin, pressing the paper strips together and around the rod to form a spiral tube.

[0005] In known apparatuses for manufacturing of spiral tubes, one of rollers around which the forming strip is guided is stationary, and the other is adjustable and is used to tighten the forming strip, thus the rollers are not arranged symmetrically in relation to the continuous tube forming point around which the forming loop of the forming strip is wound. The distance from one roller to the forming loop and the forming rod is constant, and the distance from the other roller to the forming loop and the forming strip may vary, which may result in a deformation of the forming rod and a deviation in production parameters, thus in manufacturing tubes of reduced quality.

[0006] The object of the invention is a drive unit of a forming unit of an apparatus for manufacturing of spiral tubes having at least two layers, provided with rollers for a forming strip. The unit according to the invention is characterised by being provided with a symmetrical movement mechanism adapted to synchronously move the rollers of the forming strip so as to move the rollers towards or away from each other.

[0007] The drive unit according to the invention is further characterised in that one of the rollers is a drive roller.

[0008] The drive unit according to the invention is further characterised in that two rollers are drive rollers.

[0009] The drive unit according to the invention is further characterised in that the drive rollers are driven by separate drive units synchronised with each other.

[0010] The drive unit according to the invention is further characterised in that the drive rollers are driven by one drive unit.

[0011] The drive unit according to the invention is further characterised in that the symmetrical movement mechanism comprises two sliding elements coupled with each other by means of a moving coupling member, the rollers being situated on the sliding elements.

[0012] The drive unit according to the invention is further characterised in that the symmetrical movement mechanism comprises the rotatably mounted coupling member, whereas the rotational movement of the coupling member is coupled with the movement of the sliding elements.

[0013] The drive unit according to the invention is further characterised in that the symmetrical movement mechanism comprises a slidably linearly mounted coupling member, whereas the linear movement of the coupling member is coupled with the movement of the sliding elements.

[0014] The drive unit according to the invention is further characterised in that the symmetrical movement mechanism comprises links connected by joints with the sliding elements.

[0015] The drive unit according to the invention is further characterised in that the symmetrical movement mechanism comprises two linear drives for synchronous movement of the sliding elements.

[0016] The object of the invention is further an apparatus for manufacturing of spiral tubes having at least two layers, comprising at least two feeding units for feeding a material strand, at least one glue unit for feeding the glue onto the material strand, a forming unit comprising a forming rod, rollers for guiding the forming strip and a drive unit of the forming strip, a cutting head for cutting off an individual tube from a formed continuous tube. The apparatus is characterised in that the forming unit is provided with a drive unit according to the invention.

[0017] Due to the application of the invention, the tensions in the forming strip loops are similar to one another so the forming rod is not subject to deformation, and the quality of the manufactured tubes is maintained for the whole range of operating speeds of the tube manufacturing apparatus. Moreover, the use of such mechanism facilitates mounting and dismounting of the forming strip.

[0018] The object of the invention is shown in detail in a preferred embodiment in a drawing in which:

Fig. 1 shows, in simplified terms, an apparatus for manufacturing of spiral tubes;

Figs. 2 and 3 show a drive unit of a forming unit in the first embodiment;

- Figs. 4 and 5 show the drive unit of the forming unit in the second embodiment,
- Fig. 6 shows the drive unit of the forming unit in the third embodiment,
- Fig. 7 shows the drive unit of the forming unit in the fourth embodiment, and
- Fig. 8 shows the drive unit of the forming unit in the fifth embodiment.

[0019] Fig. 1 shows, in simplified terms, an apparatus for manufacturing of spiral tubes according to the invention. The apparatus 1 for manufacturing of the spiral tubes 2 cut off from a continuous spiral tube 3 comprises feeding units 4 for feeding material strands, and further comprises a glue unit 5, a forming unit 6, and a cutting head 7.

[0020] The feeding unit 4 for feeding the material strand is adapted to unwind the material strand from a bobbin and feed such strand to the forming unit 6. The embodiment presented in Fig. 1 shows the apparatus 1 provided with two feeding units 4, 4' for feeding two material strands 10, 10'. For simplicity, the figure does not show the bobbins from which the material strands 10, 10' are unwound. The material strand 10, 10' is guided through multiple rollers, in the figure the last roller is marked as 11, 12 for each of the material strands 10, 10', from these rollers the material strand 10, 10' runs directly to a forming rod 13 in the forming unit 6. The material strand 10' passes the glue unit 5 which feeds the glue continuously onto the surface of the strand.

[0021] The forming unit 6 is adapted to receive the material strands 10, 10' and wind such strands in such a way that a spiral tube layer is continuously formed of the material strand, in the following description the formed tube will be referred to as a continuous tube or a continuous spiral tube. The forming unit 6 comprises a drive unit 8 provided with a symmetrical movement mechanism 9 (Figs. 2 and 3), the forming rod 13 and a forming strip 14. Each of the rollers 16, 17 may be a drive roller, and simultaneous driving of both rollers, for example by means of two motors synchronised with each other, is also possible, whereas an alteration in rotational speed for each of the motors is made in the same way.

