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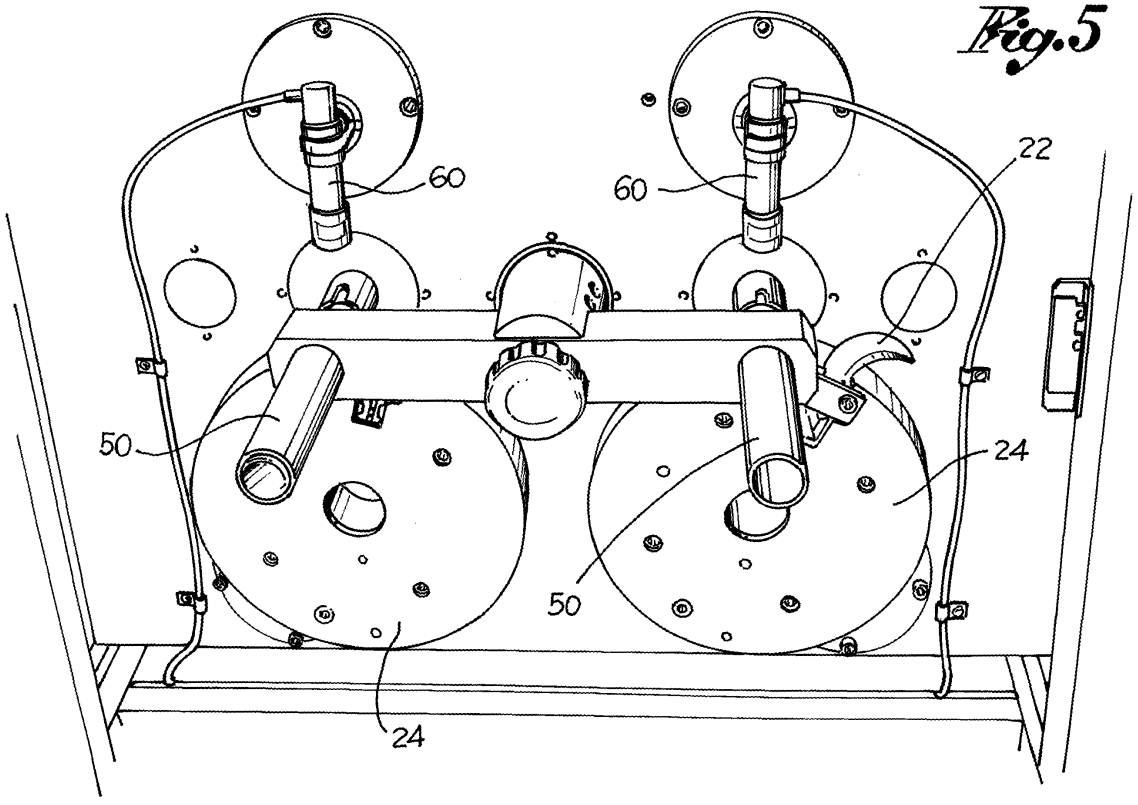
(54) **Cutting device of an apparatus for producing synthetic caps**

(57) The object of the present invention is a cutting device associable to a production device for producing caps of synthetic material. The production device produces a cord of cylindrical elements, which will form the caps, connected by a tang. The cutting device comprises cutting means suitable for cutting said tang. Said cutting means comprise a rotating blade (22), mounted on a cutting drum (24). Moreover, there are provided advance means, continuous or intermittent, for advancing the cord and moving the tang to a position suitable for being cut. In such position, the solid element to be cut is stationary and the blade (22) cuts the tang, separating the solid element from the cord and forming a semi-finished cap.



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Description

[0001] The object of the present invention is a cutting device of an apparatus for producing caps of synthetic material, for example of plastic material. In particular, the object of the present invention is a cutting device for an apparatus for producing synthetic caps having the shape of a small full cylinder, typical of corks, normally used for corking up wine bottles.

[0002] The production of synthetic caps has undergone considerable increase over the last years, essentially due to the low production costs, if compared to those of corks, to the wide availability of raw materials and, last but not least, to the fact that the plastic material is virtually inert relative to the wine contained in the bottle.

[0003] For the production of synthetic caps it is possible to use a moulding process, using a mould and a punch with a large number of impressions. However, such process does not allow obtaining large productions.

[0004] On the other hand, an extrusion process is very effective, wherein a device produces a cord comprised of a succession of cylindrical elements connected to each other by a tang. The cord is then cut by a cutting device, for making a semi-finished cap intended for subsequent processing steps for the production of the finished cap.

[0005] An extrusion device for the production of synthetic caps is described, for example, in Italian patent IT 1326870, of which the Applicant is the holder.

[0006] However, currently known cutting devices exhibit the disadvantage of being suitable for meeting only low productions of synthetic caps.

[0007] The object of the present invention is to make a cutting device for an apparatus for producing synthetic caps which should meet the above needs and overcome the disadvantages mentioned above.

[0008] Such object is achieved by a cutting device obtained according to claim 1. The dependent claims describe embodiment variations.

[0009] The features and advantages of the cutting device according to the present invention will appear more clearly from the following description, made by way of an indicative and non-limiting example with reference to the annexed figures, wherein:

[0010] - figure 1 shows a diagram of an apparatus for making semi-finished caps, comprising a cutting device according to a variation of embodiment of the present invention;

[0011] - figure 2 shows a front perspective view of the cutting device of figure 1;

[0012] - figure 3 shows a back perspective view of the cutting device of figure 2;

[0013] - figures 4a and 4b show a partial cutting sequence carried out through the device of figure 2;

[0014] - figure 5 shows a cutting device according to a further variation of embodiment of the present invention, and

[0015] - figures 6a and 6b show means for advancing the cutting device of figure 5, respectively in a disengaged and an engaged configuration;.

[0016] An apparatus 1 for producing synthetic caps, for example of plastic material, comprises a production device 2 and a cutting device 4.

[0017] The production device 2 is suitable for producing at least one continuous cord of semi-finished caps of synthetic material. In other words, the continuous cord is comprised of a succession of solid elements C1, C2, that will make the semi-finished caps and after that, the finished caps, and tangs T that hold said solid elements C1, C2 connected.

[0018] In particular, once an advancement direction of the production, which goes from the production device 2 to the cutting device 4, has been fixed, a previous solid element C1, which will first reach the cutting device 4, and a subsequent solid element C2, which will reach the cutting device 4 right after the previous solid element C1, are distinguished.

