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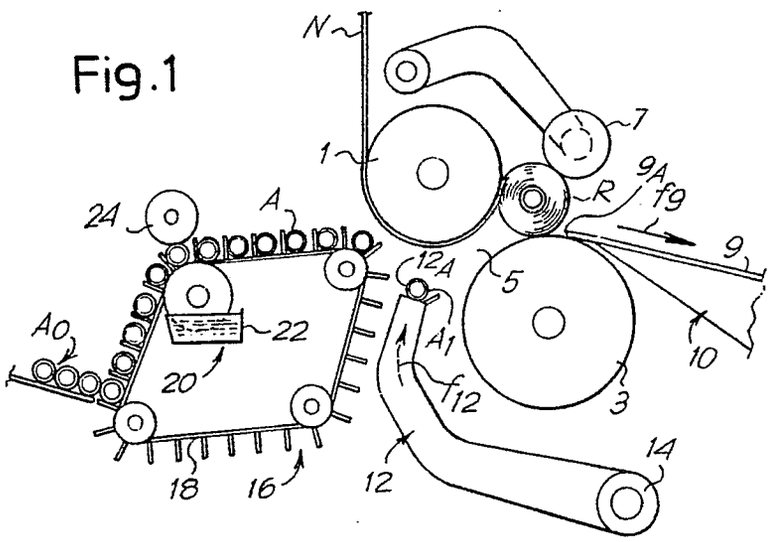
(54) Apparatus for the formation of rolls of web material on a winding core.

(57) An apparatus for winding webs of paper or similar material on a core (A) including a first rotary winding roller (1), along which a web material (N) is driven. A second rotary winding roller (3), forms a nip (5) with said first winding roller (1) to receive a core (A1). A pusher (12) inserts a core (A1) into the nip (5). A movable roller (7) controls the diameter of the roll (R) or log in the course of formation between said three rollers (1, 3, 7). Only the second roller (3) is arranged to have a variable speed and to slow down during the insertion of a core (A1) into said nip (5). An adhesive applicator (20) is provided to wet the cores (A) with glue before being inserted into said nip (5), and a take-off surface (9) near said second winding roller (3) extends away from the exit of said nip (5).

Fig.1



EP 0 402 325 A2

It is well-known in the art how to prepare long rolls (sometime called "logs") of paper on rewinding machines for the production of toilet paper, kitchen towels or the like. The rolls are made from webs of paper (which may be as wide as 5 meters) and are unwound from a large "parent roll" onto a cardboard core. These 5 meter long "logs" generally have an external diameter of 4 to 5 inches, and in many cases may also be slit into smaller rolls approximately 4-1/2 inches wide. The webs may also be transversely perforated to provide individual sheets 4-1/2 x 4 1/2 inches square.

It is important, for economy of operation and costs, carefully to control the amount of paper wound onto the cores, the number of sheets or usable units provided in the roll, and the outside diameter of the roll. Furthermore, because the rewinding machines operate at very fast speeds it is also important to ensure that the leading edge of the web is secured to the core and that the separation of the "tail" of one roll be precisely and rapidly separated from the leading edge of the following roll.

Relevant patents relating to the background of this type of paper-converting machinery and process are the U.S. Patents 3,869,095, 4,327,887 and 4,422,588.

DESCRIPTION OF THE INVENTION

The invention is an improvement on prior means for the formation of rolls or logs by winding a web of paper or similar material on a core. Prior art shows a first rotary winding roller along which the web material is driven; a second rotary winding roller forming a nip with said first winding roller to receive a fed core; means for inserting a core into said nip; and a movable roller to control the diameter of the roll or log during formation between said three rollers. The prior apparatus also provides for cyclically varying the surface speed of the second winding roller and of the diameter control roller in order to achieve, during each insertion of a new core, the slackening of the web and thus the wedging of a double thickness of web between the just-inserted core and the second winding roller. This may include pneumatic means. This causes the paper to start the winding on the newly- inserted core and to tear between the just-finished roll and the newly-inserted core.

The present invention simplifies the apparatus and makes the start of the winding of paper on the core more regular.

