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(54) **Leaflet folding apparatus with rolling station**

(57) A leaflet folding machine 2 comprises a leaflet folding station 4 and, immediately adjacent the output of that station 4, a leaflet rolling station 6 comprising at least two successive pairs of rollers.

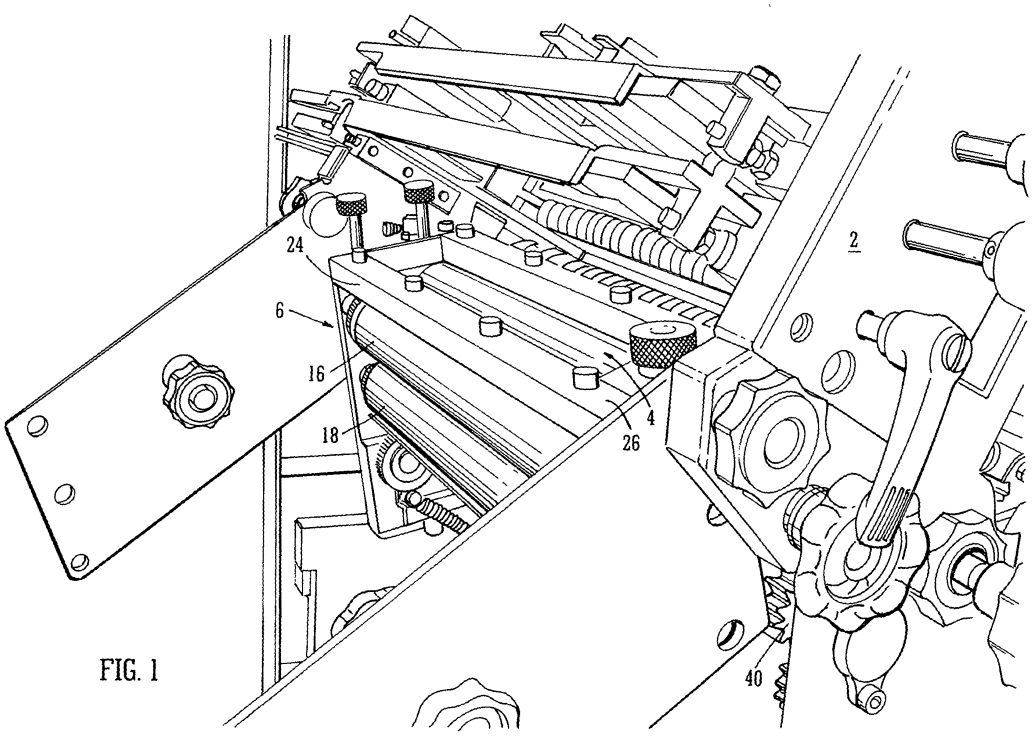

FIG. 1

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Description

[0001] The present invention relates to leaflet folding apparatus, and more particularly to leaflet folding apparatus which incorporates a pressure roller unit which ensures that the folded leaflet maintains its flatness after folding.

[0002] In existing leaflet folding apparatus, a leaflet is folded into a desired configuration and then conveyed to a flattening roller unit which is some distance, typically 1 metre, away. This presents a problem in that suitable conveyor means must be provided to pass the folded leaflets between the folding apparatus and the roller unit and for presenting the leaflets to the roller unit..

[0003] The present invention seeks to overcome this problem, and in a first aspect provides a leaflet folding machine comprising a leaflet folding station and, immediately adjacent the output of that station, a leaflet rolling station comprising at least two successive pairs of rollers.

[0004] By positioning the rolling station immediately adjacent the output of the leaflet folding station, a more compact machine is provided in which feeding of the folded leaflets to the rolling station is considerably facilitated.

[0005] Preferably, the leaflet rolling station is located within one folded leaflet distance from the output of the folding unit whereby leaflets are fed directly to the rolling unit after folding. Thus the rollers are preferably positioned such that the leaflet is gripped between the rollers as it exits the folding station so as to be transported through the rolling unit.

[0006] Preferably, the rollers each pair are biased towards one another by biasing means, for example spring means. Preferably the biasing means are arranged such that the biasing force between the rollers can be varied.

[0007] The first, upstream set of rollers preferably acts to squeeze air out of the leaflet while the second set of rollers preferably acts to kill the creases in the leaflet. In these embodiments, therefore, preferably the first set of rollers is subjected to a lower biasing force than the second set of rollers.

[0008] The rollers may be made from any suitable material. In the preferred embodiment, however, one roller, for example the lower roller, of each roller pair is of metal, for example steel and the other made from a plastics material. A suitable plastics material is an acetal copolymer, for example Ertacetal®.