[0022] The cutting head 7 is situated below the forming rod 13 and is adapted to cut off individual spiral tubes 2 from the continuous spiral tube 3. The cutting head 7 is provided with a rotating body in which circular knives are mounted, and the channel for the continuous spiral tube 3 is situated coaxially with the forming rod 13. The circular knives rotate around their axes and when cutting the tube they move in a direction parallel to the axis of rotation of the body at a speed equal to the speed of continuous tube forming, which makes it possible to cut off individual spiral tubes from the moving continuous tube 3. The operation of such cutting head is described in more detail in the international publication WO2020099361A1. The

individual spiral tubes 2 may be received from the cutting head 7 in any way.

[0023] The continuous spiral tube 3 is formed by the forming loop 14A of the forming strip 14 in the forming unit 6, the loop 14A being situated centrally between the loops 14B and 14C of the forming strip 14 (Fig. 1) wound around the rollers 16 and 17 of the drive unit 8, whereas the rollers 16, 17 are mounted on the symmetrical movement mechanism 9 (Fig. 2, Fig. 3). The symmetrical movement mechanism 9 is adapted to move rollers 16, 17 simultaneously away from or towards each other, i.e. synchronously in opposite directions. Alteration in the position of the rollers 16, 17 may be necessary due to selection of optimal operating parameters for the apparatus. When installing and replacing the forming strip, the forming loop does not alter its position, thus there is no force directed transversely to the forming rod which may deform the rod. The forming of the continuous spiral tube 3 requires a certain tension of the forming strip 14. The symmetrical movement of the rollers 16, 17 ensures that in the loops 14B, 14C of the forming strip, for the manufacturing speed being varied, the tensions vary in a similar way over the whole range of speed of the apparatus 1 for manufacturing of spiral tubes so that the oppositely directed forces acting on the forming rod 13 have similar values and the forming rod 13 is not deformed during the operation of the apparatus. The symmetrical movement mechanism 9 may be adapted to move the drive roller 16 together with the drive unit and the roller 17 being a passive roller simultaneously away from or towards each other.

[0024] The symmetrical movement mechanism comprises slidably mounted elements, for example plates on which the rollers for the forming strip are mounted, the movable elements coupling the movement of both sliding elements and the drive element which forces alteration in the position of the sliding elements. In the embodiment shown in Figs. 2 and 3, the drive roller 16 is mounted on the shaft 20 of the motor 21 which is mounted on a plate 22, slidably mounted in a guide 23 on a supporting plate 24. The motor 21 and the drive roller 16 constitute the drive unit 35. The passive roller 17 is rotatably mounted on a plate 25, slidably mounted in a guide 26 on the supporting plate 24. The movement of the plate 22 and the movement of the plate 25 are coupled together. The plate 22 and the plate 25 are coupled with a rotatably mounted coupling member 27 by means of links 28, 29. The link 28 is connected with the plate 22 by means of a joint 30 and with the coupling member 27 by means of a joint 31, and the link 29 is connected with the plate 25 by means of a joint 32 and with the coupling member 27 by means of a joint 33, whereas the coupling member 27 has the form of a disc with an axis of rotation k. The position of the rollers 16, 17 in relation to the centre of the forming loop 14A and in relation to the centre plane S of the symmetrical movement mechanism 8 is described by dimensions A and B (the forming rod 13 is not shown in Fig. 2). The rotation of the coupling member 27 results in ro-

tation of the joints 31, 33 around the axis k, thus alteration in the position of the rollers 16, 17 symmetrically in relation to the plane S which is perpendicular to the plane of the drawing and on which lies the centre R of the forming loop 14A. The axis of rotation k of the coupling member 27 may also lie in the plane S.

[0025] The rotation of the coupling member 27 may be made after fixing the forming strip 14 in order to introduce an appropriate tension in the forming strip 14. During the operation of the apparatus, the tensions in the strip may be corrected. Alteration in angular position in the direction H results in increased tensions in the forming strip, and alteration in angular position in the direction L results in decreased tensions. The alteration in angular position of the coupling member 27 is effected by means of a mechanism 37 for altering the position of the coupling member. The mechanism 37 for altering the position of the coupling member comprises a link 38, a pin 39 and a body 40. The link 38 is connected with the coupling member 27 by means of a joint 41, and at the end 42 of the link 38 on the side opposite to the joint 41 there is a threaded hole 43 into which the threaded pin 39 is screwed. The pin 39 is rotatably mounted in the body 40. The body 40 is mounted by means of a joint 44. The alteration in angular position of the coupling member 27 is effected by turning the pin 39 around the axis m by means of a motor M1 or manually, the turning mechanism for turning the pin 39 is not shown. The rotation of the coupling member 27 may be effected by any other mechanism.

[0026] The symmetrical movement mechanism may be adapted to move two drive rollers. Each of the drive rollers may have a separate drive, or one drive unit for both rollers may be used. Figs. 4 and 5 show a drive unit 8' in the second embodiment wherein two drive rollers 16, 18 driven by two separate drive units 35, 36 are used. Uniform pushing back and forth of the drive units 35, 36 ensures that the tensions in both loops 14B, 14C of the forming strip 14 are kept at a similar level so that the forming strip 13 is symmetrically loaded and is not deformed, thus the parameters necessary for manufacturing of the spiral tube 3 of proper quality are maintained. The use of two drive rollers is more advantageous than the use of one drive roller because during the start of the apparatus the tensions in the forming strip increase in a similar way, and the same happens every time when the machine speed changes.

