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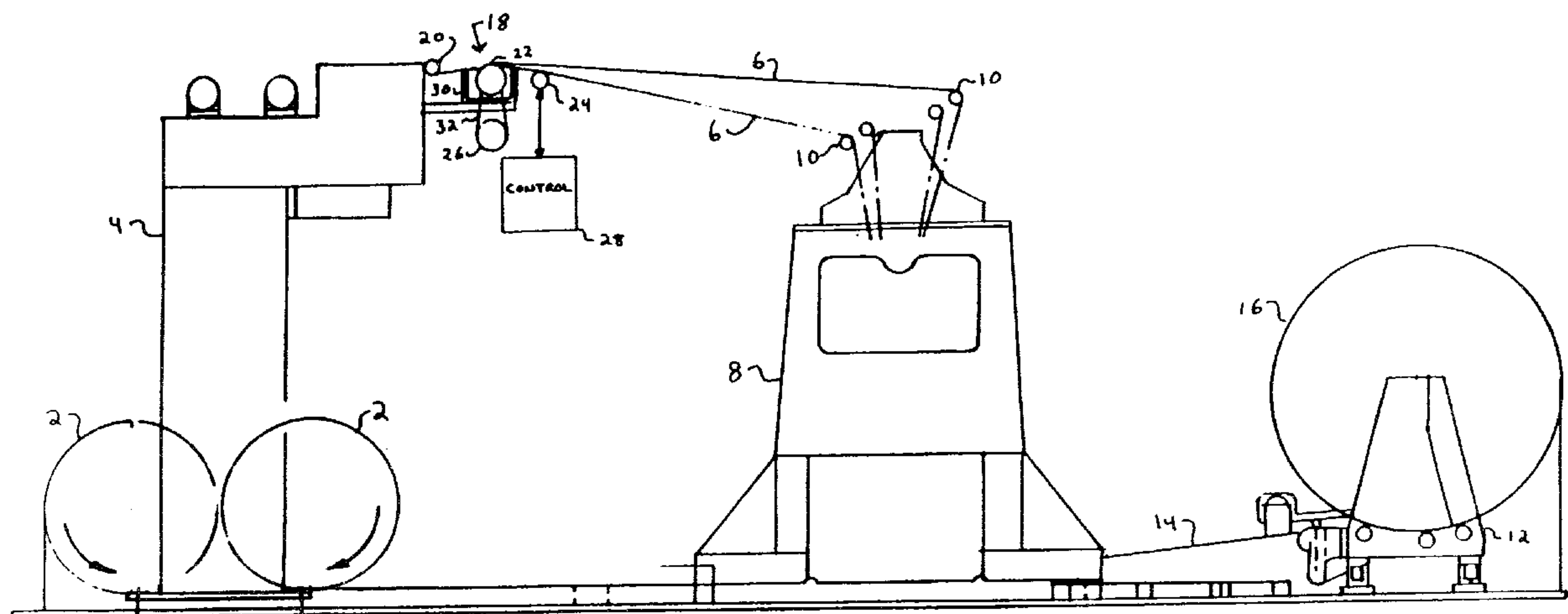
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(54) **APPAREIL ET METHODE DE PRODUCTION D'UN FILET
TRICOTE COLORE**

(54) **APPARATUS AND METHOD FOR PRODUCING COLORED
KNITTED NET**



(57) An apparatus for producing colored knitted net from a plurality of individual ribbons. A coloring apparatus adapted to color selected ribbons of said plurality of individual ribbons is provided between the orientation and knitting stages in the net production process. After the selected ribbons have been colored, a knitting apparatus knits the plurality of individual ribbons into a Raschel net.

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ABSTRACT

An apparatus for producing colored knitted net from a plurality of individual ribbons. A coloring apparatus adapted to color selected ribbons of said plurality of individual ribbons is provided between the orientation and knitting stages in the net production process. After the selected ribbons have been colored, a knitting apparatus knits the plurality of individual ribbons into a Raschel net.

FOR: APPARATUS AND METHOD FOR PRODUCING
COLORED KNITTED NET

BACKGROUND OF THE INVENTION

The invention relates to methods and apparatus for the production of colored knitted nets. More particularly, the invention relates to apparatus and methods for coloring individual ribbons of knitted nets.

Knitted nets are currently used for products including sacks for agricultural produce, bird protection nets, shading nets, insect protection nets and nets for wrapping round bales of hay. Such knitted nets are generally produced in a process which includes production of a primary film, slitting of the film into individual ribbons, orientating the ribbons, knitting the individual ribbons into a knitted net, and winding the knitted net onto a spool. The primary film may be produced in various colors according to the intended application of the knitted net.

Frequently, there is a desire for knitted net which includes a strip of a particular color that differs from the overall color of the net. This may be for providing a strip of a particular shade at the end or middle of the net to indicate the netting product as originating from a specific supplier. Different color markings for similar products may also be used either for marking the end of a roll or in conjunction with a photoelectric cell to count the number of cuts.

A common method of coloring knitted netting is to use bobbins of different colored ribbons. These bobbins of colored ribbons are

1 conveniently placed at the knitting machine and the colored ribbons
2 are threaded into the machine as replacements for the original
3 ribbons. Usually these colored ribbons have some amount of
4 orientation and the bobbins are, therefore, located after the
5 orientation stage in the net production process. The original
6 ribbons of the overall color which have been replaced are
7 automatically wound onto rolls and then recycled.