[0009] Preferably, the roller pair or pairs are driven from the folding station. In a preferred embodiment of the invention, therefore, the roller station comprises a drive gear which is drivingly coupled to a suitable output drive on the folding station.

[0010] In the preferred embodiment, just one of the rollers is driven by the folding station, with the remaining roller(s) being driven by that roller through a suitable drive train.

[0011] In a preferred embodiment, the rollers are provided with gear teeth which are driven by a drive belt which engages therearound.

[0012] Preferably the roller station is provided with a belt tensioner to keep the drive belt taut. Preferably this comprises a spring biased idler wheel.

[0013] Preferably the tensioner comprises a further, fixed idler drive wheel around which the drive belt extends and which is positioned adjacent to the movable drive wheel.

[0014] In an alternative embodiment, the rollers may be driven independently of the folding station, but their speed synchronised with that of the folding unit in any suitable manner, e.g. electronically.

[0015] Preferably, the rolling station is formed as a unit which can be removably mounted to the folding unit so as to facilitate servicing and setting. This will also allow the unit to be used on more than one machine, if necessary.

[0016] It will be appreciated that the invention extends to a method of flattening a folded leaflet comprising feeding the leaflet directly from a folding station to a rolling station which is positioned less that one leaflet's length from the output of the folding station whereby the leaflet is gripped by the rolling station as or before it leaves the folding station.

[0017] A preferred embodiment of the invention will now be described, by way of example only, in which:

Figure 1 shows an apparatus in accordance with the invention;
Figure 2 shows the apparatus of Figure 1 from a different angle;
Figure 3 shows a rear view of the rolling unit of the apparatus of Figure 1;
Figure 4 shows a view of the roller unit of the present invention from one side;
Figure 5 shows a view of the unit of Figure 4 from the other side; and
Figure 6 shows a detail of the drive belt tensioning mechanism of the folding unit of the present invention.

[0018] With reference to Figure 1, there is shown a known leaflet folding unit 2. The particular unit shown is an FA 35/8 FL2 unit manufactured by GUK. This machine is well known in the art, and its operation will not, therefore, be described in detail here. However, suffice it so say that leaflets are folded in a predetermined manner and output in parallel rows from the unit 2. The output from the unit is referenced 4 in Figure 2.

[0019] Immediately adjacent the folding unit output 4 is mounted a roller unit 6. This unit 6 grasps the leaflets as they leave the folding unit output for further processing as will be described further below.

[0020] The roller unit 6 comprises a first pair 8 of upstream rollers and a second pair 10 of downstream rollers arranged closely adjacent to one another. The roller pairs 8, 10 are arranged generally horizontally. The upstream roller pair 8 comprises an upper roller 12 and a lower roller 14. The downstream roller pair 10 comprises an

upper roller 16 and a lower roller 18. The upper rollers 12, 16 are similar in design to one another and the lower rollers 14, 18 are also similar in design to one another.

[0021] In the embodiment shown, the rollers each have a diameter of 4 cm, although other sizes are possible. The diameter is, however, small to allow the roller unit 6 to be place immediately adjacent the outlet of the folding unit 4 so that the folded leaflets can be gripped immediately by the roller unit 6.

[0022] The upper rollers 12, 16 are made from an acetal copolymer, Ertacetal. The rollers have blind bores (not shown) at their ends to receive either a shaft or bearing for supporting the rollers in the unit. The lower rollers 14, 18 are of steel. The respective rollers 12, 14, 16, 18 are supported in end plates 20, 22 provided on either side of the unit 6 and separated by an upper frame 24. As can be seen in Figure 1, the frame 24 is in use provided with a with a transparent cover 26 whereby the rollers of the unit 6 may be observed during operation..

[0023] The respective lower rollers 14, 18 are journaled in bearings 28, 30, 32, 34 in the respective end plates 20, 22. The upstream lower roller is provided with an extending shaft 36 on which is mounted a drive gear 38. This drive gear 38 engages with a drive 40 of the folding unit 2 (see Figure 1). This provides the drive to the roller unit 6.

[0024] The respective upper rollers 12, 16 of each roller pair 8, 10 are mounted in an adjustable manner in the end plates 20, 22. In particular, the end plates 20, 22 are provided with vertically extending slots 42, 44, 46, 48 in which are slidably mounted bearing supports 50. Each bearing support 50 is provided with a boss on its inner face, the boss having a recess which receives a bearing which in turn receives an end portion of the respective roller 12, 16.