[0027] Fig. 6 shows a drive unit 8" in the third embodiment wherein the symmetrical movement mechanism 9' comprises a coupling member 45 adapted to make a linear movement, and a mechanism 37 for altering the position of the coupling member and a link 46, 47. The operation of the mechanism 37 for altering the position of the coupling member was discussed for the first embodiment. The coupling member 45 is movably mounted in a linear guide 48. The linear movement of the coupling member 45 along the guide 48 results in alteration in the position of the sliding elements 22 and 25 and alteration in the position of the drive rollers. The linear movement

of the joint 49 situated on the coupling member 45 by the link 46 and the joint 51 results in a movement of the sliding element 22 along the guide 23. The linear movement of a joint 50 situated on the coupling member 45 by the link 47 and a joint 52 results in a movement of the sliding element 25 along the guide 26.

[0028] Fig. 7 shows a drive unit 8''' in the fourth embodiment wherein the driving torque from a motor 60 is transmitted to the drive rollers 16, 18 by means of angular gears 61, 62 which are slidable in relation to a shaft 63.

[0029] Fig. 8 shows a drive unit 8'''' in the fifth embodiment wherein the drive rollers 16, 18 are driven by separate drive units 35, 36. The symmetrical movement mechanism 9'' comprises the plates 22, 25 moved away from and towards each other by means of two linear drives 70, 71 (the drives are shown schematically). The plate 22 is moved by means of a motor 72 driving a guide screw 73 along which moves a nut 74 connected to the plate 22. The plate 25 is moved by means of a motor 75 driving a guide screw 76 along which moves a nut 77 connected to the plate 25.

[0030] During the operation of the apparatus, the material strands 10, 10' are fed from the feeding unit 4, 4' to the forming unit 6, and the material strands 10, 10' are wound around the forming rod 13. The first material strand 10 is wound as first, the second material strand 10' is wound as second and onto one side of the same a glue layer is applied. The fed material strands 10, 10' are pressed against the forming rod 13 by means of the forming strip 14. The forming loop 14A causes that during the movement of the forming strip 14 the material strands 10, 10' are simultaneously pressed, and the continuous spiral tube 3 being formed is turned and linearly moved. The moving continuous spiral tube 3 is cut by means of the cutting head 7 into the individual tubes 2.

Claims

1. A drive unit (8, 8', 8'', 8''') of a forming unit (6) of an apparatus (1) for manufacturing of spiral tubes (2) having at least two layers, provided with rollers (16, 17, 18) for a forming strip (14),
characterised by
being provided with a symmetrical movement mechanism (9, 9', 9'') adapted to synchronously move the rollers (16, 17, 18) of the forming strip (14) so as to move the rollers (16, 17, 18) towards or away from each other.
2. The drive unit as in claim 1, **characterised in that** one of the rollers (16) is a drive roller.
3. The drive unit as in claim 1, **characterised in that** two rollers (16, 18) are drive rollers.
4. The drive unit as in claim 3, **characterised in that** the drive rollers (16, 18) are driven by separate drive

units (35, 36) synchronised with each other.

5. The drive unit as in claim 3, **characterised in that** the drive rollers (16, 18) are driven by one drive unit (35). 5
6. The drive unit as in any of claims 1 to 5, **characterised in that** the symmetrical movement mechanism (9) comprises two sliding elements (22, 25) coupled with each other by means of a movable coupling member (27), the rollers (16, 17, 18) being situated on the sliding elements (22, 25). 10
7. The drive unit as in claim 6, **characterised in that** the symmetrical movement mechanism (9) comprises the rotatably mounted coupling member (27), whereas the rotational movement of the coupling member (27) is coupled with the movement of the sliding elements (22, 25). 15
20
8. The drive unit as in claim 6, **characterised in that** the symmetrical movement mechanism (9') comprises a slidably linearly mounted coupling member (45), whereas the linear movement of the coupling member (45) is coupled with the movement of the sliding elements (22, 25). 25
9. The drive unit as in claim 7 or 8, **characterised in that** the symmetrical movement mechanism (9; 9') comprises links (28, 29; 46, 47) connected by joints with the coupling member (27; 45) and with the sliding elements (22, 25). 30
10. The drive unit as in claim 3, **characterised in that** the symmetrical movement mechanism (9'') comprises two linear drives (70, 71) for synchronous movement of the sliding elements (22, 25). 35
11. An apparatus (1) for manufacturing of spiral tubes (2) having at least two layers, comprising 40
 - at least two feeding units (4, 4') for feeding a material strand (10, 10'),
 - at least one glue unit (5) for feeding the glue onto the material strand (10'), 45
 - a forming unit (6) comprising a forming rod (13), rollers (16, 17, 18) for guiding the forming strip (14) and a drive unit (8) of the forming strip (14),
 - a cutting head (7) for cutting off an individual spiral tube (2) from a formed continuous spiral tube (3), 50
 - characterised in that**
 - the forming unit (6) is provided with a drive unit (8, 8', 8'', 8''') as in any claim 1 to 10. 55