Thus there is provided that only the second roller be combined with means for reducing the speed thereof during the phase of inserting a core into said nip; that means be provided to wet with glue the cores to be inserted in said nip; and that a take-off surface extends from a zone of said second winding roller which is adjacent to the exit of said nip.

With the above and other objects in view, more information and a better understanding of the present invention may be achieved by reference to the following detailed description.

DETAILED DESCRIPTION

For the purpose of illustrating the invention, there is shown in the accompanying drawings a form thereof which is at present preferred, although it is to be understood that the several instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

In the drawings, wherein like reference characters indicate like parts:

Fig. 1 shows a schematic cross-sectional side view of an embodiment of the apparatus during an intermediate operative step of the formation of a roll, showing also an assembly for the feeding of the cores.

Figs. 2 and 3 show the start of a phase for the separation of the web to remove the formed roll and the starting phase of the formation of a new roll.

Fig. 4 shows in detail a device for supporting and moving a takeoff surface.

Fig. 5 shows a modified embodiment of Fig. 4.

Referring now to Figs. 1 to 3, numeral 1 indicates a first upper winding roller, around which there is continuously driven the web N, which is transversally perforated at predetermined distances according to the size of the sheets that must be detached from the finished roll.

Numeral 3 indicates a second, lower winding roller which, together with roller 1, defines space (i.e., a nip 5) for the insertion of a tubular core made of cardboard or similar material, around which the roll is to be formed.

Numeral 7 indicates a diameter control movable roller which cooperates with rollers 1 and 3 to form a roll R of paper material N which is fed without stopping. Numeral 9 indicates a take-off surface which is a part of a unit 10 that may be either fixed or adjusted in position. The surface 9 has a front edge 9a, substantially adjacent and almost touching the lower winding roller 3 at the zone of formation of the roll R between the three

rollers 1, 3 and 7. The surface 9 may be slightly inclined to allow the spontaneous rolling removal of the roll in the direction of arrow f9.

Numeral 12 generally indicates a pusher for the insertion of a core A1 into the nip 5 formed by rollers 1 and 3. The pusher 12 may be formed by arms pivoted at 14 to the fixed structure and having an end 12a to push the core A1 into the nip 5.

Numeral 16 indicates an assembly for successively feeding cores to the position A1, from which they are moved by the pusher 12 to the nip 5.

This assembly 16 may comprise a flexible conveyor 18 having a plurality of seats for the cores A fed from a chute-like supply reservoir AO. Along the path of the conveyor 18, the cores have adhesive applied thereto by a distributor 20 which may comprise a basin 22 and an assembly of distribution cylinders and counter-rollers, generally indicated by 24, to transfer a required amount of adhesive onto their surface until they contact a core in transit, thereby determining a glueing region on said core. The glueing region may consist of either longitudinal segments parallel to the core axis or annular bands of adhesive spaced from each other. The adhesive is such as to ensure the anchorage of the leading edge of the web material N that must be wound on the core.

The winding roller 1 rotates with a peripheral speed corresponding to the feeding speed of the paper web N and, therefore, with constant speed. According to the invention, the diameter control roller 7 also rotates uniformly at the same circumferential speed of roller 1. However, the winding roller S rotates at the same peripheral speed as rollers 1 and 7, for the most part of the winding cycle.

However, during the replacement of the formed roll R with a new core A1, roller 3 undergoes a short slowing down phase for the purposes indicated below.

When a roll R has reached the required diameter, or when it has accumulated a desired length of paper material, or when it has reached such a length of material as to include a predetermined number of sheets, the pusher 12 moves the core A1 in the direction of arrow f12 into the nip 5 where it comes in contact with rollers 1 and 3.

At the same time, the winding roller 3 is made to slow down slightly which causes the roll R to move in the direction of arrow f9 until it strikes the front edge 9a of surface 9. The slowing down of roller 3 also causes a slight advancement of core A1 into the nip 5.