[0025] The bearing supports 50 are slidably mounted in the slots 42, 44, 46, 48 so that a biasing force on the respective roller pairs 8, 10 can be varied. In particular, adjustable biasing screws 52 engage biasing springs 54 which engage an upper surface of the bearing supports 50. The pressure between the rollers of each pair can simply be varied by screwing down more or less on the respective screws 52. Springs 55 are also provided under the bearing supports, the springs being located in pockets provided in the base of the slots 42, 44, 46, 48.

[0026] As stated above, the roller unit 6 is driven by a gear wheel 38 provided on one end of the lower upstream roller 14. To transmit this drive to the other rollers in the unit, each roller is provided, at its end remote from the drive gear 38, with a drive wheel 56. A drive belt 58 passes around the drive wheels 56.

[0027] In order to maintain proper tension in the drive belt 58, a tensioning unit 60 is provided. This is shown most clearly in Figures 3 and 6.

[0028] The tensioning unit 60 comprises a support plate 62 which is movably mounted in mounting slots 64 provided in a downward extension of one of the end plates 22. The support plate 62 comprises a lug 66 extending into a central slot 68 in the end plate 22. The lug 66 has a vertical threaded bore for receiving a positioning screw 70 which extends into the slot 68 through the bottom of the end plate 22. After being positioned appropriately in the slot 68 by the positioning screw 70, the support plate 62 is clamped in position by clamping screws 72 which engage in threaded apertures in the support plate 62.

[0029] The support plate 62 mounts a fixed, toothed idler wheel 74 around which the drive belt 58 passes. A further, movable toothed idler wheel 76 is mounted on one end of an L-shaped lever arm 78 the other end of which is mounted on a shaft 80 projecting from the support plate 62. A tensioning spring 82 extends between respective pins 84, 86 provided on the lever arm 78 and support plate 62 respectively. This acts to pull the movable idler wheel 76 downwardly, thereby maintaining tension in the drive belt 58.

[0030] Having described the various components of the apparatus., its operation will now be described.

[0031] Folded leaflets leaving the folding unit 2 are immediately caught in the nip between the rollers of the upstream roller pair 8 as they leave the folding unit 4. This avoids the need for any transport mechanism between the two units. The leaflets are caught in the nip of the downstream roller pair 10 as they leave the upstream roller pair 8.

[0032] The biasing force between the rollers of the upstream pair 8 is set to be less than that between the rollers of the downstream pair 10 whereby the first pair 8 act to squeeze air out of the leaflet, while the second pair act to kill the folds in the leaflet, thereby maintaining the leaflet's flatness.

[0033] The leaflets are driven through the roller unit 6 by frictional engagement with the rollers which are driven off the folding unit as described above.

[0034] After rolling, the leaflets will be discharged either directly into a container or onto a conveyor for transportation to a packing location.

[0035] The roller unit described can be used with any folded leaflet, such as concertina type folded leaflets. It can, however, be used with other types of folded leaflet.

Claims

1. A leaflet folding machine comprising a leaflet folding station and, immediately adjacent the output of that station, a leaflet rolling station comprising at least two successive pairs of rollers.

2. A leaflet folding machine according to claim 1 wherein the leaflet rolling station is positioned within one folded leaflet distance from the output of the folding unit.

3. A leaflet folding machine according to claim 1 or 2 wherein the leaflets are fed from the folding unit di-

rectly into the nip between the rollers such that the leaflet is gripped between the rollers as it exits the folding station.

4. A leaflet folding machine according to any preceding claim wherein the rollers of each pair are biased towards one another by biasing means.

5. A leaflet folding machine according to claim 4 wherein the biasing means are arranged such that the biasing force between the rollers can be varied.

6. A leaflet folding machine according to claim 5, wherein the first set of rollers is subjected to a lower biasing force than the second set of rollers.

7. A leaflet folding machine according to any preceding claim wherein the roller pair or pairs are driven from the folding station.

8. A leaflet folding machine according to claim 7 wherein just one of the rollers is driven by the folding station, with the remaining roller(s) being driven by that roller through a suitable drive train.

9. A leaflet folding machine according to claim 8 wherein the roller station comprises a drive gear which is drivingly coupled to an output drive of the folding station.

10. A leaflet folding machine according to claim 9 wherein the respective roller pair(s) are driven by a drive train which is suitably coupled to the drive gear.

11. A leaflet folding machine according to claim 11 wherein the rollers are provided with gear teeth which are driven by a drive belt which engages therearound.