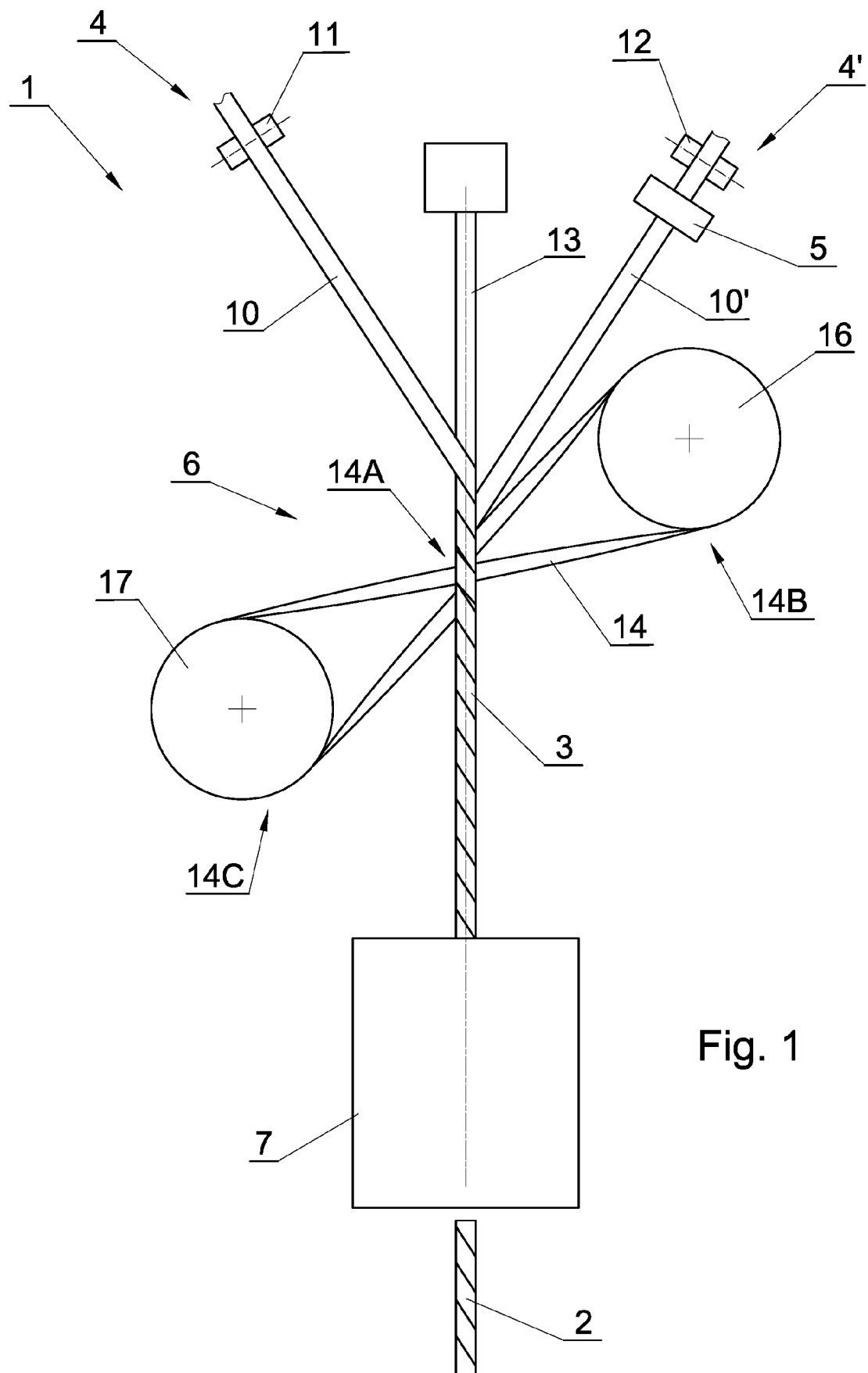
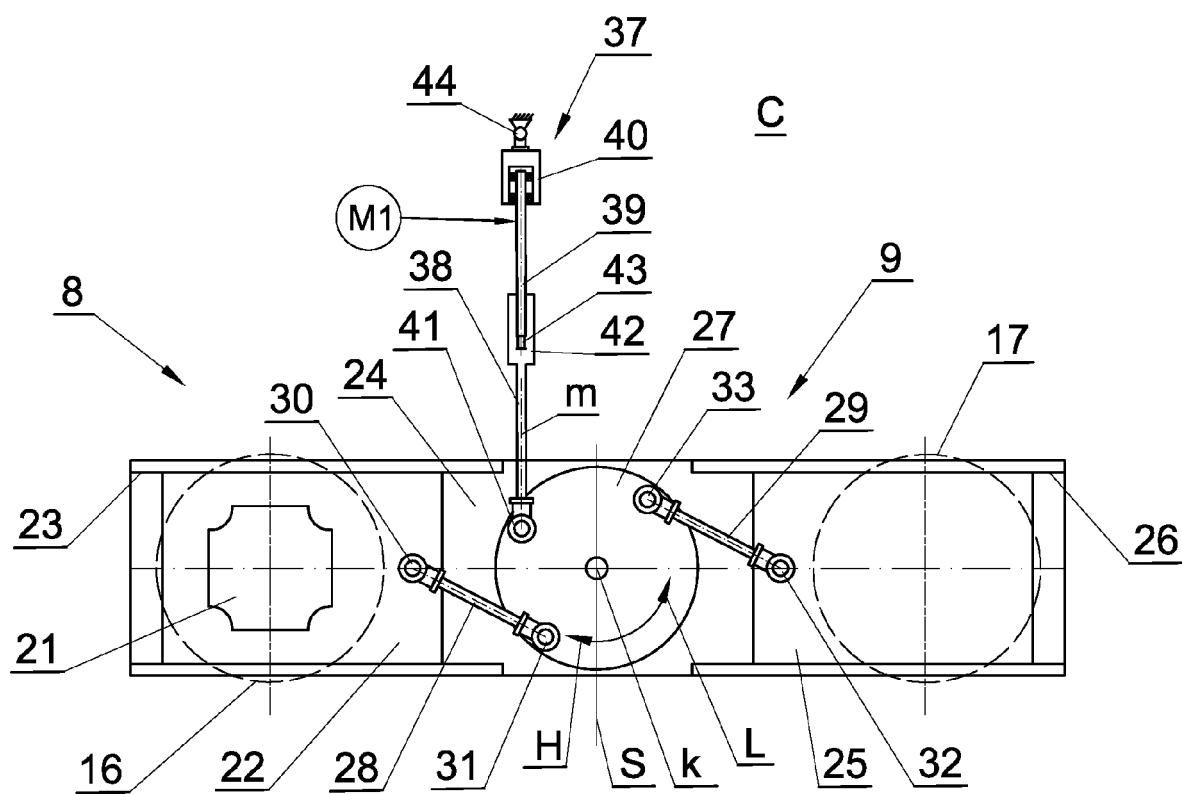