8 In the Raschel method of knitting, two types of ribbons are
9 employed; transverse ribbons and longitudinal ribbons. When there
10 is a desire to change color in the netting in the longitudinal
11 direction, ribbons may be replaced as described above. When there
12 is a desire to change color in the transverse direction, however,
13 the above described method may not be used as the knitting of the
14 longitudinal ribbons takes less than a second. Shutting down the
15 knitting machine, changing the ribbons, and restarting the machine
16 to run for a such a short period of time is extremely inefficient.

17 Accordingly, the existing coloring method is only useful when
18 there is a need to color longitudinal ribbons. Additionally,
19 multiple colored ribbons must be stocked, each having
20 characteristics compatible with the final product. The existing
21 coloring method also introduces technical complications in the net
22 knitting procedure causing wastage of raw materials and increase in
23 the cost of the final product.

24 Accordingly, there is a need in the art to provide an
25 efficient method and apparatus for coloring knitted nets during
26 production of the netting.

27 SUMMARY OF THE INVENTION

28 In view of the foregoing it is an object of the invention to
29 provide an apparatus and method for producing colored knitted net
30 which colors the individual ribbons of the knitted net.

1 It is a further object of the invention to provide an
2 apparatus and method for producing colored knitted net which may be
3 incorporated into the on-line production of the knitted net.

4 It is a further object of the invention to provide an
5 apparatus and method for producing colored knitted net which is
6 independent of the characteristics of the individual ribbons of the
7 knitted net.

8 In accordance with the invention, an individual ribbon
9 coloring apparatus is provided in the net production process after
10 the orientation stage and prior to the knitting stage. All or some
11 of the individual ribbons may pass through the coloring apparatus.
12 Each ribbon passing through the coloring apparatus may be either
13 included in or excluded from the coloring process in accordance
14 with a control system which operates consistently with the knitting
15 machine cycle, thereby selecting which of the individual ribbons
16 are to be colored. It is thereby possible to program the system to
17 color any particular area of the knitted net, including lengthwise,
18 widthwise, strips or in any other desired pattern.

19 As preferably embodied, a coloring apparatus includes a roller
20 which rotates in a bath of colored ink. The ribbons are colored by
21 contacting the roller and will remain uncolored when not contacting
22 the roller. A control system may be provided for raising the
23 ribbons from the roller and may include an electromagnetic or
24 pneumatic piston which is operated in accordance with signals
25 coming from a real time control system. Alternatively, the
26 complete coloring apparatus may be moved down and out of contact
27 with the ribbons.

28 BRIEF DESCRIPTION OF THE DRAWINGS

29 The accompanying drawings, referred to herein and constituting
30 a part hereof, illustrate preferred embodiments of the invention,

1 and, together with the description, serve to explain the principles
2 of the invention, wherein:
3

4 Fig. 1 shows an apparatus for the production of knitted
5 netting including the coloring apparatus in accordance with the
6 invention;

7 Fig. 2 is a side sectional view of the coloring apparatus;

8 Fig. 3 is a front partially sectional view of the coloring
9 apparatus;

10 Fig. 4 is a side sectional view of an alternative embodiment
11 of the coloring apparatus;

12 Fig. 5 is a perspective view of a further alternative
13 embodiment of the coloring apparatus; and

14 Fig. 6 is a perspective view of a further alternative
15 embodiment of the coloring apparatus.

16 DETAILED DESCRIPTION OF THE DRAWINGS

17 In the following detailed description of the drawings wherein
18 several alternative embodiments of the invention are discussed,
19 like components are given like numeral designations for
20 convenience.

21 In Fig. 1 is shown an apparatus for producing knitted netting.
22 A primary film, e.g., linear low density polyethylene (LLDPE) is
23 supplied on rolls 2. The primary film enters drawing unit 4 which
24 slits and orients the primary film into individual ribbons 6. A
25 drawing unit appropriate for this purpose is the ISO In-Line
26 Drawing Unit for tape yarns from Karl Mayer (Germany). The
27 individual ribbons 6 exit the drawing unit and enter knitting
28 machine 8 via alignment rollers 10. Knitting machine 8 knits the
29 individual ribbons 6 into a continuous Raschel knitted net 14.
30 Appropriate knitting machines for this purpose is the Raschel

1 machine from Karl Mayer (Germany) or similar machines. The
2 continuous knitted netting 14 is wound onto roll 16 by winding
3 machine 12.

4 In accordance with the invention, interposed between drawing
5 unit 4, where the primary film is slit and oriented into individual
6 ribbons, and knitting machine 8, where the knitted netting is
7 actually knit, is coloring apparatus 18. Coloring apparatus 18
8 includes alignment roller 20, coloring roller 22 and contact roller
9 24. Coloring roller 22 is located in vessel 30 and is connected by
10 drive belt 32 to motor 26. Alternatively, the coloring roller may
11 be driven by direct motor connection. Movement of contact roller
12 24 is controlled by control 28 to engage or disengage the
13 individual ribbons 6 from contact with coloring roller 22.

14 It may be appreciated from Fig. 1 that the preferred point in
15 the net production process to color the individual ribbons is after
16 the ribbons are oriented and before the ribbons are knitted into
17 the net. If coloring is performed before orientation, the colored
18 ink which colors the ribbon will be spread over an area 5-7 times
19 longer than the original area because of the drawing process during
20 ribbon orientation. The color will, therefore, become very dull.
21 There may also be unexpected reactions of the colored ink on the
22 ribbon because of the heat which is needed for orientation.