[0019] Said solid elements C1, C2 generally exhibit cylindrical or truncated cone shape and a nominal dimension, such as the diameter, greater than the nominal dimension of the tang that holds them together.

[0020] According to a preferred embodiment, the production device 2 comprises an extruder unit 6, for extruding the synthetic material, and a forming unit 8, downstream of the extruder unit 6, for forming the tang.

[0021] The forming unit 8 is of the chain type, that is, comprising two chains of coupling half-chills. Each half-chill exhibits an inner cavity. By coupling the half-chills, a chill is obtained which exhibits an impression therein, formed by the coupling of the inner cavities of each half-chill. Said impression, in negative, matches the shape of a solid element C1, C2 and of a portion of the relevant tang T.

[0022] The two chains rotate in opposite direction. By a coupling portion, they connect forming said chill. At the beginning of the coupling portion, the extruder unit 6 feeds the synthetic material to the chill. At the end of the coupling portion, the two chains separate and the cord comes out.

[0023] Preferably, the forming unit 8 is suitable for the concurrent production of two cords.

[0024] Moreover, the production apparatus 1 comprises a cooling unit, comprising a chute 12 and at least one cooling station, for example by air.

[0025] The cord moves on chute 12, for example carried by said tape, towards the cutting device 4. Over the path from the production device 2 to the cutting device 4, the cord is impinged by air jets blown by the cooling stations.

[0026] Once the cutting device 2 has been reached, the cord exhibits a sufficient consistency for separating the solid elements C1, C2 without them being deformed.

[0027] The cutting device is suitable for separating said previous solid element C1 from said next solid element C2, cutting tang T that connects them. Said cutting operation is carried out in a cutting zone of the device.

[0028] Preferably, the cutting device 2 comprises guid-

ing means suitable for guiding said solid elements C1, C2 of the cord from the production device 2 towards said cutting zone. For example, said guiding means comprise at least one tube 20 suitable for seating at least one portion of the cord.

[0029] Tubes 20 carry the solid elements C1, C2 to be cut towards the cutting zone.

[0030] The cutting device 2 comprises cutting means suitable for cutting tang T, for separating the previous solid element C1 from the tang, that is, from the next solid element C2.

[0031] Said cutting means comprise at least one blade 22 suitable for continuously rotating in one direction of rotation for interfering with said tang T and cutting it.

[0032] Preferably, said cutting means comprise at least one cutting drum 24, comprising a circular plate, at the periphery of which said blade 22 is mechanically connected.

[0033] The cutting drum 24 is suitable for rotating about an axis of rotation Z-Z.

[0034] Preferably, the cutting device 2 comprises two cutting drums 24, carrying respective blades 22, each drum being intended for cutting a respective cord. Said cutting drums preferably rotate in the same direction of rotation and the respective rotation axes Z-Z are parallel to one another.

[0035] Moreover, said cutting device 2 comprises synchronisation means suitable for synchronising the rotation of said cutting drums 24.

[0036] In particular, said synchronisation means comprise, for example, toothed wheels 26 integral with said cutting drums 24 and a single driving belt 28 that engages said toothed wheels 26 and are associable to an electrical motor for placing in rotation said cutting drums 24. It should be noted that said synchronisation means impart rotation into the same direction to said rotation drums 24.

[0037] Moreover, said cutting device 2 comprises advance means, suitable for influencing said cord for moving said tang T to a position suitable for interfering with said blade 22.

[0038] In accordance with a first embodiment variation, said advance means operate on the cord continuously, and in particular directly on the previous solid element C1 intended for being separated from the cord (figures 2 and 3).

[0039] Said advance means comprise a pushing track 30 having spiral pattern, suitable for rotating about its axis for influencing the previous solid element C1.

[0040] In particular, said pushing track is integral with said cutting drum 24 and peripherally connected thereto, for example at the side surface of said cutting drum 24.

[0041] Preferably, the pushing track 30 comprises an active portion, for example helix like, and a passive portion, that is, flat. During the drum rotation, the active portion of the pushing track 30 pushes the solid element C1, making it advance; at the end of the active portion, the passive portion slightly touches the solid element C1, but does not cause the advancement thereof, the profile of said passive portion being flat.

[0042] Blade 22 is connected to the cutting drum 24 at the flat portion of the pushing track 30, so that the cutting of tang T takes place while the previous solid element C1 is stationary.

[0043] Preferably, said advance means comprise at least one advance drum 36, also suitable for rotating and peripherally carrying a further pushing track 30, opposite the respective cutting drum 24.

[0044] In other words, according to such embodiment variation, a pair of drums acts on a single cord: a cutting drum 24, carrying blade 22 and pushing track 30, and an advance drum 36, carrying the pushing track 30 only.

[0045] Preferably, the axis of rotation of the cutting drum 24 and the axis of rotation of the advance drum 36 are aligned with the advance axis of the cord. Moreover, the direction of rotation of the cutting drum 24 and of the advance drum 36, through said synchronisation means, is equal.

[0046] In accordance with a preferred embodiment variation, said advance means operate in an intermittent manner, coming into contact with the cord for pushing it only when a cord advance is necessary.

[0047] Preferably, said advance means comprise a fixed wheel 100, having fixed axis of rotation, perpendicular to the cord advance axis. Said fixed wheel 100 is operatively connected to advance actuating means, for example comprising an electrical motor, suitable for placing in rotation said fixed wheel 100.

[0048] Moreover, said advance means comprise an oscillating wheel 102, having moving axis of rotation, perpendicular to the cord advance axis and parallel to the axis of rotation of the fixed wheel 136. Preferably, the oscillating wheel 102 is idle, that is, not connected to any motors.

[0049] Moreover, said advance means comprise an oscillating plate 104, carrying, for example in the proximity of an end, said oscillating wheel 102.

[0050] Said advance means are suitable for switching from an engaged configuration, wherein they influence the cord for the advance, to a disengaged configuration.

[0051] In the engaged configuration, the oscillating plate 104 is in such angular position that the oscillating wheel 102 engages with the cord, so that said cord remains engaged between the oscillating wheel 102 and the fixed wheel 100, placed in rotation by said electrical motor of the advance actuating means (figure 6b).

[0052] By virtue of the friction of the cord on the fixed wheel 100 and the oscillating wheel 102, the cord is pushed to advance.

[0053] In the disengaged configuration, the oscillating plate 104 is in such angular position that the oscillating wheel 102 does not engage the cord or engages it to an extent not sufficient for pushing it to advance (figure 6a).

[0054] Moreover, said advance means are also suitable for locking said cord in a predetermined advance position and comprise, to this end, braking means.