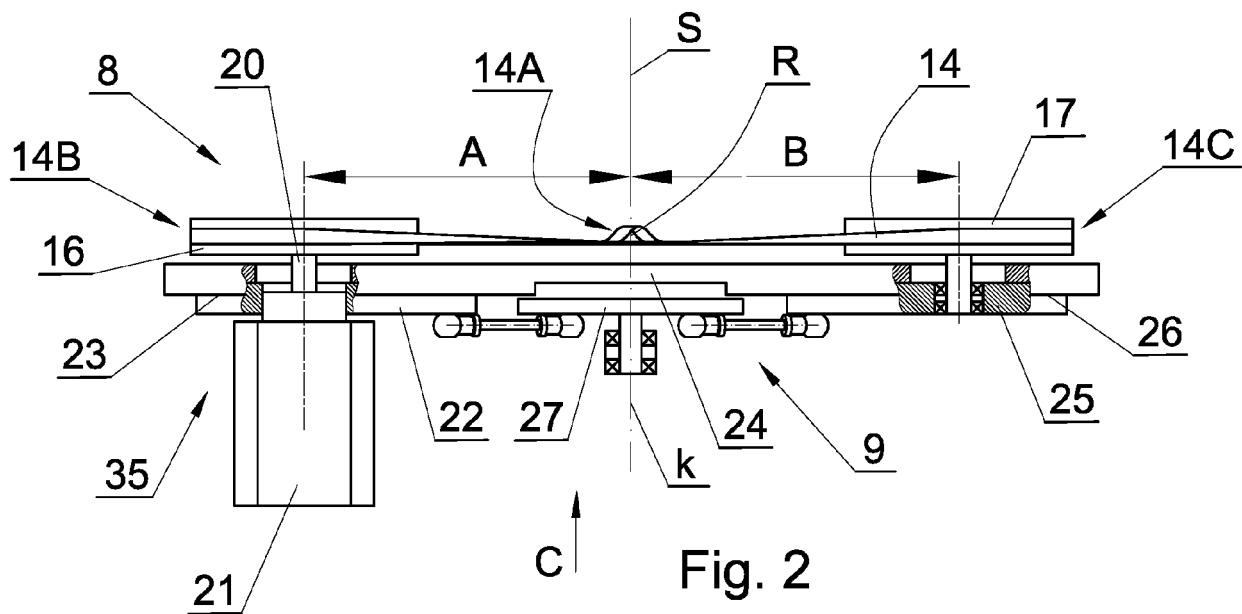