When the roll R contacts the leading edge of surface 9, it is instantly and abruptly slown down, and this causes a slackening of the web stretch NO (see Fig. 2) between its point of contact of core A1 with the roller 1 and its point of contact with roll R. Therefore, the paper material (that comes in contact with the core A1 having adhesive thereon) tends to adhere to the core A1. During rotation of the core between rollers 1 and 3, the core drags the web material around itself towards the contact region between itself and the roller 3. At the same time, the slackening of the portion NO (which forms a loop) provides an easy folding and wedging of the web material between the core A1 and the roller 3. A reversing of the paper material is thus caused in a direction opposite to that of the advancement of said material during the winding thereof on the roll R. As a result, the web N is torn in the region NO. If the web is perforated (for the formation of a log or roll made up of a plurality of sheets to be detached along the perforation lines), the web tears along the perforation in region NO. It is preferred that the web in region NO is determined by a synchronization between the core assembly 16 and the lines of transversal perforations formed in the paper material N.

With the tearing of web N at the region NO, the roll R is separated from the incoming web material N and is moved away in the direction of arrow f9 by the rolling effect caused by the rotation of the diameter control roller 7, and made easier by the inclined surface 9. The leading edge of web N is glued to the core A1 and pressed thereon by the contact of the core between roller 1 and with roller 3 so that, during the rotation of the core, the web end fold, which has wedged itself between the core 1 and the roller 3, is made to follow the rotating core. In this way the winding of the paper material begins immediately on the newly-inserted core A1.

The completed roll R is moved away (see Fig. 3) and the diameter control roller 7 is lowered towards the nip 5 to come in contact with the new roll that has just begun to be formed. The new roll moves out of the nip 5 to come in contact with the diameter control roller 7 owing to the difference in peripheral speed between roller 1 and roller 3.

As soon as a core A1 has been inserted into the nip 5, the pusher 12 goes back in a direction opposite to arrow f12 to allow the next core to move to position A1 (Fig. 1) from the supply assembly 16. This assembly may advance with intermittent motion or continuous motion. The cycle is then repeated in the manner described for the preceding roll.

Fig. 4 shows in detail another embodiment of the assembly of members already described for the winding and removing of the formed roll. The surface 9, and in particular its front edge 9a, facing the nip 5, is advanced towards the nip the moment the formed roll must be stopped by contact with surface 9 and, in particular, with the edge thereof, in order to cause a sudden stop of the roll and the formation of the loop between the roll and the new

core inserted into nip 5. To this end, the surface 9 is part of a unit 30 which is moved forward by a rocker arm 32 pivoted at 34 to the fixed housing frame and connected to the unit 30 through a connecting rod 36. The rocker arm 32 is mechanically connected to a tappet 38 which cooperates with a cam 40 mounted on a programming cam shaft 42. Depending on the profile of cam 40, the system 38, 32, 36 causes a timely and temporary advancement of the edge 99a in the direction of arrow f9 against the just completed roll. This abruptly breaks the roll and causes the formation of the loop as described above.

The mechanical connection between the rocker arm 32 and the tappet 38 may be of direct type; that is, the two mechanical members may be rigidly connected to one another. However, in order to make it possible to vary the phase between the motion of tappet 38 and the motion of surface 9, it is particularly advantageous to provide that the angle between the tappet 38 and the rocker arm 32 may be varied and pre-set to meet peculiar working requirements, even during the machine operation. To this end, it may be provided that the tappet 38 be rigidly connected to a reducer 50 oscillating about the axis 34. The rocker arm 32 may be connected to one of two shafts (for example, to the slow shaft of reducer 50), while the other shaft of the reducer 50 is provided with a hand-wheel 52 whose adjustment causes a change of the angle formed by the rocker 32 and tappet 38.

Fig. 5 shows schematically an assembly similar to the one of Fig. 4, but in which a different device is provided to modify the position of the surface 9. In Fig. 5, the rigid rocker arm 32 is replaced by a rocker arm made up of two portions 132A and 132B, the portion 132A being fastened to the connecting rod 36 and the portion 132B carrying the tappet 38. The two portions are articulated on the axis 34, and the portion 132A includes an arm 132C which forms an acute angle with the portion 132B. This angle may be adjusted by a screw tension rod 134 having opposite threadings which engage into two movable bushes of portion 132B and of arm 132C. The tension rod 134 can be turned by the knob 134A in order to change the above-mentioned angle and thus to change, with respect to tappet 38, the position of the surface 9.

It is evident that, by the above described arrangement, a winding system is provided for a rewinder or equivalent paper converting machine, which is simpler than the existing arrangements and which allows a more uniform product to be obtained. In particular, it affords an easier start of paper winding on the core, without the presence of unusable pieces of paper (which occur frequently in the packages obtained with prior-art rewinders).