23 In Fig. 2 is shown a side sectional view of the coloring
24 apparatus in accordance with the invention. The coloring apparatus
25 includes a vessel 30 filled with a desired colored ink 34 to a
26 predetermined level. The preferred colored ink includes a basic
27 coloring agent NEWFLEX OD C/41 made by SUNCHEMICAL and may be mixed
28 with a solvent that evaporates quickly. Various paints may also be
29 used.

30 Inside the vessel there is a rough coloring roller 22 which

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has about half of its diameter immersed in the colored ink 34 and which rotates on an axle 36. The coloring roller 22 is a simple rough metal axle with a knurled roller surface. The axle 36 is supported by two sealed bearings 38. A
5 length 40 of the axle protrudes through the walls of the vessel 30 and beyond the bearings 38. A small motor 26 rotates the coloring roller 22 via drive belt 32 connected to the protruding length of the axle.

The individual ribbons 6 pass transverse to the
10 axle direction of the coloring roller 22 and contact the upper circumference of the coloring roller. When in contact with the coloring roller 22, the colored ink will color one side of the individual ribbons 6 as the coloring roller 22 rotates in colored ink 34. Since small motor 26
15 rotates the coloring roller 22, contact between the individual ribbons 6 and coloring roller 22 is non-restrictive, i.e., no drag is imparted by the roller on the ribbons as they traverse the coloring apparatus.

In accordance with signals from a real time
20 control system, rotation of the coloring roller may be controlled. Such control systems for the dyeing and printing of materials are known in the art. When the coloring roller does not rotate, colored ink does not reach the upper portion of the coloring roller circumference and
25 the coloring of the individual ribbons ceases.

Alternatively, as shown in Fig. 3, contact roller 24 may be positioned downstream of rough roller 22 and controlled by electromagnetic or pneumatic piston 44 to alter the path of travel of individual ribbons
30 6. When piston 44 is retracted, contact roller 24 allows contact between individual ribbons 6 and coloring roller 22. When extended, contact roller 24 alters the path of travel of individual ribbons 6 thereby preventing contact between the individual ribbons
35 and coloring roller 22. In the extended position, no coloring of the individual ribbons occurs despite

1 continued rotation of the coloring roller.

2 Two-sided coloring of the ribbons can be accomplished by
3 repositioning the ribbons so that the ribbons contact the lower
4 circumference of the coloring roller 22. In Fig. 4, an entrance
5 roller 46 and an exit roller 48 are provided at vessel 30 to direct
6 the path of travel of individual ribbons 6 to the underside of
7 coloring roller 22.

8 In accordance with this embodiment, the path of travel of the
9 individual ribbons 6 is directly through the colored ink 34 and in
10 contact with coloring roller 22 thereby coloring both sides of the
11 individual ribbons. Electromagnetic or pneumatic piston 46 is
12 provided to raise and lower coloring roller 22 and motor 26 to
13 bring coloring roller 22 in and out of contact with individual
14 ribbons 6.

15 In this case, when coloring is to be stopped, the coloring
16 roller is raised in order to allow free passage of the individual
17 ribbons. In its raised position individual ribbons 6 travel
18 directly from entrance roller 46 to exit roller 48 without
19 contacting either coloring roller 22 or colored ink 34.
20 Accordingly, no coloring of individual ribbons 6 occurs in this
21 condition.

22 As another alternative embodiment of the invention, the
23 coloring apparatus may be implemented utilizing capillary action.
24 As shown in Fig. 5, a cylindrical vessel 52 is filled with colored
25 ink 34 to about half its diameter. A thread 56 is held by a thread
26 support 58 located perpendicular to the passage of the individual
27 ribbons 6 and is immersed into the colored ink 34.

28 As the ribbon 6 passes through the thread support 58, the
29 ribbon contacts the upper portion of the thread 56 which is wet
30 with colored ink because of capillary action. It may be

1 appreciated that a particular advantage of this embodiment is that
2 no moving parts are required for the coloring apparatus itself. If
3 an interruption in coloring is desired, the ribbon 6 is simply
4 moved upward and out of contact with the thread by a pneumatic or
5 electromagnetic cylinder 60 with ribbon guide 62.

6 Control of the movement of the above-described rollers and
7 pistons may be obtained via electromagnetic or pneumatic devices as
8 are commonly known in the art and may be maintained under computer
9 programmed control. A movement of about 1-3mm is sufficient to
10 break the contact between the coloring device and the individual
11 ribbons. When the ribbons are raised, contact between the coloring
12 device and the individual ribbons is broken and coloring ceases.
13 It will be appreciated that this method and apparatus for producing
14 colored knitted net is extremely versatile and with appropriate
15 control any colored pattern may be created.

16 As a further embodiment, the coloring apparatus may also be
17 implemented using an ink jet printer as shown in Fig. 6. Ink jet
18 64 is positioned directly above individual ribbons 6 and is
19 connected via feed line 66 to a colored ink supply and via
20 connection 68 to an appropriate control system. An appropriate ink
21 jet printer is ALPHA JET by Metronic Geratebau GmbH & Co.
22 (Germany).