12. A leaflet folding machine according to claim 11 further comprising a drive belt tensioner.

13. A leaflet folding machine according to claim 12 wherein said drive belt tensioner comprises a movable, spring biased idler wheel

14. A leaflet folding machine according to claim 13 further comprising a fixed idler drive wheel around which the drive belt extends and which is positioned adjacent to the movable idler wheel.

15. A leaflet folding machine according to any preceding claim wherein the rolling station is formed as a unit which can be removably mounted to the folding station.

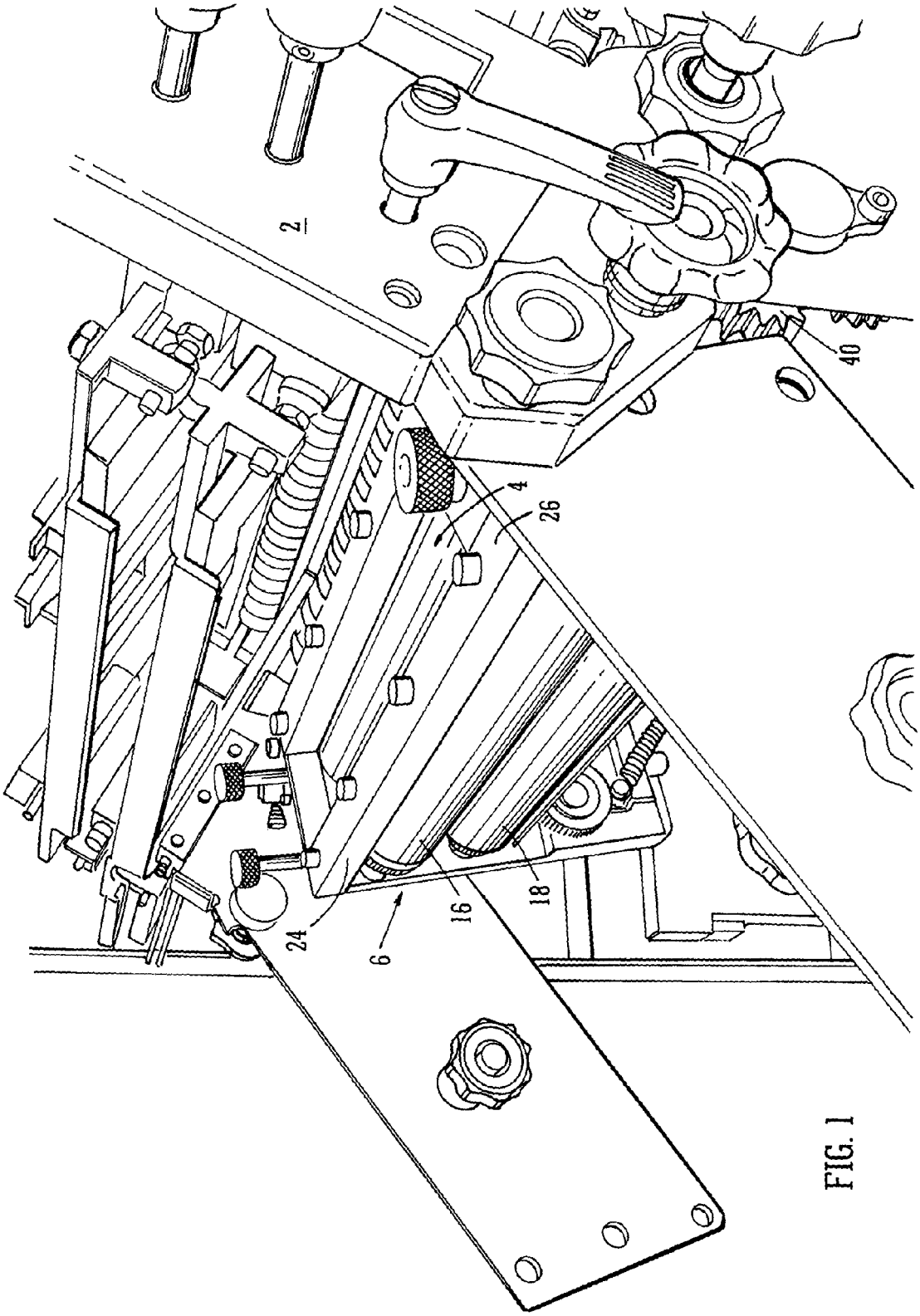

FIG. 1