Claims

1: An apparatus for the formation of rolls by winding a web material on a core, comprising:
-a first rotary winding roller (1), along which the web material (N) is driven;
-a second rotary winding roller (3) forming a nip (5) with said first winding roller to receive a core (A);
-means (12) for inserting a core (A1) into said nip;
-a third movable roller (7) for controlling the diameter of a roll (R) during its formation between said three rollers:
-only the second roller (3) being driven to slow down the speed thereof during the insertion of a core (A1) into said nip (5);
-means (20, 24) to wet with glue the cores (A) to be inserted in said nip;
-and a take-off surface (9) near said second winding roller and adjacent the discharge side of said nip.

2: An apparatus for winding ribbon-like material (N) on a core to form a roll (R) of web material comprising:
-means to feed the web (N);
-a first winding roller (1);
-a second winding roller (3) spaced from said first winding roller (1);
-a nip (5) formed between the spaced surfaces of the first and second winding roller, the width of which nip (5) is smaller than the outer diameter of the core;
-means (16) to feed the cores in succession;
-means (20, 24) to apply adhesive on the advancing cores;
-means (12) to insert a core into the nip (5);
-a movable roller (7) for controlling the diameter of roll (R);
-means to rotate the first winding roller (1), the second roller (3) and the diameter-controlling roller (7);
-means to impose a differential speed only on said second winding roller (3) to reduce the peripheral speed of said second winding roller with respect to the peripheral speed of the first winding roller (1) and of the diameter-controlling roller (7), whereby to advance a core through said nip (5) and to remove the finished roll; and
-a take-off surface (9) adjacent said second winding roller (3) and below the diameter- controlling roller (7), on which surface a formed roll is moved away.

3: Apparatus according to Claim 2, including:
-means to keep said diameter-controlling roller (7) against the outer surface of the web as it is wound on said core, thereby limiting and controlling the outer diameter of the roll (R) of web material wound on said core;
-said diameter-controlling roller, said take-off surface, said second winding roller, and said means

for controlling the peripheral speed of the second winding roller causing the roll (R) to move away from said nip (5) thus forming a web portion (NO) in the nip;
-said take-off surface (9) having a leading edge (9a) close to said nip (5) and close to said second winding roller (3) in order to suddenly stop said roll (R) when coming in contact therewith, thus creating a loop in the web material (NO) which is dragged along by the web material being glued to a second, newly-inserted core;
-said loop being clamped between the second winding roller (3) and said second core;
-and said diameter-controlling roller (7) causing said roll to move away from said nip whereby to tear the web (NO) between the nip and the formed roll.

4: Apparatus according to Claim 3, including means to generate a plurality of lines of perforations in a cross-web direction at regular and uniform distances;
-and including means for controlling said web-perforating means to ensure that a line of perforations is positioned in the nip at the time the web is torn.

5: Apparatus according to Claim 1 or 2 or 3 or 4, including means to adjust the position of the front edge (9a) of said take-off surface adjacent to said second winding roller (3).

6: Apparatus according to Claim 2 or 3, including means to control the movement of said take-off surface close to and away from the roll (R) during formation.

7: Apparatus according to Claim 6, wherein said means to control the movement of said take-off surface (9) includes a rocker arm (32; 132), and a tappet (38) operated by a cam (40) to oscillate said rocker arm.

8: Apparatus according to Claim 7, wherein the position of said rocker arm and said tappet may be changed to modify the motion phase of the take-off surface (9) with respect to the motion phase of the cam (12).

9: Apparatus according to Claim 8 wherein said tappet (38) is carried by an arm engaged to the rocker arm (32; 132) and that said arm and said rocker arm are connected to each other through screw means (50, 52, 134) able to change the angle between the arm and the rocker arm.