23 Ink jet printers create an electrostatic field which moves the
24 ink jet in order to create letters and other complex patterns. For
25 printing on ribbons, however, all that is required is on/off
26 control of the ink jet. Ink jet equipment works very fast creating
27 a printed line 3 mm thick at a speed of 600 m/min. At this rate,
28 an ink jet can print by line scanning (similar to a printer wherein
29 the print head moves horizontally and the paper moves vertically)
30 at a rate of about 1.8 sq. m/min. This printing rate is sufficient

1 coloring oriented ribbons. It will be appreciated that an
2 advantage of this embodiment is that the ribbons which are to be
3 colored may be scanned and colored by the ink jet printer under
4 computer program control, instead of mechanically picking-up the
5 ribbons when the ribbons are not to be colored.

6 Advantageously, the ability of having full program control of
7 the position of "jet on" or "jet off" signals allows continuous
8 control as to which (and when) individual ribbons will be colored.
9 This particular embodiment may also be implemented with less
10 physical equipment than previously described embodiments.

11 While the invention has been described in its preferred
12 embodiments, it is to be understood that the words which have been
13 used are words of description, rather than limitation, and that
14 changes may be made within the purview of the appended claims
15 without departing from the true scope and the spirit of the
16 invention in its broader aspects.

CLAIMS:

1. An apparatus for producing colored knitted net, comprising:
 - 5 a source for providing a plurality of individual oriented ribbons;
 - a coloring apparatus including a plurality of rotatably driven dye applicators for non-restrictive coloring of selected ribbons of said plurality of individual oriented ribbons from said source; and
 - 10 a knitting apparatus for knitting said plurality of individual oriented ribbons from said coloring apparatus into a net.
- 15 2. An apparatus according to claim 1, wherein said plurality of individual ribbons consist essentially of linear low density polyethylene.
3. An apparatus according to claim 1, wherein said
20 plurality of individual ribbons are produced from a primary film.
4. An apparatus according to claim 1, wherein said knitting apparatus is adapted to knit a Raschel net.
- 25 5. An apparatus according to claim 1, wherein said coloring apparatus further comprises:
 - an ink supply; and
 - a coloring roller adapted to apply ink from said
30 ink supply to said selected ribbons of said plurality of individual ribbons.
6. An apparatus according to claim 5, further comprising means for controlling rotation of said coloring
35 roller.

7. An apparatus according to claim 5, further comprising means for controlling the contact between said coloring roller and said selected ribbons of said plurality of individual ribbons.

5

8. An apparatus according to claim 1, wherein said coloring apparatus further comprises:

an ink supply; and

10 a means for transferring ink from said ink supply to said individual ribbons by capillary action.

9. An apparatus according to claim 8, further comprising means for controlling the application of ink by said means for transferring to said selected ribbons of
15 said plurality of individual ribbons.

10. An apparatus according to claim 1, wherein said coloring apparatus further comprises:

an ink supply; and

20 an ink jet for applying ink from said ink supply to said selected ribbons of said plurality of individual ribbons.

11. An apparatus according to claim 10, further
25 comprising means for controlling the operation of said ink jet.

12. A method for producing colored knitted net, comprising the steps of:

30 providing a plurality of individual oriented ribbons;

non-restrictively coloring selected ribbons of the plurality of individual oriented ribbons using a plurality of individually selectable rotatably driven dye
35 applicators; and

knitting the plurality of individual oriented ribbons into a net.

13. A method according to claim 12, further comprising the step of knitting the plurality of individual ribbons into a Raschel net.

14. A method according to claim 12, further comprising the step of applying ink from an ink supply to the selected ribbons of the plurality of individual ribbons with a coloring roller.

15. A method according to claim 14, further comprising the step of controlling the rotation of the coloring roller.

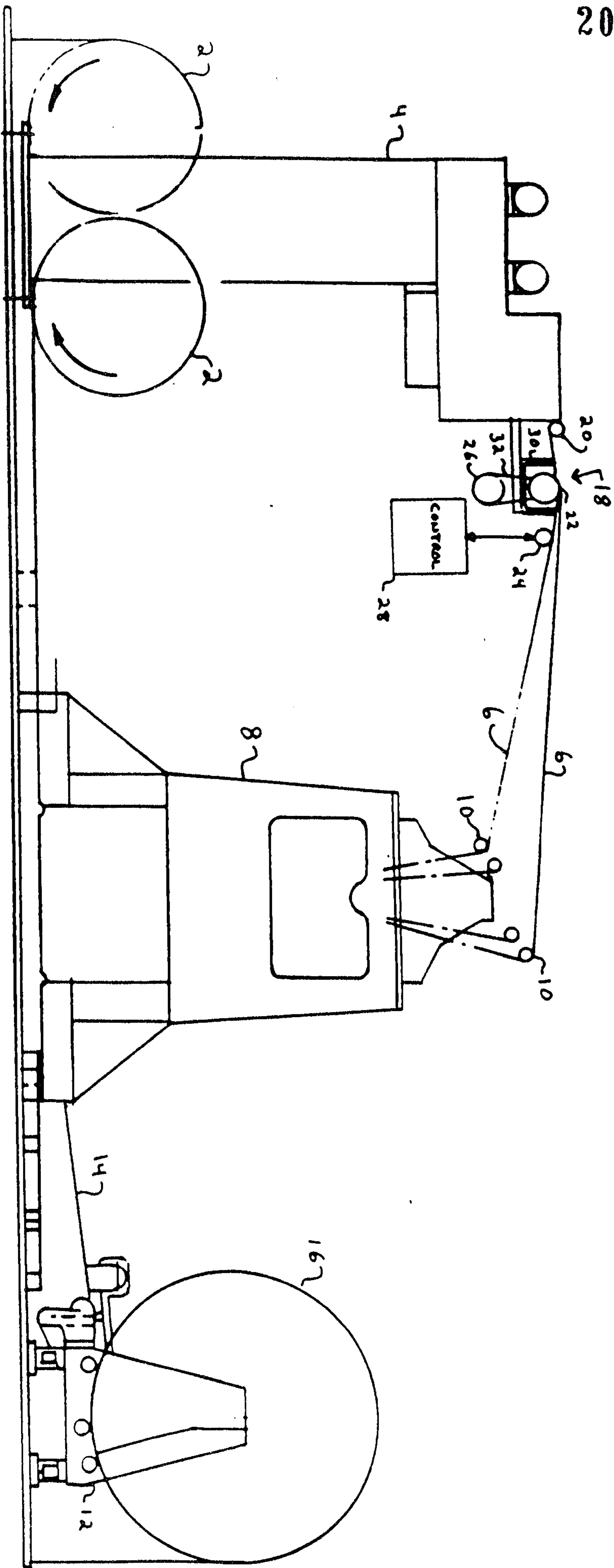
16. A method according to claim 14, further comprising the step of controlling contact between the coloring roller and the selected ribbons of the plurality of individual ribbons.