[0055] Said braking means comprise a braking wheel

106, suitable for rotating about a moving axis, perpendicular to the cord advance axis. For example, said braking wheel 106 is mounted idle at the end of said oscillating plate 104, opposite the position of the oscillating wheel 102.

[0056] Preferably, moreover, said braking means comprise an influencing opening 108, obtained through tube 20 of the guiding means.

[0057] Said braking wheel 106 is suitable for switching from an engaged configuration, wherein it locks the cord, to a disengaged configuration.

[0058] In the engaged configuration, that corresponds to the disengaged configuration of the oscillating wheel 102, said braking wheel 106 engages the cord through opening 108, so as to lock it against the inner wall of tube 20, preventing the advance thereof (figure 6a).

[0059] In the disengaged configuration, that corresponds to the engaged configuration of the oscillating wheel 102, the braking wheel 106 does not engage the cord or does not engage it to an extent sufficient for preventing the advance thereof (figure 6b).

[0060] The fixed wheel 100, the oscillating wheel 102 and the braking wheel 106 exhibit an annular cavity shaped so as to match the shape of the cord caps, so that also in the case where such caps have not sufficiently solidified and are therefore still soft, the engagement with said wheels does not change the shape thereof.

[0061] Moreover, said cutting device 2 comprises distribution means suitable for guiding said cut solid element C1 towards container of cut elements. For example, said distribution means comprise at least one tube 50 suitable for guiding said cut solid element C1 towards said container.

[0062] Moreover, said cutting device 2 comprises detecting means suitable for detecting the correct positioning of said previous solid element C1 for being separated from said cord. For example, said detecting means comprise at least one proximity sensor 60.

[0063] In the normal operation of the production apparatus 1, the extruder unit 6 extrudes the synthetic material, feeding the chills formed to the subsequent coupling of the half-chills of the chains of the forming unit 8.

[0064] At the end of the coupling portion of the chains, the half-chills separate and two cords comprised of a succession of solid elements C1, C2 connected by tangs T generally exit from the forming unit 8.

[0065] The formed solid elements C1, C2 pass through the cooling unit, consolidating and reaching the cutting device.

[0066] The solid elements pass inside the tubes of the guiding means, to be conducted towards the cutting zone of the cutting device.

[0067] According to an embodiment variation of the device, the previous solid element C1 engages, at the end connected to the next solid element C2 through tang T, with the pushing tracks 30 of the cutting drum 24 and of the advance drum 36, in continuous rotation.

[0068] The active portion of the pushing track 30, being shaped as a helix, operates on the previous solid element C1 pushing it and causing the advance thereof.

[0069] At the end of the active portion, the passive portion of the pushing track 30 slightly touches the previous solid element C1, but does not cause the advance thereof, as it is shaped as a flat curve.

[0070] Blade 22 of the cutting drum 24 is arranged at the passive portion of the pushing track 30, axially spaced therefrom, so as to interfere with tang T that connects the previous solid element C1 to the next solid element C2.

[0071] During the rotation, the blade drives into tang T and cuts it, separating the previous solid element C1 from the next solid element C2.

[0072] As the rotation continues, the beginning of the active portion engages with the end of the next solid element C2, connected to a further tang of a further next solid element, for causing the advance thereof.

[0073] The previous solid element C1, on the other hand, now separate from the cord, is guided by said distribution means, for example by a chute, towards the container of cut elements, to be sent to the next processes.

[0074] It should be noted that the blade rotation is continuous, also during the advance step of the solid element to be cut, advantageously imparting a high cutting frequency to the cutting device 2.

[0075] If the previous solid element C1 to be cut arranges in an incorrect position for carrying out the cut, the proximity sensor 60 detects such incorrect position and stops the cutting device 2 on the whole apparatus 1.

[0076] According to the further embodiment variation of the device, the advance means engage the cord in an intermittent manner.

[0077] According to such variation, the proximity sensor 9 detects the advance position of the previous solid element C1. If such position is incorrect for the cut, which must take place at the tang, the oscillating wheel 102 is kept in the engaged configuration (figure 6b).

[0078] As a consequence, the tang engaged between the fixed wheel 100, motor driven and placed in rotation, and the oscillating wheel 102, advances.

[0079] When the previous solid element C1 reaches the suitable cutting position, detected by the proximity sensor 60, the oscillating wheel 102 is removed from the tang while the fixed wheel 100 remains in rotation.

[0080] Correspondingly, the braking wheel 106 pushes the cord, through opening 108, against the side wall of tube 20, locking it into position.

[0081] Blade 22, by rotating, interferes with the tang between the previous solid element C1 and the next solid element C2, separating them.

[0082] Innovatively, the cutting device according to the present invention exhibits a high cutting frequency, thus being especially suitable for apparatus for producing a large number of pieces.

[0083] Advantageously, moreover, the cord advance and the cut are synchronised, so as to make the cut when the cord is stationary.

[0084] According to a further advantageous aspect, the solid element to be cut is pushed by pairs of drums or by pairs of wheels, preventing jamming or misalignment of the element relative to the blade.

[0085] Advantageously, moreover, the solid elements to be cut, although locked, are not deformed or affected, ensuring a high quality standard of the produced caps.

[0086] It is clear that a man skilled in the art can make several changes and adjustments to the cutting device described above in order to meet specific and incidental needs, all falling within the scope of protection defined in the following claims.

Claims

1. Cutting device (4) associable to a production device (2),
   wherein said production device is suitable for producing a continuous cord of synthetic material comprising a succession of solid elements (C1, C2) and tangs (T),
   wherein a previous solid element (C1) is connected to a next solid element (C2) by said tang (T),
   said cutting device being suitable for separating said previous solid element (C1) from said next solid element (C2) cutting said tang (T)
   wherein said cutting device comprises

   - cutting means suitable for cutting said tang (T);

   said cutting device being **characterised in that** said cutting means comprise at least one blade (22) suitable for interfering with said tang (T) and cutting it.

2. Device according to claim 1, wherein said cutting means comprise at least one cutting drum (24), said blade (22) being integral to said drum (24).

3. Device according to claim 2, wherein said cutting drum (24) comprises a circular plate having a predetermined diameter, said blade (22) being peripherally connected to said circular plate.

4. Device according to claim 2 or 3, wherein said device comprises two cutting drums (24), suitable for rotating about respective axes of rotation parallel to one another, each drum being positioned for operating on a respective cord.

5. Device according to claim 4, comprising synchronisation means suitable for synchronising the rotation of said cutting drums (24).