10: A method for tearing a continuously-fed web while it is wound into a roll of web material, which comprises:
-providing a first winding roller and a second winding roller, disposed at some distance to one another to form a nip therebetween;
-providing a core;
-providing the core with adhesive and causing said core with adhesive to be inserted into said nip;
-moving said web between the core and the first winding roller;
-winding said web around said core to form a roll;
-providing a diameter-controlling roller and controlling the diameter of the roll by said diameter-controlling roller;
-reducing the speed of only said second winding roller to cause the removal of the roll away from said nip and the advancement of the next core into the nip between said rollers;
-providing a take-off surface for the roll during the removal phase;
-said take-off surface having an edge adjacent said second winding roller, to stop the roll when the roll comes in contact with the edge;
-braking the roll to form a loop in the web between the roll and another core newly-inserted into the nip;
-gripping the web of said loop between the newly-inserted core and the second winding roller to form a fold; and
-tearing the web between the formed roll and the loop wedged between the newly-inserted core and the second winding roller.

11: Method according to Claim 10 including moving said take-off surface along said second winding roller to a position closely near said nip and synchronizing the movement of the take-off surface with the variation of the rotational speed of the second winding roller.

12: Method according to Claim 10 or 11, wherein the insertion of the core is synchronized with the positioning of a web perforation line.