17. A method according to claim 12, further comprising the step of transferring ink from an ink supply to the selected ribbons of the plurality of individual ribbons by capillary action.

18. A method according to claim 17, further comprising the step of controlling the transfer of ink between the ink supply and the selected ribbons of the plurality of individual ribbons.

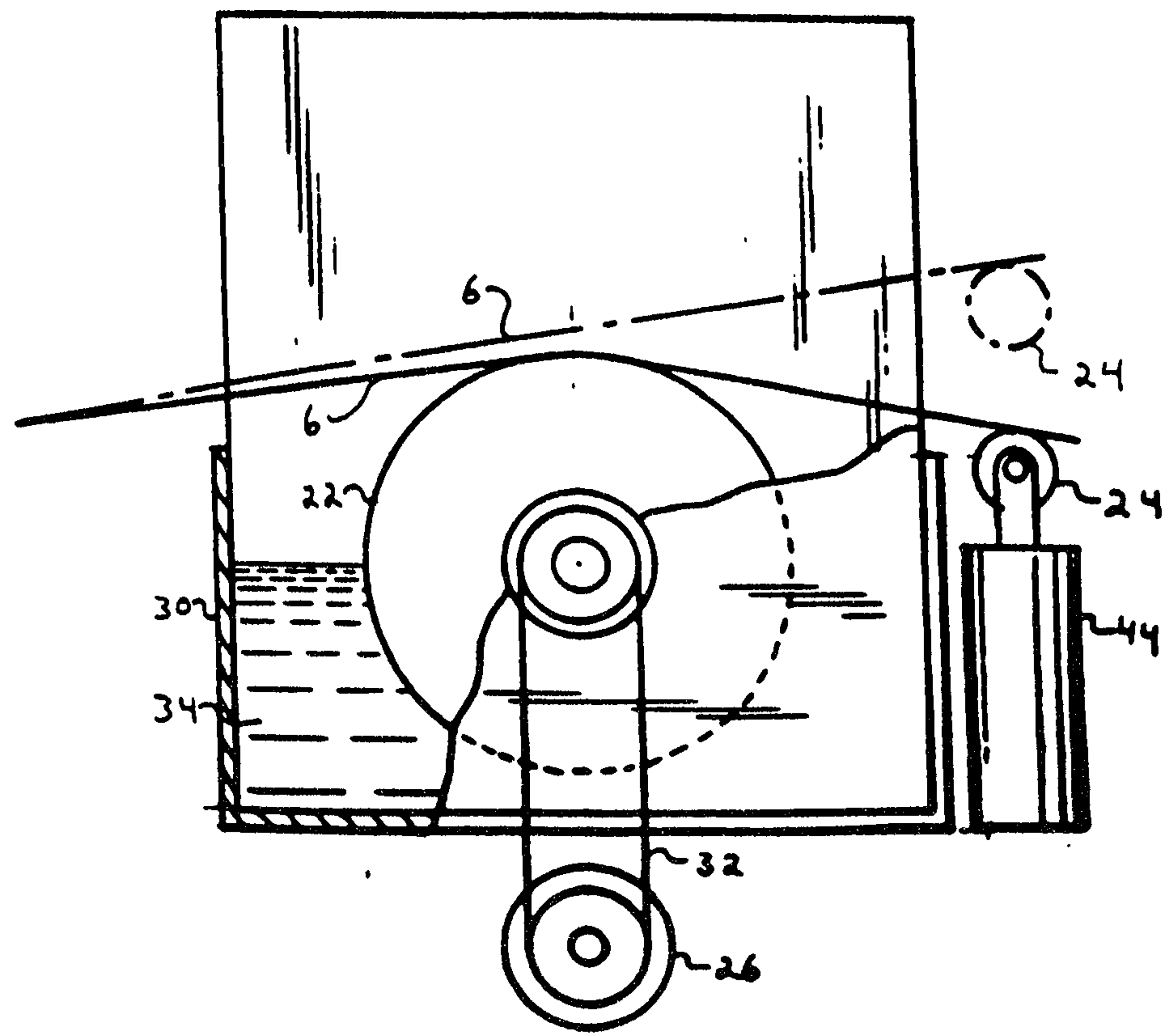
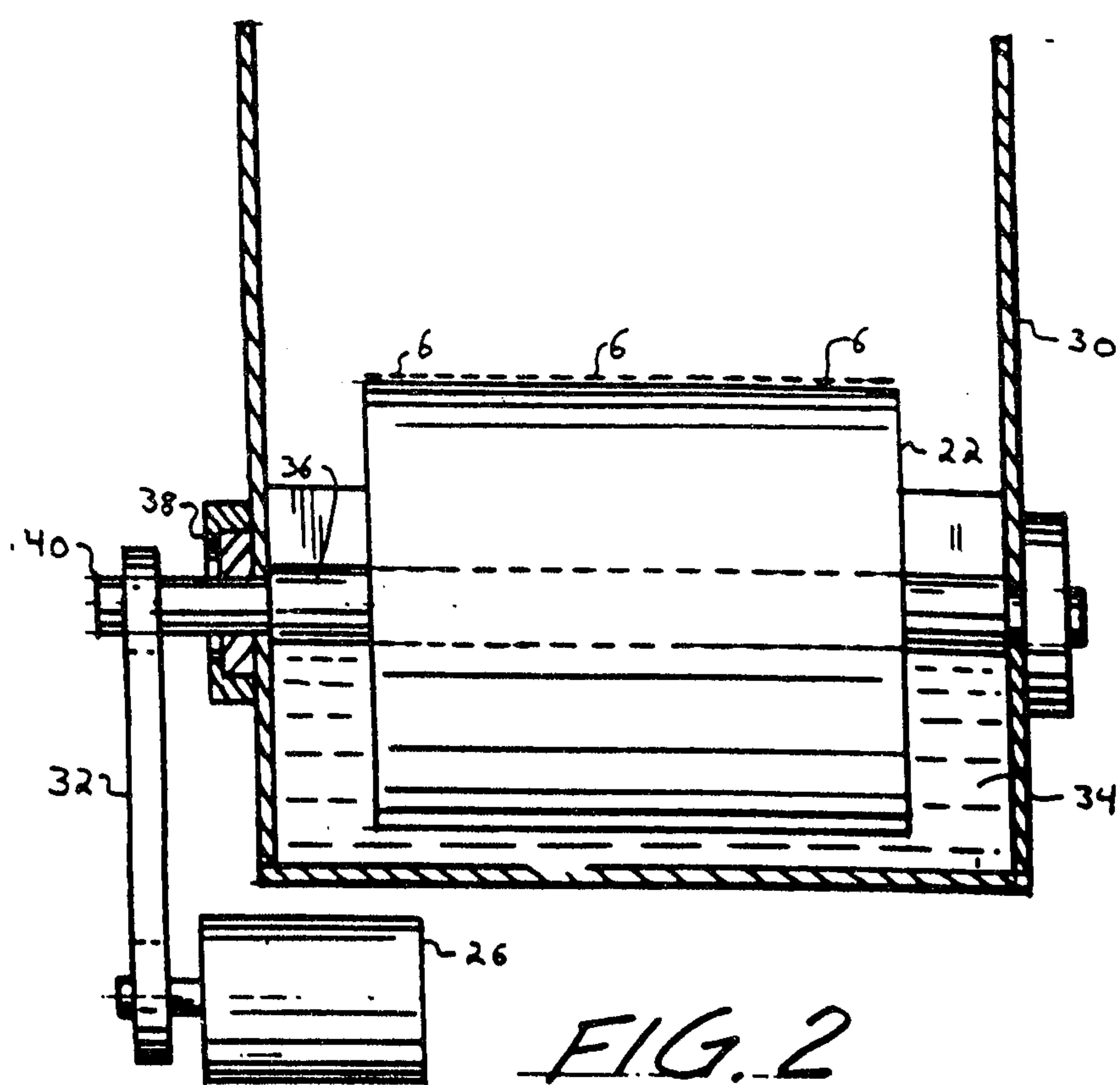
19. A method according to claim 12, further comprising the step of applying ink from an ink supply to the selected ribbons of the plurality of individual ribbons by an ink jet.