6. Device according to claim 5, wherein said synchronisation means are associable to a motor for placing in rotation said cutting drums (24) and are suitable for imparting a rotation in the same direction to said cutting drums (24).

7. Device according to claim 6, wherein said synchronisation means comprise toothed wheels (26), made integral to cutting drums (24), and a driving belt (28) suitable for kynematically connecting said toothed wheels (26) and said motor.

8. Device according to any one of the previous claims, further comprising advance means, suitable for influencing said cord for moving said tang (T) to a position suitable for interfering with said blade (22).

9. Device according to claim 8, wherein said advance means are continuously in abutment with said previous solid element (C1), intended for being separated from the cord.

10. Device according to claim 8 or 9, wherein said advance means comprise a pushing track (30) having spiral pattern, said track being suitable for rotating about its axis for pushing said previous solid element (C1) intended to be cut.

11. Device according to claim 10, wherein said pushing track comprises an active helix portion and a flat passive portion.

12. Device according to claim 2 and 11, wherein said pushing track (30) is integral to said cutting drum (24).

13. Device according to any one of claims 10 to 12, wherein said advance means comprise at least one pair of pushing tracks (30), each pushing track of said pair acting on a single cord.

14. Device according to claim 12 and 13, wherein said advance means comprise said cutting drum (24) and an advance drum (36), each pushing track (30) of said pair of pushing tracks being integral with a single drum (24, 36).

15. Device according to claim 14, wherein said cutting drum (24) and said advance drum (36) exhibit respective rotation axes (Z-Z) aligned with the advance axis of said cord.

16. Device according to claim 8, wherein said advance means operate intermittently on said cord, being suitable for switching from an engaged configuration, suitable for carrying out the cord advance, to a disengaged configuration.

17. Device according to claim 17, wherein said advance means, arranged upstream of said drum (24), comprise a fixed wheel (100) operatively connected to advance actuating means suitable for placing it into

rotation, and an oscillating wheel (102) suitable, in said engaged configuration, for pushing said cord against said fixed wheel (100), for carrying our the cord advance.

18. Device according to claim 18, wherein said fixed wheel and/or said oscillating wheel are circumferentially shaped for coupling to the shape of the solid elements (C1, C2) of said cord.

19. Device according to claim 17, wherein said advance means further comprise braking means suitable for locking said cord in a predetermined position.

20. Device according to claim 20, wherein said braking means comprise a braking wheel (106) oscillating between an engaged configuration, wherein it pushes said cord against a fixed stop for locking the advance thereof, and a disengaged configuration.

21. Device according to claim 18 and 21, further comprising an oscillating plate (104), said oscillating wheel (102) and said braking wheel (106) being arranged at the ends of said oscillating plate (104).

22. Device according to any one of the previous claims, comprising guiding means suitable for guiding said flat elements (C1, C2) of the cord from said production device towards said blade (22).

23. Device according to claim 23, wherein said guiding means comprise at least one tube (20) suitable for seating at least one portion of said cord.

24. Device according to any one of the previous claims, comprising distribution means suitable for guiding said cut solid element towards container of cut elements.

25. Device according to claim 25, wherein said distribution means comprise at least one chute suitable for guiding said cut solid element towards said container.

26. Device according to any one of the previous claims, comprising detecting means suitable for detecting the correct positioning of said previous solid element (C1) for being cut from said cord.

27. Device according to claim 20, wherein said detecting means comprise at least one proximity sensor (40).

28. Apparatus (1) for producing synthetic caps comprising

- production device (2) suitable for producing at least one continuous cord of synthetic material comprising a succession of solid elements (C1, C2) and tangs (T),

wherein a previous solid element (C1) is connected to a next solid element (C2) by said tang (T);

- a cutting device (4) made according to any one of the previous claims, said cutting device being arranged downstream of said production device.

29. Apparatus according to claim 22, wherein said production device comprises

- an extruder unit (6) for extruding the synthetic material;
- a forming unit (8), downstream of said extruder unit, for producing said cord.

30. Apparatus according to claim 23, wherein said forming unit (8) comprises two chains of coupling half-chills for forming, when coupled, at least one cavity corresponding, in negative, to said solid element (C1, C2) and to a portion of the tang (T).

31. Method of production of a cap of synthetic material comprising the steps of

- producing at least one continuous cord of synthetic material comprising a succession of solid elements (C1, C2) and tangs (T), wherein a previous solid element (C1) is connected to a next solid element (C2) by said tang (T);
- placing a blade (22) in continuous rotation;
- advancing said cord by a predetermined movement for arranging said tang (T) in suitable position for interfering with said blade (22), for cutting said previous solid element (C1) from the tang.

32. Method according to claim 30, wherein said production step comprises the step of extruding said synthetic material and filling a cavity for forming said solid elements (C1, C2) and said tang (T).