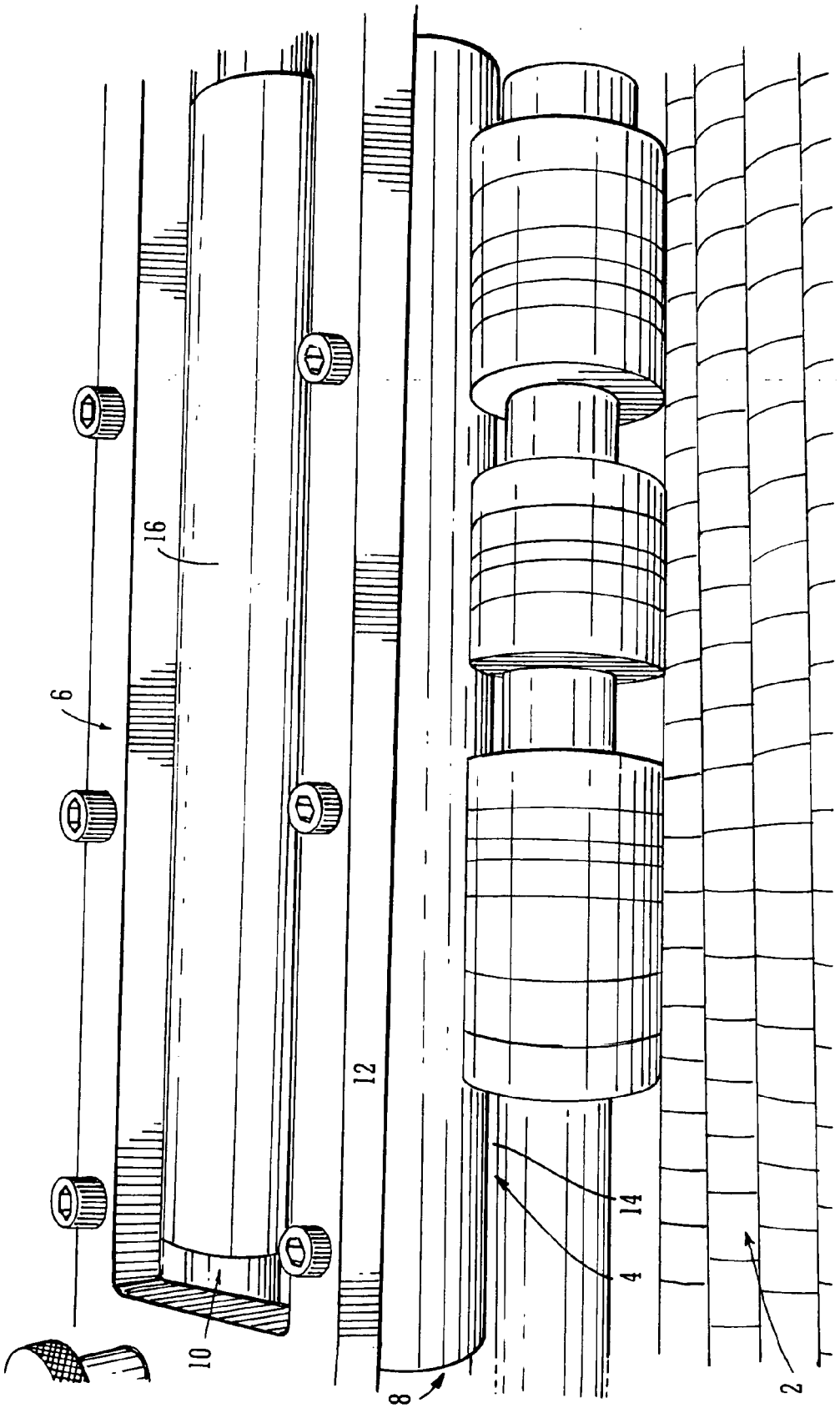

FIG. 2

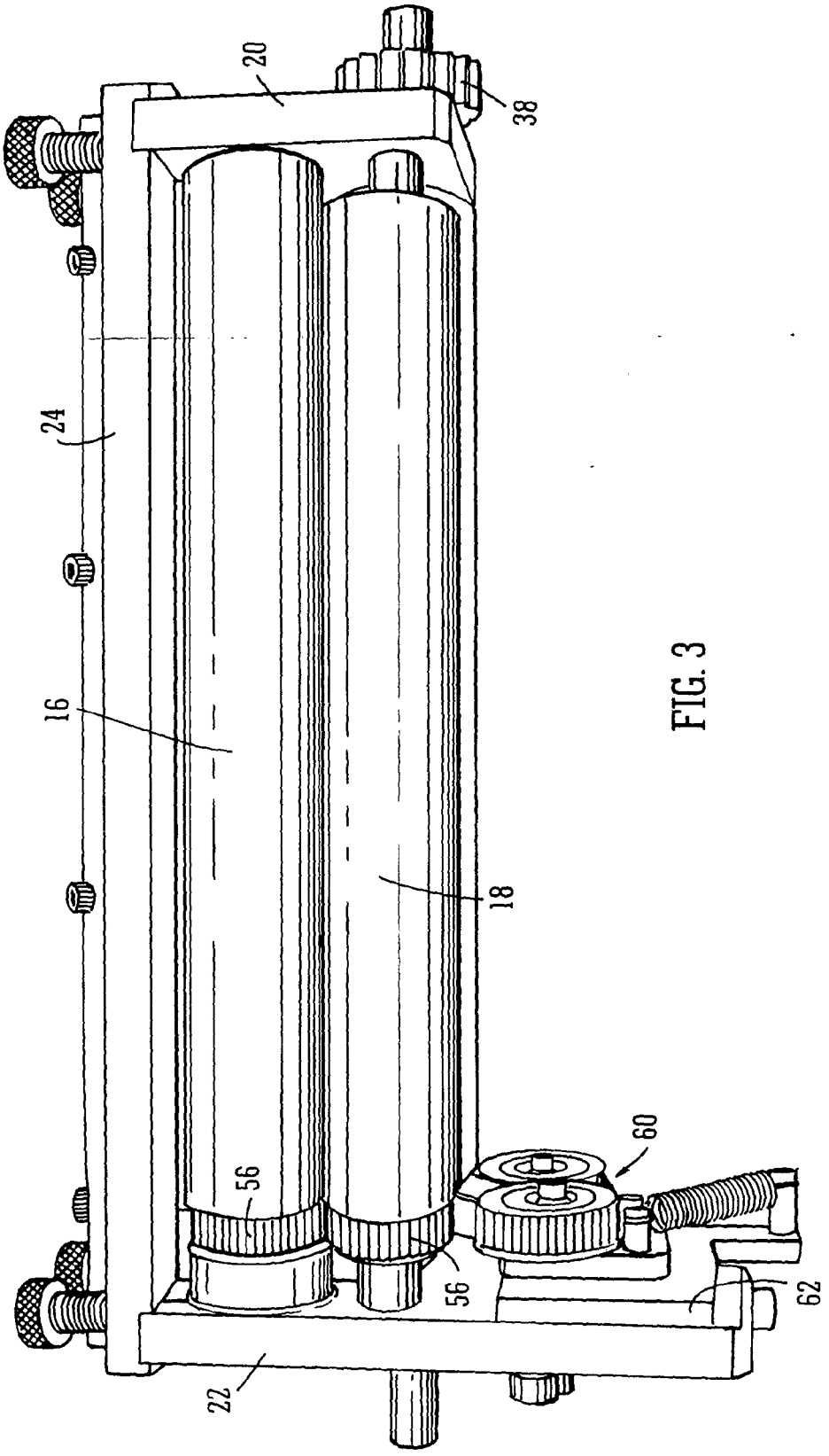

FIG. 3

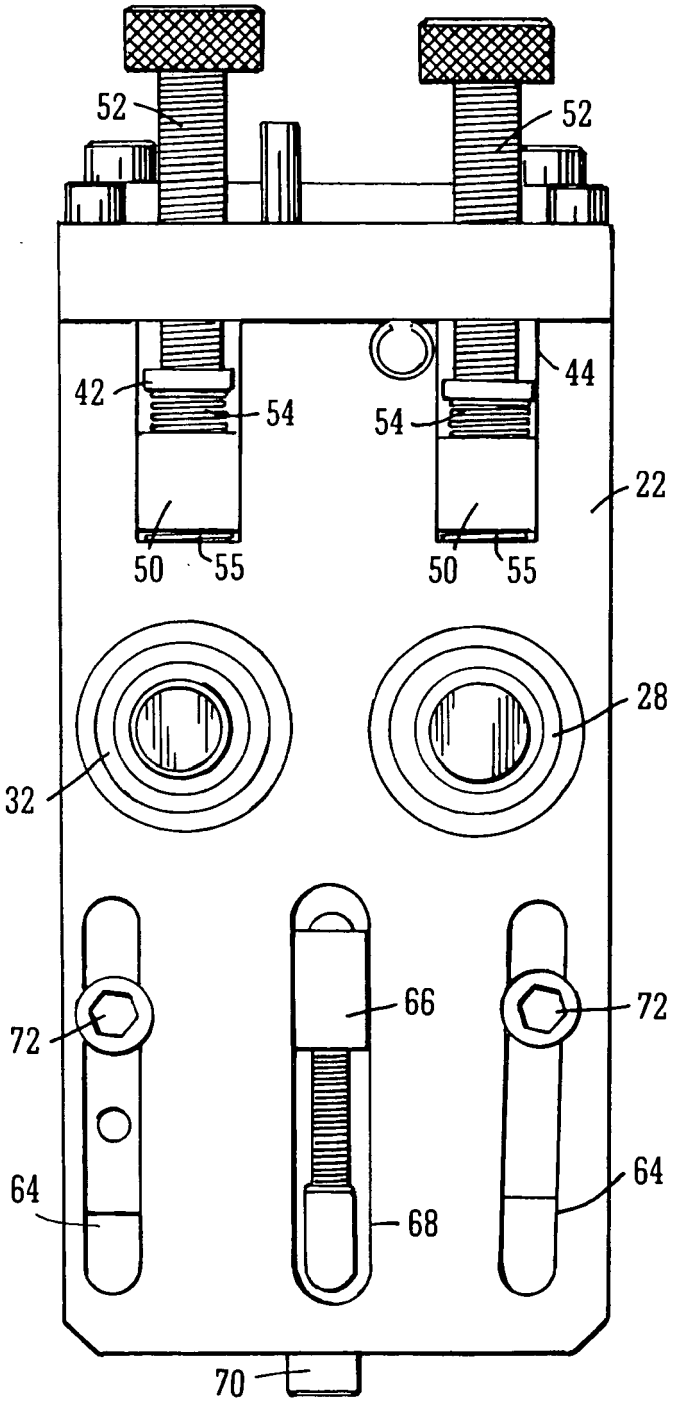

FIG. 4

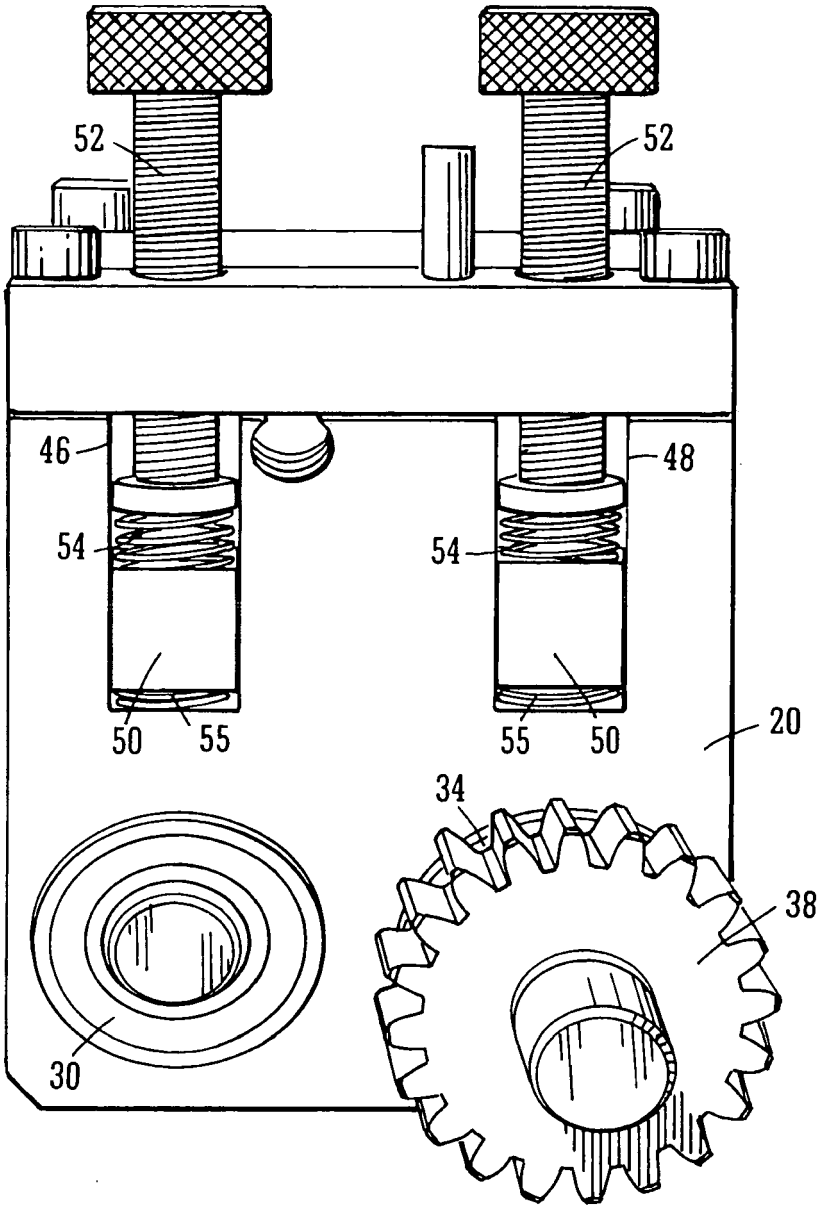

FIG. 5

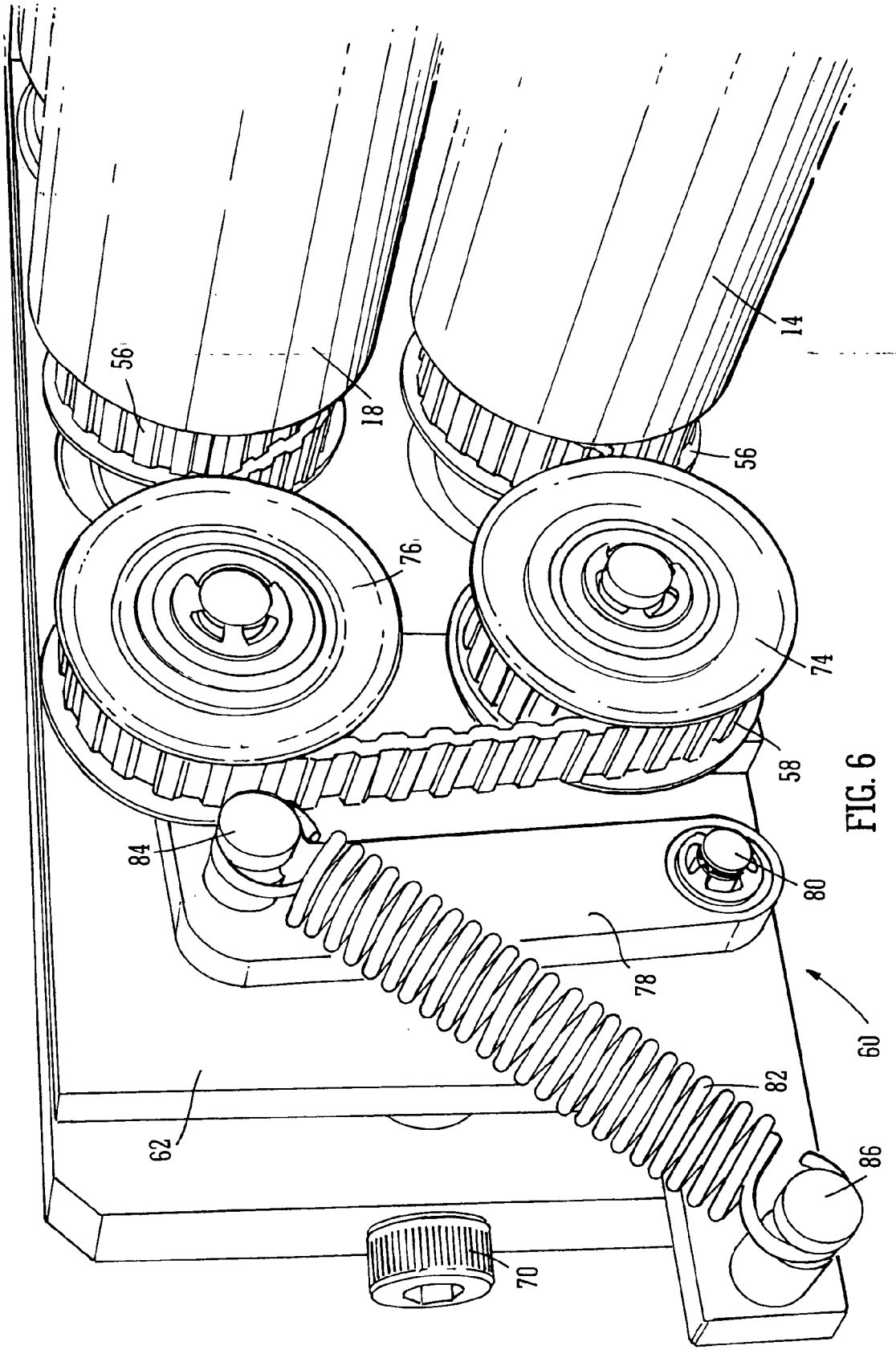

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 06 25 5379

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 January 2007	Hannam, Martin

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