Fig.1

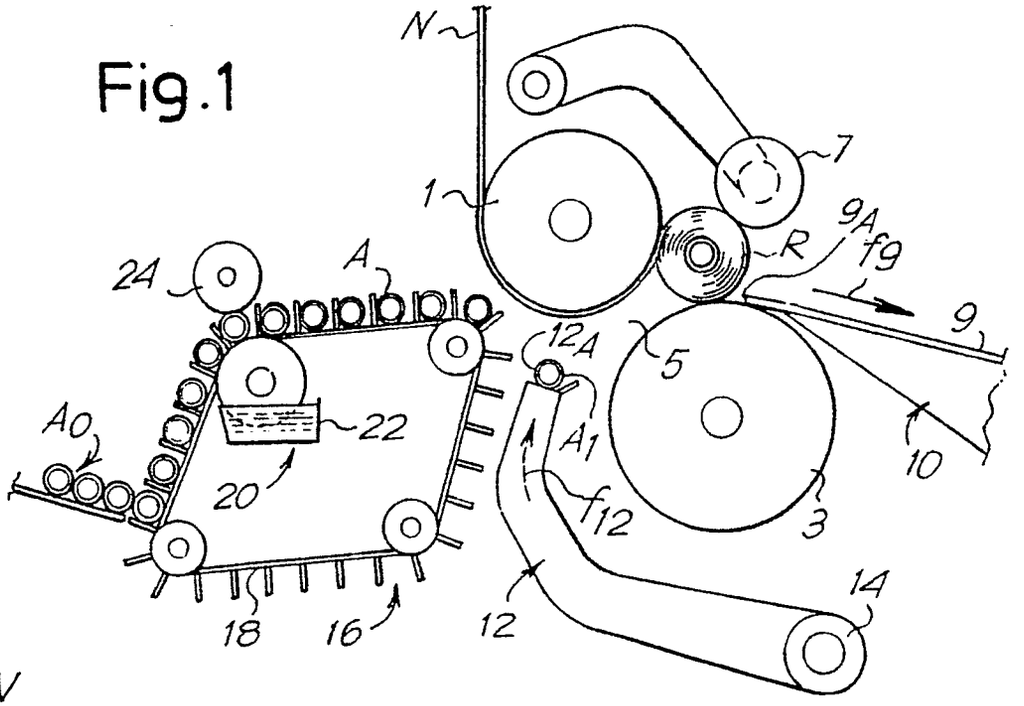


Fig. 2

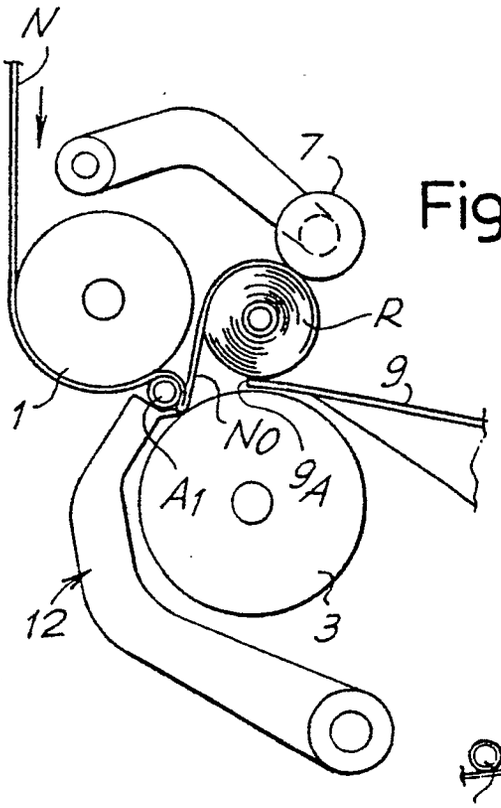


Fig. 3

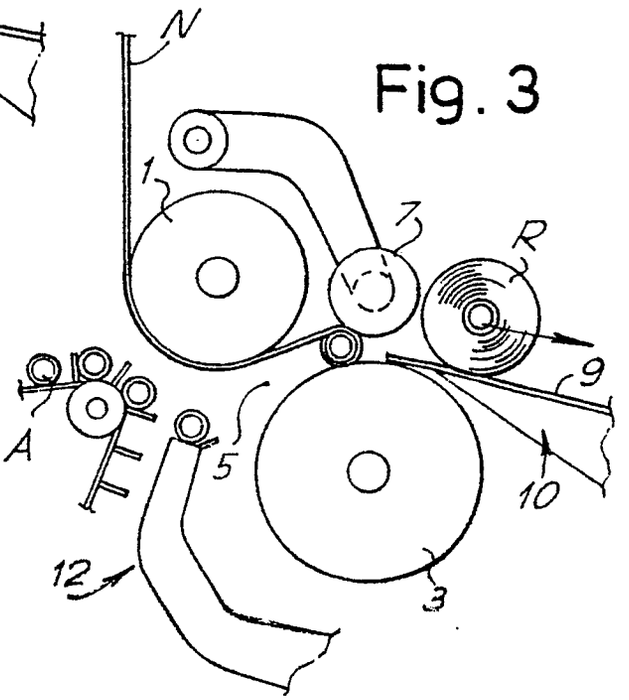


Fig. 5