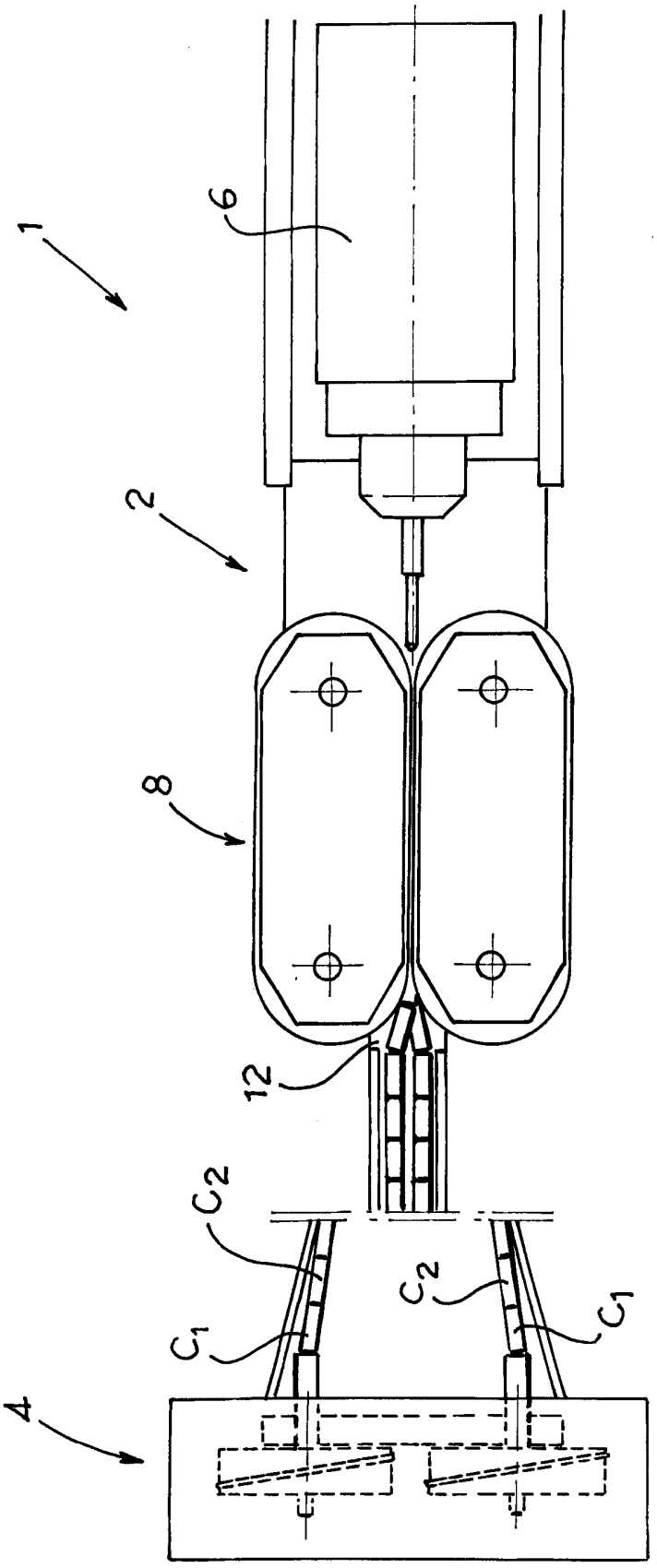


Fig.1

