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(54) **Device for individually separating flat objects, especially postal correspondence and the like, and spacing them at constant distances apart.**

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Description

This invention relates to a device for individually separating flat objects, especially postal correspondence and the like, and spacing them apart.

From US—A—3 048 393 a device for individually separating flat objects is known, which device comprises two endless driven bands with their opposing branches forming an acute angle between them and resiliently kept in mutual contact at a vertex zone of said angle to form a pinch point and means for feeding a plurality of flat objects to be handled into the V-space defined by said opposing branches of the two bands, one of said two bands being of a material of high coefficient of friction, whereas the other of the two bands is of a material having a lower coefficient of friction than the first and is driven in a manner such that that branch thereof which opposes the branch of the first band moves in the opposite direction to, and at a smaller absolute speed than this latter.

In many cases involving loose packs or heaps of flat objects, which are either at rest or arriving in a continuous or interrupted stream, it is required not only to separate the flat objects, but also to form them into a regular stream of individual objects which are spaced at constant distances apart, i.e. to obtain equal gaps between the trailing edge (in the feed direction) of each flat object and the leading edge of the immediately following object, independently of the length of the single objects.

A particular case of this kind is the handling, distribution and automatic sorting of postal correspondence.

In this and other cases, the objects to be handled can be of very variable dimensions (lengths) and consistency (thickness), and there can be considerable differences in the mass of the objects, for instance of the order of 1 to 10. An example is the comparison between a letter or postcard and an envelope containing documents.

The problem is therefore to extract or withdraw one piece at a time from a loose pack or heap of such objects, in order to make them available individually, and to then feed the individual objects into a conveying line constituted for example by two opposing belts, so that the objects become spaced at constant distances apart.

Starting from the above mentioned known prior art, the object of the present invention is therefore to provide a constructionally simple and operationally reliable device for not only individually separating flat objects, but also for spacing the objects with a constant gap between them, independently of the lengths of the flat objects.

This object is attained according to the invention by a device characterized in that downstream of the contact zone of the opposing branches of said two bands there is provided a conveyor consisting of a pair of driven belts the opposing branches of which move in the same direction as, but at a greater absolute speed than, the said branch of said first band, the said opposing branches of the two belts being kept yieldably adhering to each other to form a second pinch point and to apply to the objects passing between them a gripping force which is greater than that exerted by said first band, the said two pinch points having a distance between them which is less than the minimum length of the flat objects to be handled.

The second of the two bands being of a material having a lower coefficient of friction is suitably guided on rollers carried by a swivel-mounted support subjected to the action of an adjustable resilient means which rotates the support in such a direction as to move the front end, with reference to the feed direction of the objects, of the branch of said band into contact with the opposing branch of the first band, said branch of the second band being taut between two deviation rollers and a tensioning roller acting on the opposing branch of the first band guided over two deviation rollers in such a manner that it urges this opposing branch of the first band against the branch of the second band in the vicinity of that deviation roller thereof which is disposed at said front end of said branch of the second band.

One embodiment of the device according to the invention is described hereinafter in greater detail with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic plan view of the device on the line I—I of Figure 3,

Figure 2 is a horizontal section on the line II—II of Figure 3,

Figure 3 is an elevation of the device on the line III—III of Figure 1, and

Figure 4 is a diagram which schematically illustrates the operation of the device.

The device described hereinafter is designed to individually separate and space-apart postal correspondence such as letters of various formats and consistency, postcards etc.

In the case considered, this postal correspondence is fed in the form of an unbound pack of individual objects which are disposed vertically, i.e. not resting on a surface by means of their wide face. However, nothing prevents the objects from being fed while lying on a surface or on a band conveyor, and the special arrangement of the components of the device is not limited to the arrangement which is illustrated by way of example only.

Figures 1 to 3 show a horizontal support plate 1 with a horizontal resting table 10 for a pack 11 of flat objects disposed vertically, which is thrust by a pusher 12 in the direction of the arrow 13. The table 10 is bounded on one side by a vertical fixed guide 14.

The end part of the resting table 10 passes a short distance above the upper horizontal branch of a conveyor band 15 which moves in the direction of the arrow 16 and is guided over two deviation rollers 17, 18. A second vertical conveyor band 19 guided over rollers 20, 21 and 22

has a branch in front of the resting table 10 which passes at a distance above the upper branch of the band 15, this branch of the band 19 moving in the same direction (arrow 16) and at the same speed as the upper branch of the band 15.