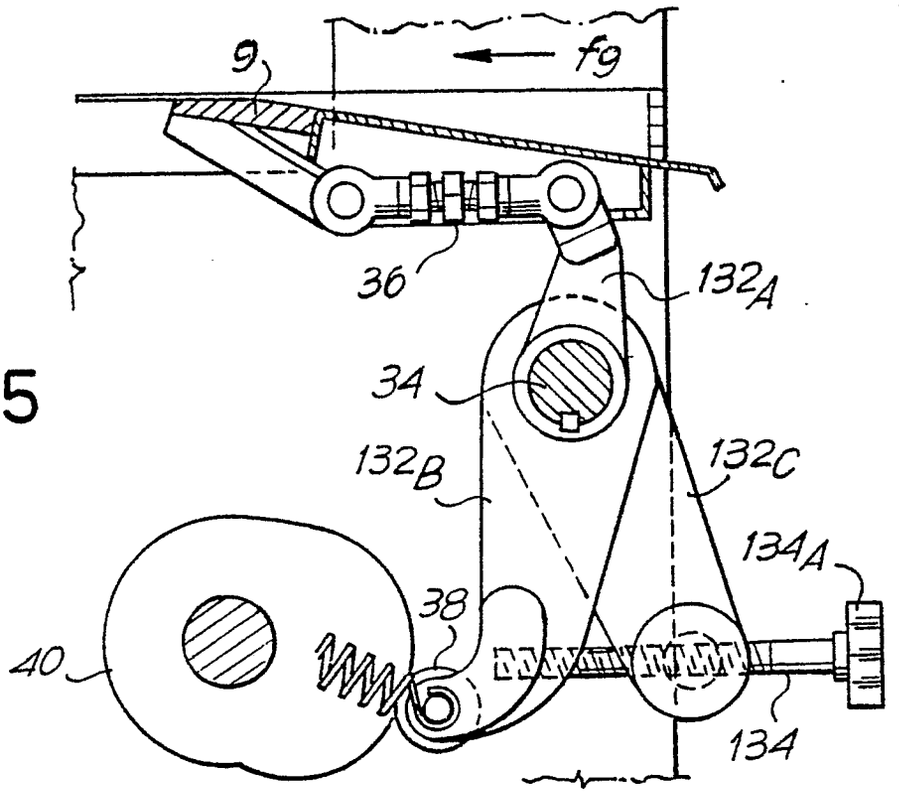

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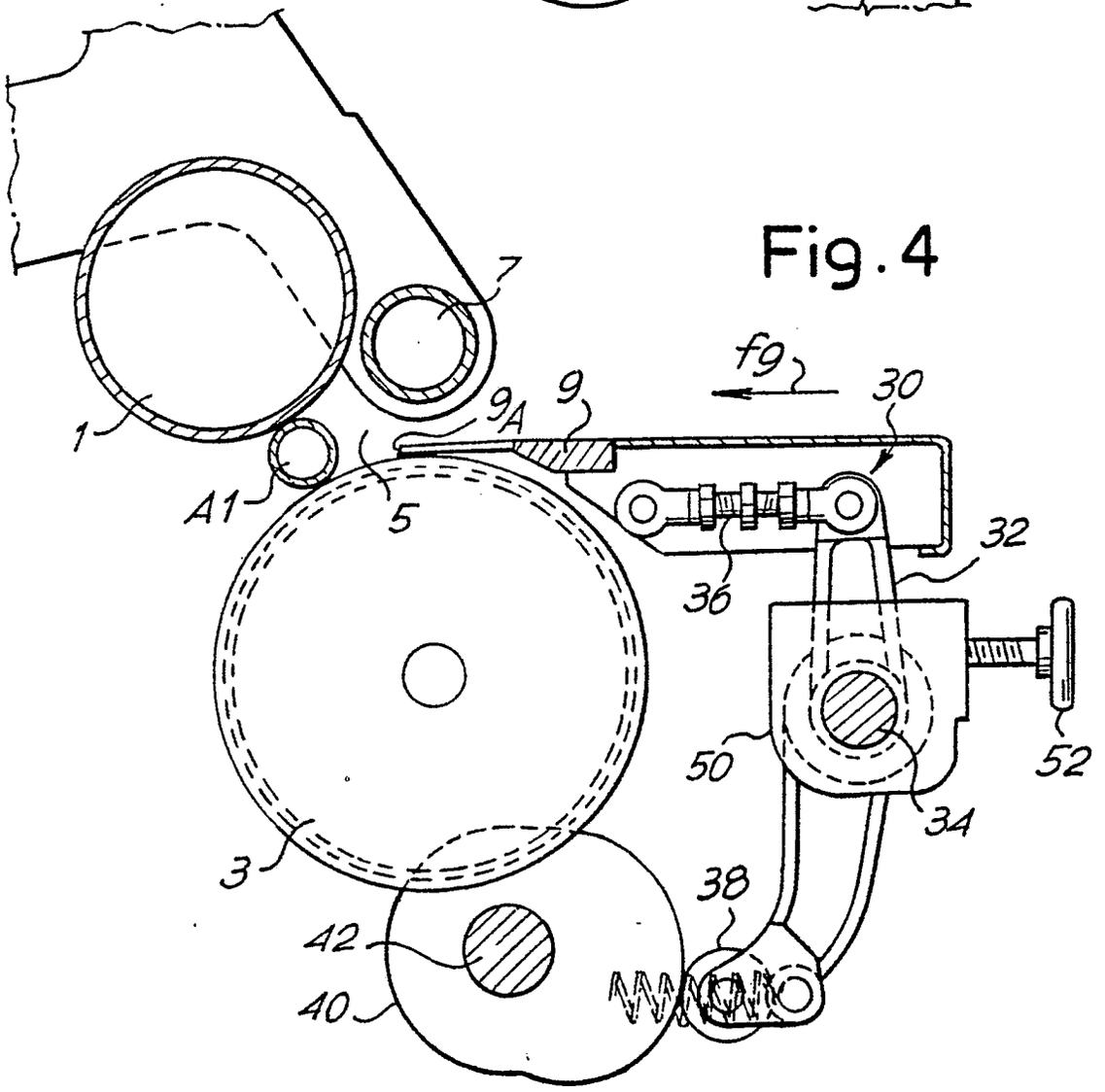
Fig. 4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