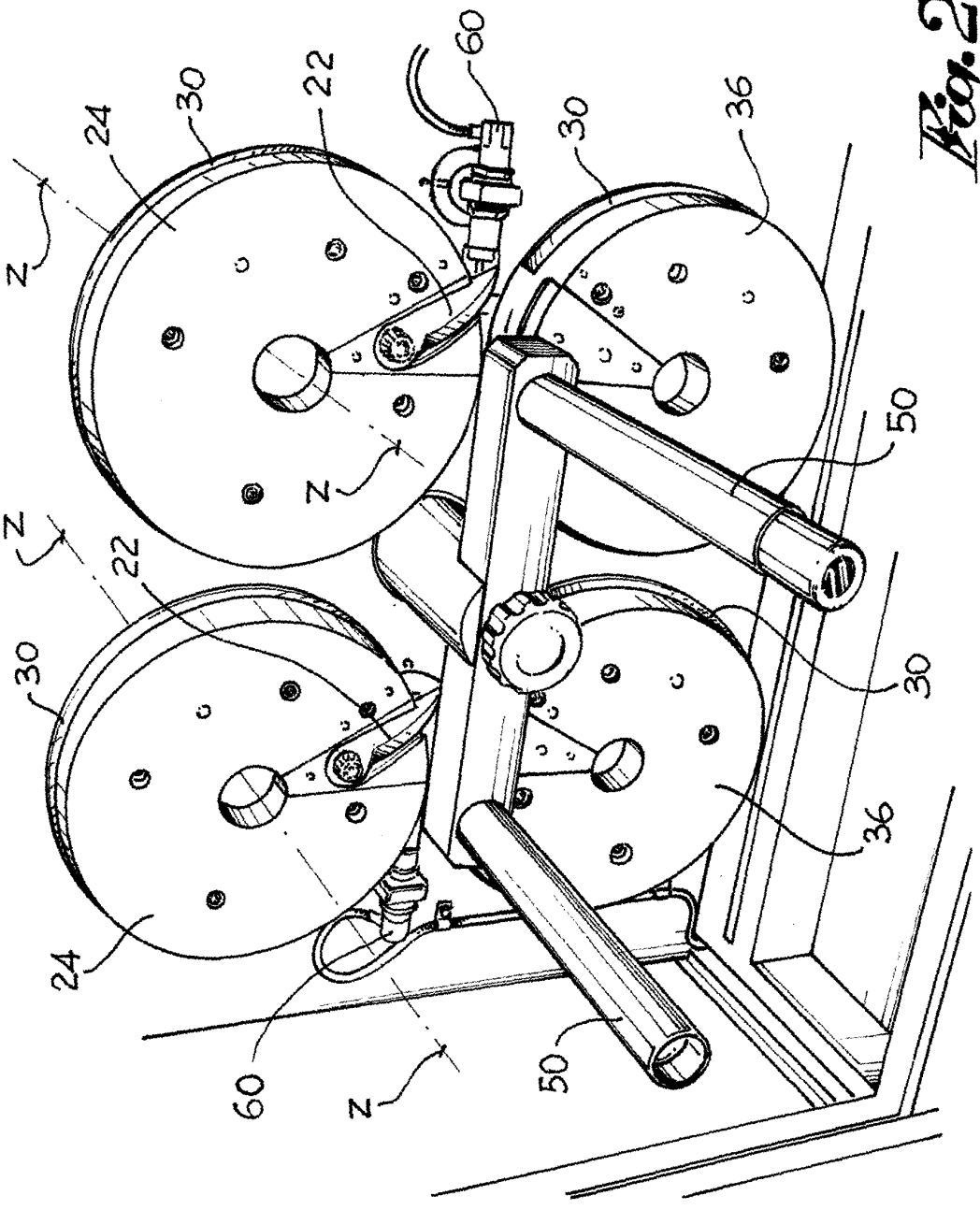
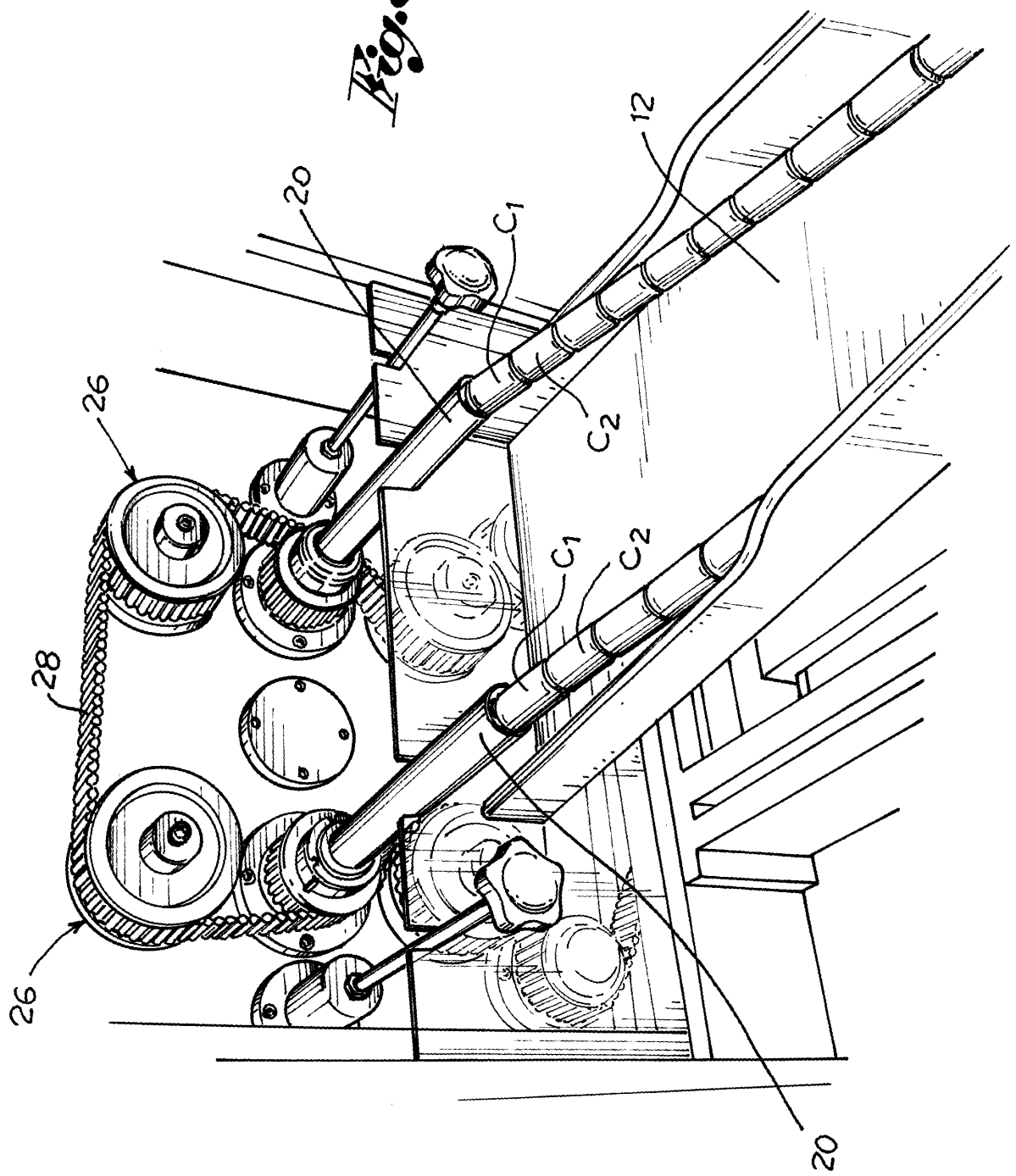