The pack 11 of flat objects which is pushed forward by the pusher 12 on to the table 10 then passes on to the upper branch of the belt 15 until it encounters the facing vertical branch of the belt 19, so that some of the initial objects of the pack 11 are thrust forward by the two bands 15, 19 in the direction of the arrow 16, i.e. in practice perpendicular to the feed direction (arrow 13) of the pack 11 on the table 10. That end of the vertical guide 14 facing the vertical band 19 is suitably bent in the direction of the arrow 16 (see Figure 1) to create in front of the band 19 a passage for a certain number of objects. It should be noted that a sensor 23, for example of the known capacitive type, detects the presence of objects on the table 10 and controls the pusher 12. For simplicity, the operating and control means for the pusher 12 are not shown, this latter being mobile linearly along the guide 24 parallel to the table 10.

The passage for said certain number of objects in front of the vertical band 19 terminates in the feed direction of said objects (arrow 16) in the form of a V space created by the opposing branches 25 and 26 of two endless vertical band 27 and 28, the opposing branches 25 and 26 forming an acute angle between each other.

The band 27, which is constituted of a material having a high coefficient of friction, for example a special rubber, is supported and guided on rollers 29, 30, 31, of which the roller 30 is a tensioning roller. Its branch 25 moves in the same direction as the feed direction of the objects (arrow 16).

The band 28 is supported and guided on rollers 32, 33, 34 and 35 of which the roller 34 is a tensioning roller, and it is constituted by a normal rubberised band having a coefficient of friction substantially less than that of the band 27 (for example the ratio of the coefficients of friction of the two bands is 1:2). The branch 26 of the band 28 also moves in the opposite direction to the feed direction of the objects (in the opposite direction to the arrow 16).

The support and guide rollers 32—35 for the band 28 are carried by a support 36 which is mounted to swivel about the axis of the roller 33 on the plate 1, and is subjected to the action of a tension spring 37 which rotates the support 36 in such a direction as to move the front end (with reference to the feed direction of the objects as indicated by arrow 16) of the branch 26 of the band 28 into contact with the branch 25 of the band 27 with a determined pressure, as is clearly visible in Figure 1. This contact zone between the branches 25, 26 of the bands 27, 28 forms a first pinch point, indicated by 38.

It is important to note that the opposing branches 25 and 26 of the bands 27, 28 form a contained open acute angle, and are properly kept in mutual contact at the vertex zone of this angle, i.e. at said first pinch point 38. For this purpose, the position of the tensioning roller 30 for the band 27 relative to the deviation roller 35 of the band 28 is important. As clearly visible in Figure 1, by deviating the branch 25 of the band 27 from the straight line joining the deviation rollers 29 and 31, the tensioning roller 30 pushes it against the branch 26 of the band 28, which is kept taut between its deviation rollers 32 and 35. This arrangement ensures the passage of only one of the objects through the pinch point 38, independently of the thrust exerted by the subsequent objects which move towards said pinch point into the V space between the two branches 25, 26 of the bands 27 and 28.

The force of the spring 37 can be adjusted by means of an adjustable tie rod 39. An adjustable stop 40 limits the rotation of the support 36 under the action of the spring 37.

The force of the spring 37 and its positioning relative to the pivot of rotation of the support 36 are determined in such a manner as to obtain a substantially constant pressure at the pinch point 38, independently of the opening of the bands 27, 28 determined by the passage of an object through the pinch point 38 and by the variable thickness of the passing object (the difference in thickness between the objects can be considerable, even of the order of 1 to 10).

A vertical belt conveyor constituted by a belt 41 guided over pulleys 42, 43 and 44 and a belt 45 guided over pulleys 46, 47, 48, 49 and 50 is provided at a certain distance downstream of the zone of contact of the opposing branches 25, 26 of the two bands 27, 28. Over a certain portion, the two belts 41 and 45 run parallel to each other in the feed direction of the objects (arrow 16) and at the same speed, and over this portion the belts are kept yieldably in mutual contact by virtue of the arrangement of the pulleys 46, 47 and 48 relative to the pulleys 42, 44 as shown in Figure 1, the pulleys 47 being a tensioning pulley. The beginning of this portion forms a second pinch point indicated by 51.

It should be noted that the distance between the pinch point 38 formed by the two bands 27, 28 and the pinch point 51 formed by the two belts 41, 45 is less than the minimum length of the flat objects (postal correspondence) to be handled.