20. A method according to claim 19, further comprising the step of controlling the operation of the ink jet.



PATENT AGENTS

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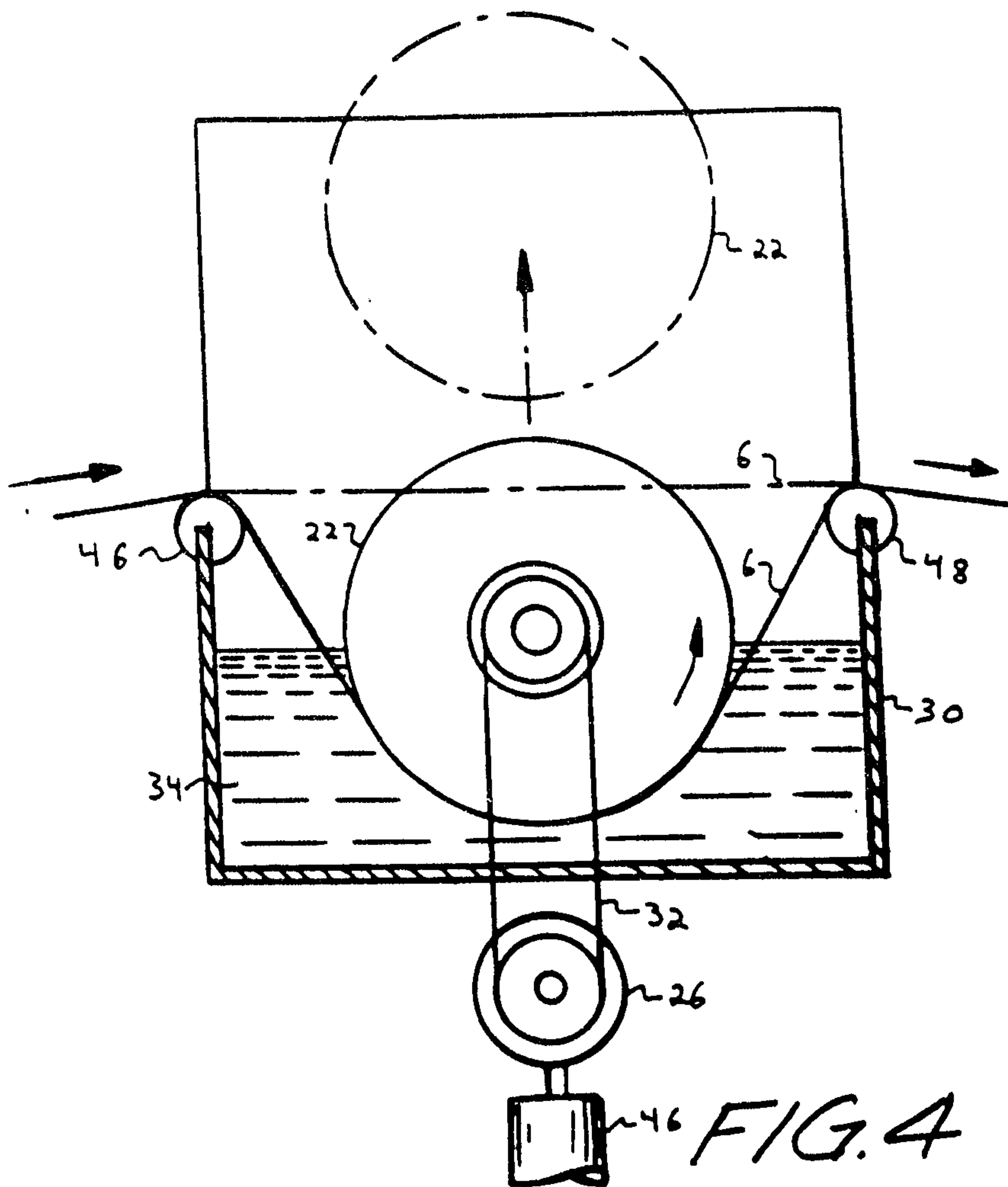