Fig. 2

Fig.3



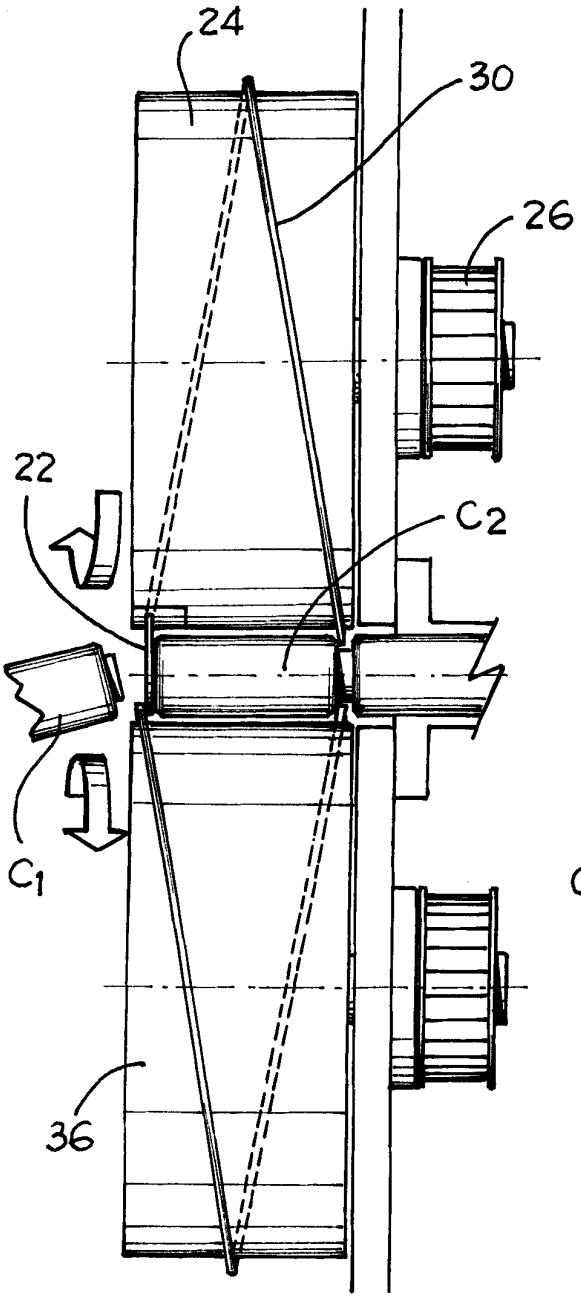


Fig. 4b

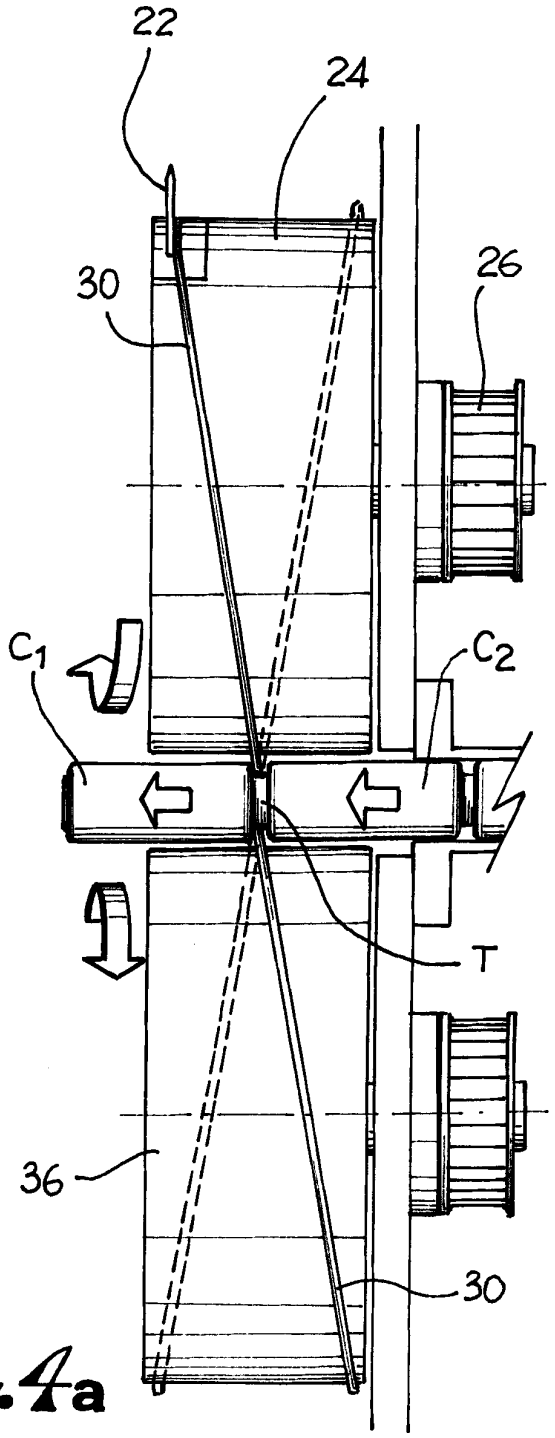
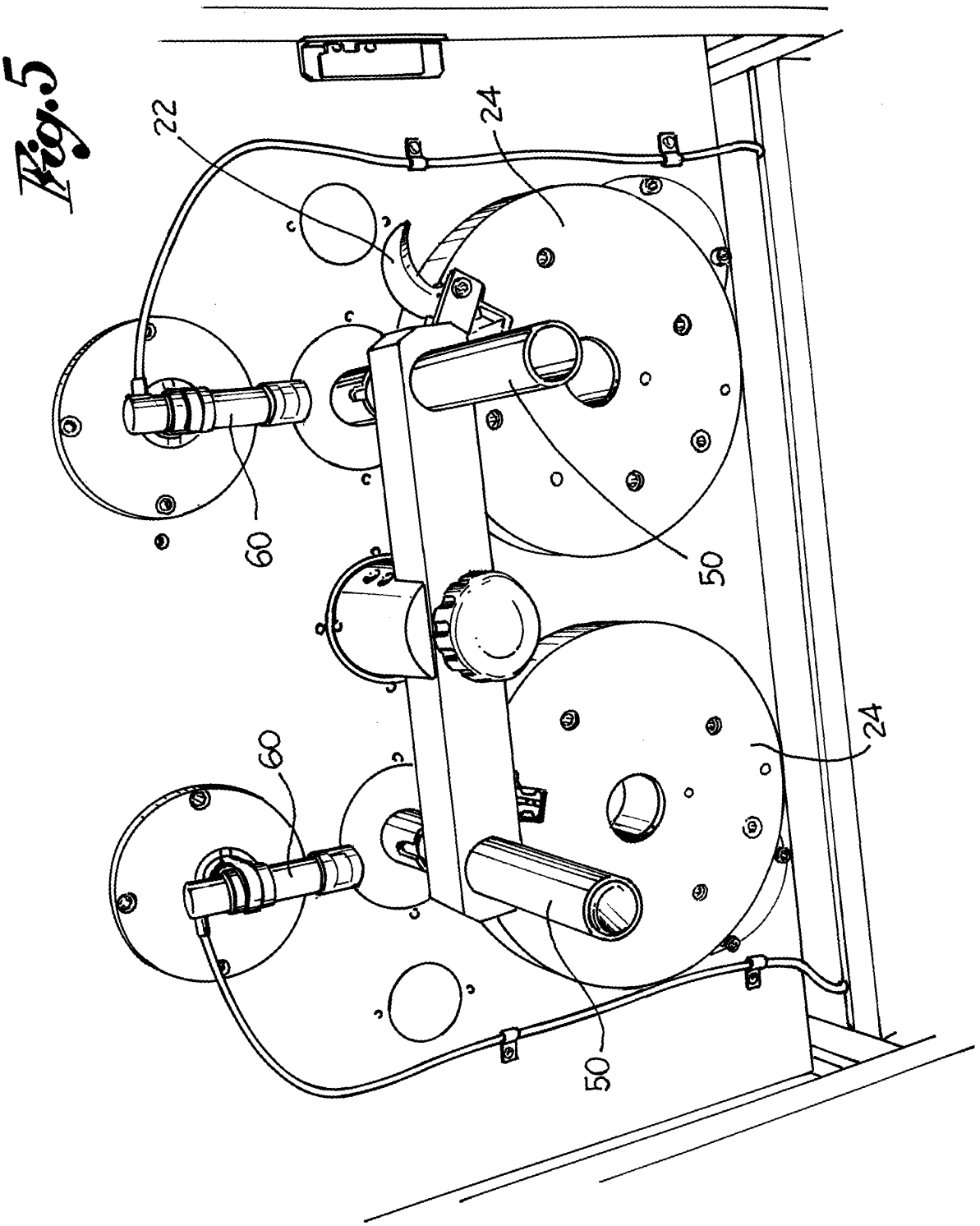