Fig. 1



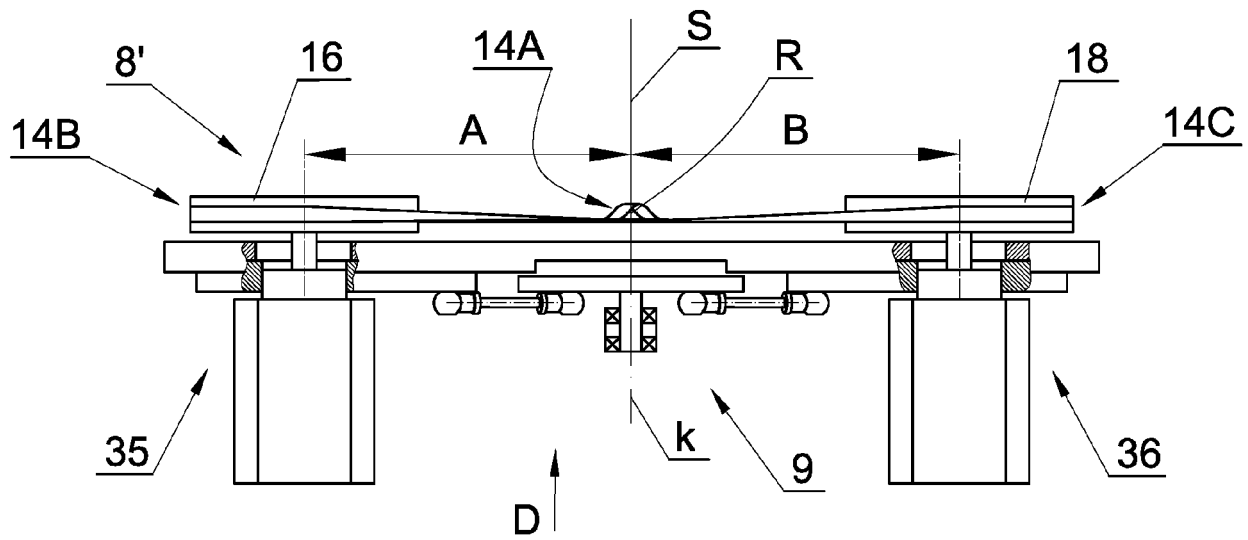


Fig. 4

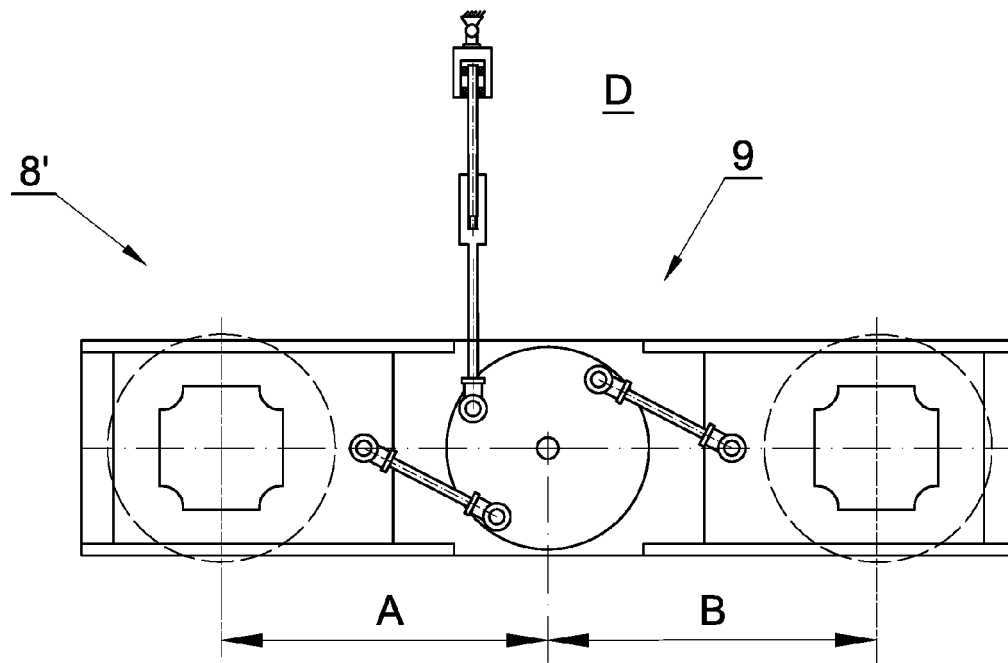


Fig. 5

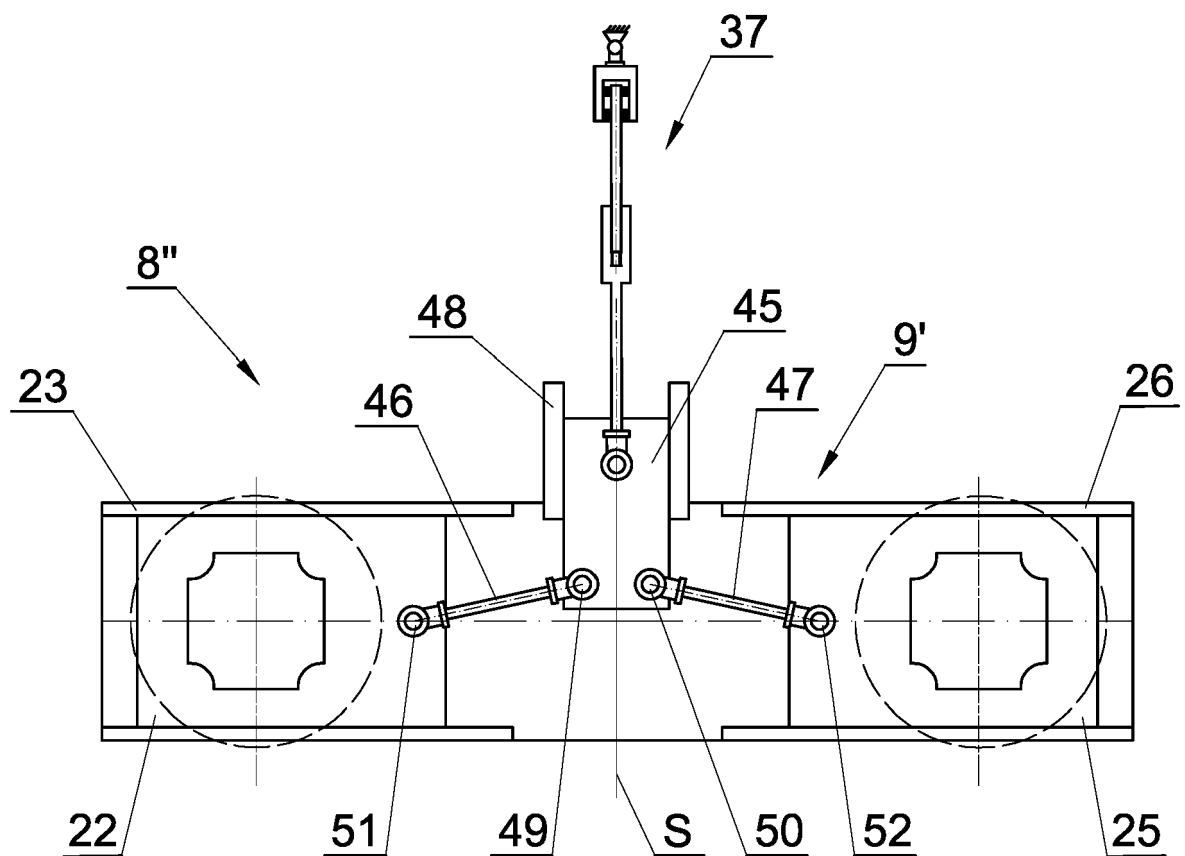


Fig. 6

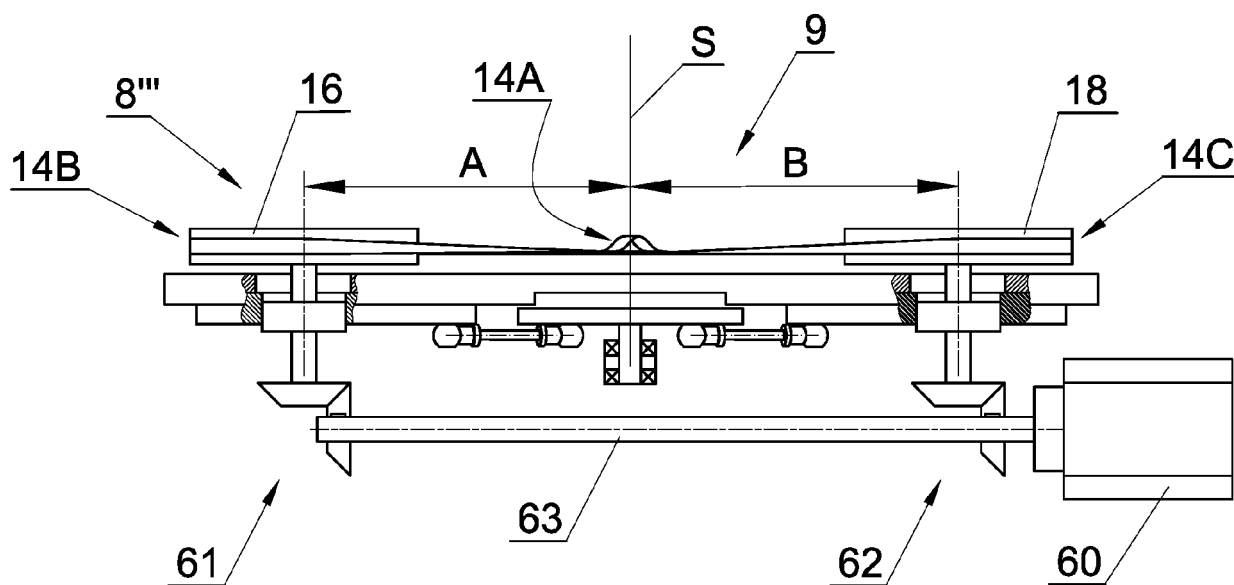


Fig. 7

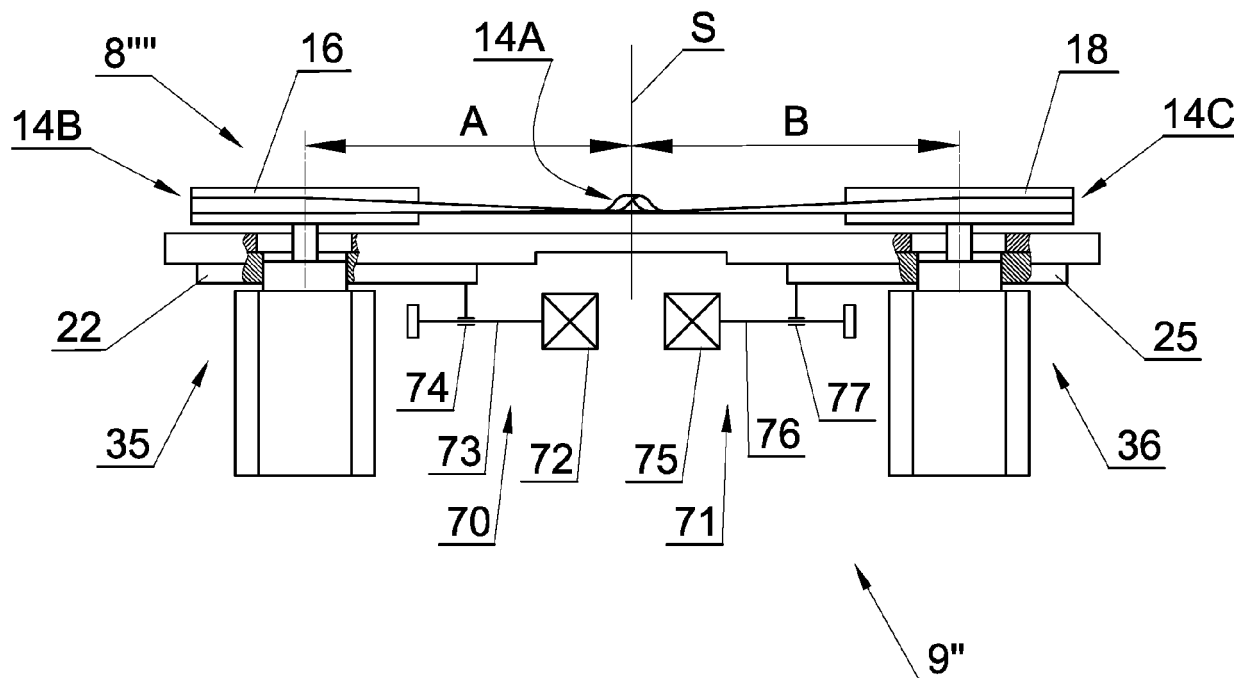


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 20 20 1336

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 1 967 171 A (JAMES BALTON) 17 July 1934 (1934-07-17)	1-3,5-9, 11	INV. B31C3/00
Y	* page 1, line 103 - page 2, line 66; figures 1, 4 *	4,10	B31D5/00

X	US 1 941 993 A (MINTON PAUL H) 2 January 1934 (1934-01-02)	1-3,5,11	
Y	* figures 1, 2 *	4,10	
A		6-9	

X	GB 771 615 A (GEE MFG COMPANY LTD) 3 April 1957 (1957-04-03)	1-3,5-9, 11	
Y	* page 2, lines 70-85; figure 1 *	4,10	