FIG. 4

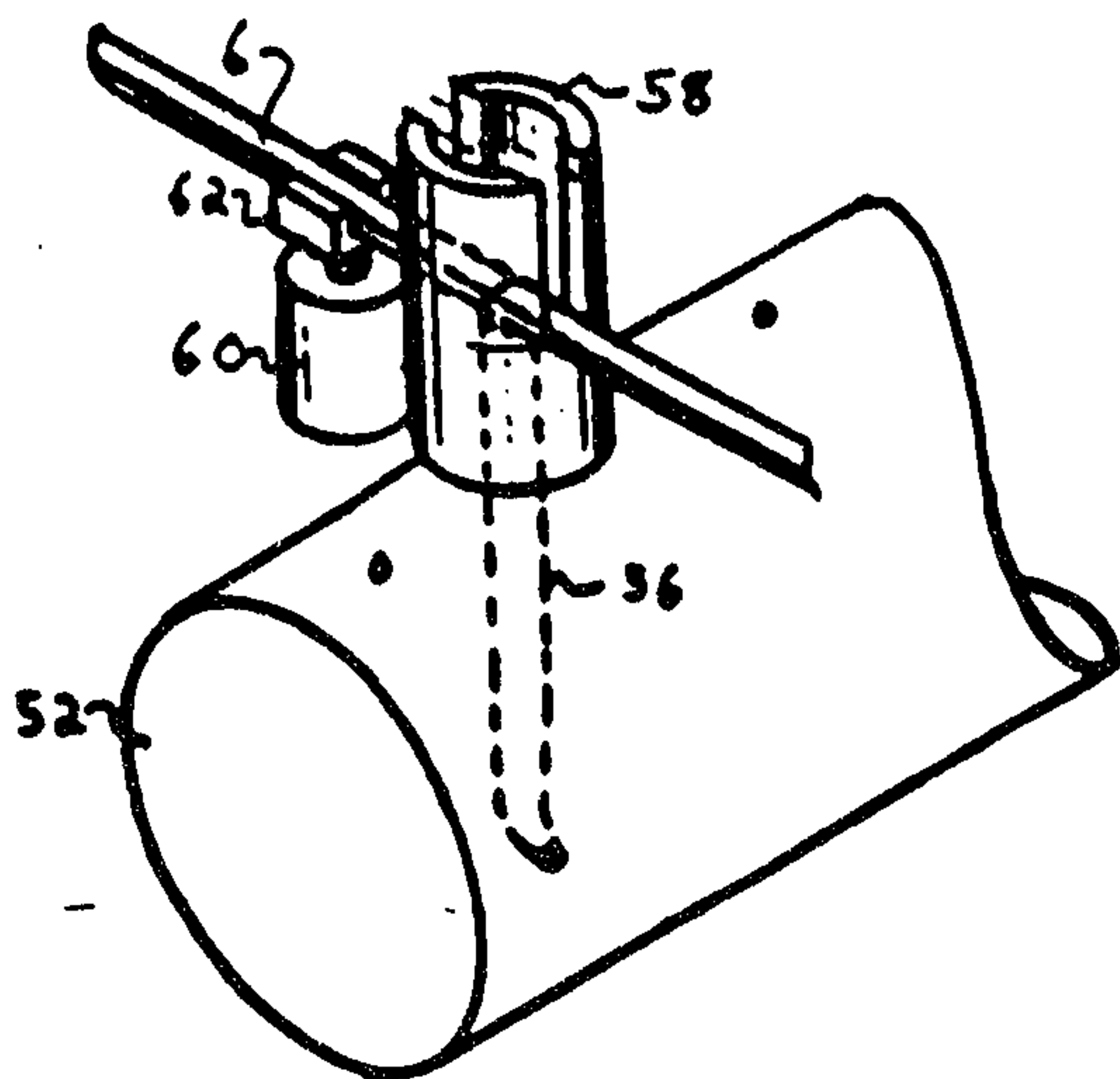


FIG. 5

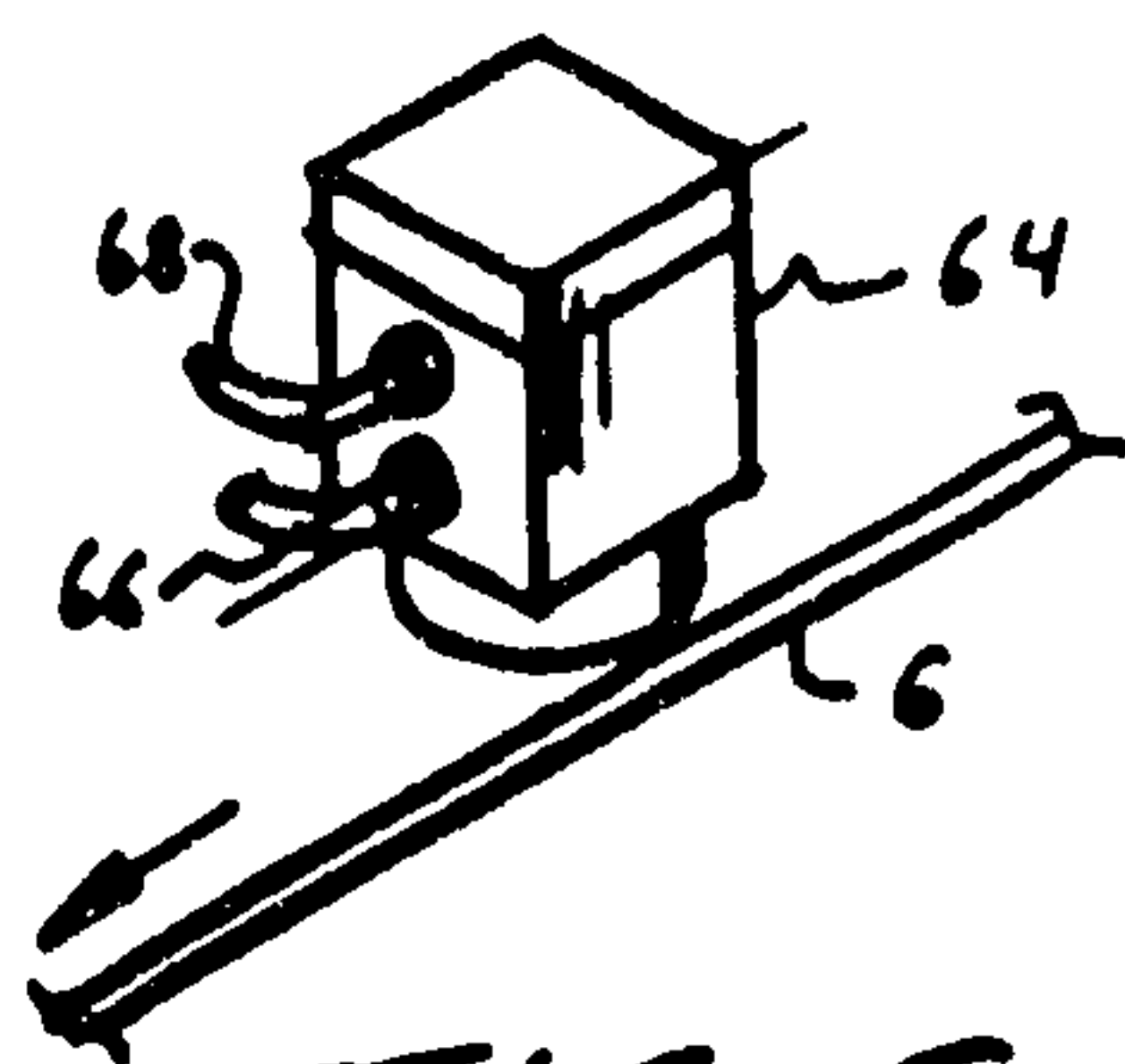


FIG. 6

PATENT AGENTS

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