Fig. 4a

Fig.5



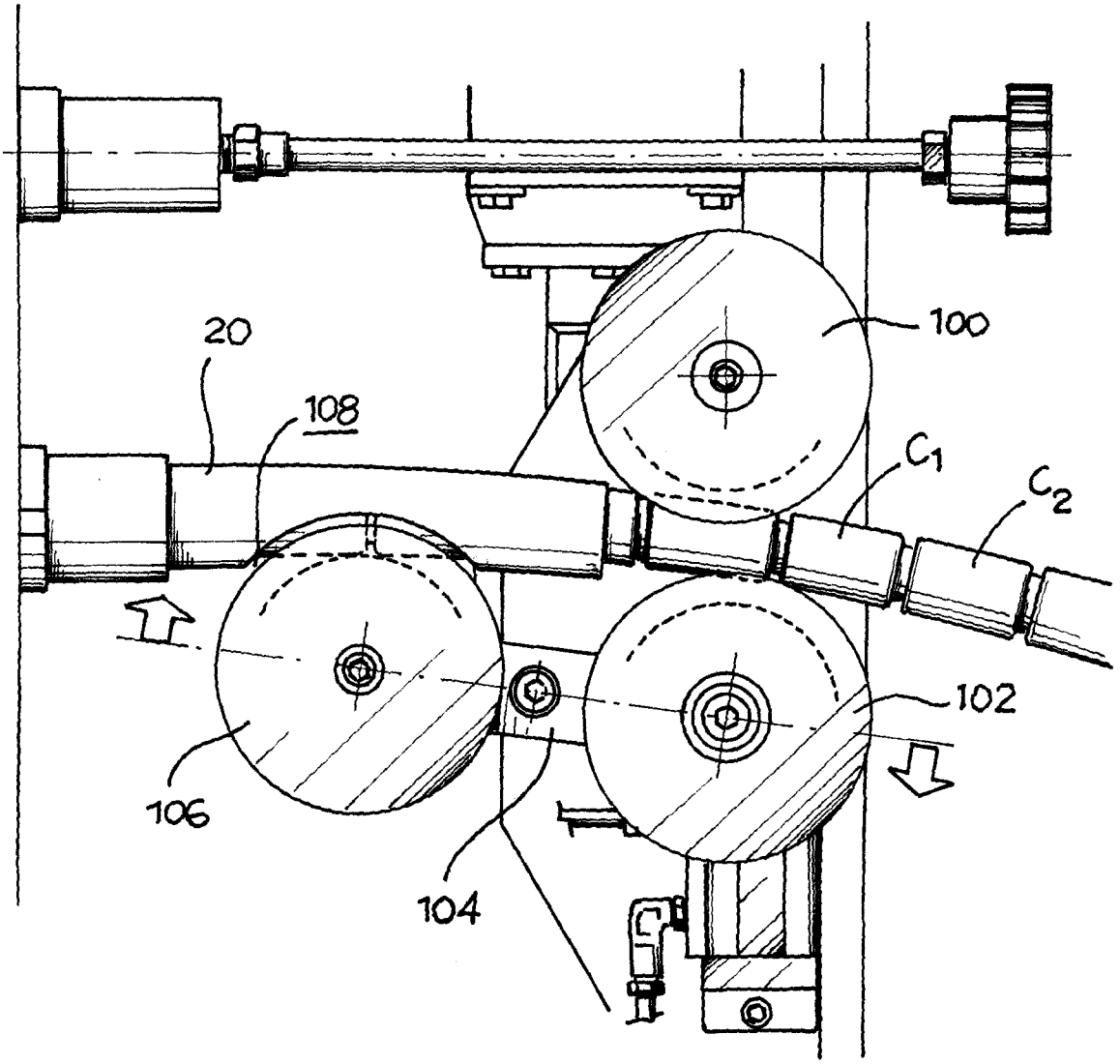


Fig.6a

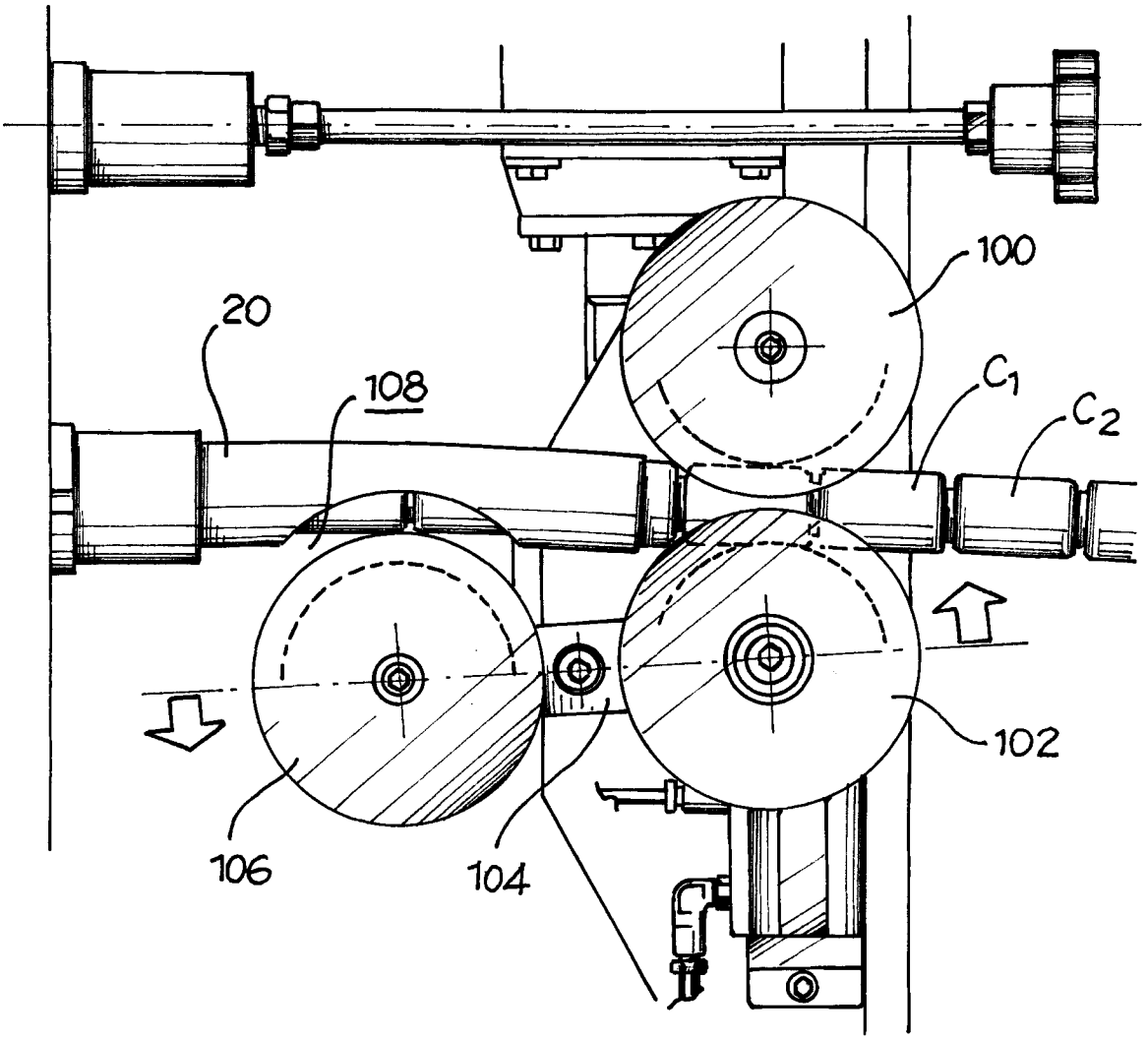


Fig. 6b

REFERENCES CITED IN THE DESCRIPTION

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