X	EP 0 074 453 A1 (ABZAC CARTONNAGES [FR]) 23 March 1983 (1983-03-23)	1-3,5-9, 11	
Y	* figure 4 *	4,10	

Y	US 3 581 744 A (VOSS JOSEPH A ET AL) 1 June 1971 (1971-06-01)	4,10	
	* figure 5 *		

A	US 4 341 523 A (IKUTA SHICKINOSUKE) 27 July 1982 (1982-07-27)	1-11	B31C B31D
	* figures 1, 2 *		

The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 March 2021	Examiner Cardoso, Victor
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		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 L : document cited for other reasons & : member of the same patent family, corresponding document	

 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 20 1336

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-03-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 1967171 A	17-07-1934	NONE	
US 1941993 A	02-01-1934	NONE	
GB 771615 A	03-04-1957	NONE	
EP 0074453 A1	23-03-1983	AT 21498 T CA 1183764 A DE 74453 T1 EP 0074453 A1 ES 8400290 A1 FR 2512733 A1 US 4473368 A	15-09-1986 12-03-1985 18-08-1983 23-03-1983 16-10-1983 18-03-1983 25-09-1984
US 3581744 A	01-06-1971	DE 1919847 A1 FR 2007786 A1 GB 1272863 A GB 1272864 A JP S4811157 B1 US 3581744 A	20-11-1969 09-01-1970 03-05-1972 03-05-1972 11-04-1973 01-06-1971
US 4341523 A	27-07-1982	JP S5642641 A JP S5841195 B2 US 4341523 A	20-04-1981 10-09-1983 27-07-1982

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 1786551 A1 [0002]
- EP 1631425 B1 [0002]
- US 3150575 A [0002]
- US 4378966 A [0002]
- US 3942418 A [0002]
- WO 2020099360 A1 [0002] [0004]
- WO 2020099361 A1 [0002] [0022]
- WO 2020099361 A [0004]
- WO A1 A [0004]