The bands and various belts of the device are driven from a single motor 52 mounted below the support plate 1 (see Figures 2 and 3). Two pulleys 53, 54 are mounted on the drive shaft. The pulley 53 drives, by way of a belt transmission 55, the pulley 56 which is mounted on the shaft of the drive roller 17 of the band 15, said belt 55 being guided over two deviation pulleys 57 and 58. The pulley 54 drives the band 19, the pair of bands 27, 28 and the belts 41, 45 of the downstream conveyor by way of a single belt transmission 60. The belt 60 takes the following path: from the pulley 54 it passes over a deviation pulley 61, over a drive pulley 62 mounted on the shaft 63 carrying the drive roller 33 for the belt 28 (said shaft also constituting the axis of rotation for the support 36), then over a drive pulley 64 mounted on the

shaft 65 carrying the drive pulley 49 for the belt 45, then over a deviation pulley 66, then over a drive pulley 67 mounted on the shaft 68 carrying the drive pulley 44 for the belt 41, then over a deviation pulley 69 and finally over a drive pulley 70 mounted on the shaft 71 carrying the drive rollers 22 and 31 for the band 19 and band 27 respectively, to then return to the pulley 54 (see Figure 2 in particular).

The transmission ratios are chosen such that when the band 27 moves in the feed direction 16 of the objects, it has a linear speed greater than the linear speed of the band 28 which moves in the opposite direction, and such that the belts 41, 45 of the downstream conveyor have a linear speed greater than that of the belt 27.

The operation of the described device is as follows.

The pack 11 of flat objects thrust by the pusher 12 on the table 10 in the direction 13 arrives on the horizontal band 15 and abuts against and facing branch of the vertical band 19. The two bands 15 and 19 urge the initial objects of the pack 11 in the direction 16, and the bent part of the vertical guide 14 allows some of them to pass into the V-constricted space of the opposing branches 25, 26 of the band 27, 28. These objects thus tend to accumulate in said V space.

Because of its high coefficient of friction, the band 27 tends to drag the objects forward in the direction 16, while the other band 28 which rotates in the opposite direction at a lower speed, and which has a coefficient of friction which is substantially less than the first, tends to halt the objects which slide against it.

An individual object which becomes gripped between the two bands 27, 28 at the first pinch point 38 is urged forward on one of its faces by the band 27, whereas it is urged backward on its other face by the band 28. The pressure acting on the two faces of the object is obviously the same, whereas the coefficient of friction of the band 27 is substantially greater (with a ratio for example of 2:1) than that of the band 28, and thus the forward thrust action of the band 27 prevails with the result that the object is moved forward at the speed of the band 27 towards the downstream conveyor.

If two objects simultaneously reach the pinch point 38, that facing the band 27 is caused to move forward in the direction 16 thereby, whereas the other facing the band 28 is halted and then caused to move backward, because the branch 26 of the band 28 moves in the opposite direction to the feed direction. On the other hand, the bands 15 and 19 and the other objects conveyed forward thereby continue to thrust this latter object forward, so that in practice it stops slightly upstream of the pinch point 38, where the band 28 is no longer able to move it backward because of lack of pressure. This second object therefore remains waiting until the first object in completely passing beyond the pinch position 38 uncovers the band 27, which by then acting on the second object moves it forward at this point.

If the belt conveyor 41—45 were to move forward at the same speed as the band 27, the objects would simply file past one at a time without any gaps between them. A continuous stream of objects would therefore be created. It should be noted that beginning with their forward movement on the table 10, the objects can be accelerated in a number of stages, firstly by the bands 15 and 19 and then by the band 27, with the result that the effect of their mass, which can be very different, is minimised.

However, to obtain a gap between one object and the next, the belts 41, 45 of the downstream conveyor are made to move at a speed greater than the band 27, and in addition the conveyor, which has a relatively long portion of the two belts pressed against each other, is designed to be able to apply a force to the object which is greater than that exerted by the band 27. When an object reaches the second pinch point 51 by being thrust by the band 27, it matches its speed to that of the belts 41 and 45 because of the greater power of the belt conveyor, so that when the object which succeeds it at its rear end is moved forward by the band 27, it advances at a lower speed (that of the band 27) between the point 38 and the point 51. In this manner, a gap is created between the two objects which can be predetermined by adjusting the difference in speed between the band 27 and the downstream conveyor, and the distance between the pinch points 38 and 51.

In order to obtain an equal gap between the various objects which is independent of the length of the objects, the distance between the pinch points 38 and 51 has only to be less than the minimum length of the objects to be handled.

The thickness differences which can exist between the objects in a same pack and which — as stated — can reach considerable values, such as 1 to 10, are absorbed in that the band 28 is mounted on the swivel-mounted support 36 which can move away from the band 27. The spring 37 acting on the support 36 creates the force necessary for pressing the band 28 against the objects and against the band 27 with the required pressure. The size of the spring 37 and its position relative to the swivel axis of the support 36 are such as to obtain within practical limits a pressure which is substantially constant at the pinch point 38, independently of the thickness of the object which is passing through it at any time.

The operation of the device for spacing objects at constant distances apart is shown schematically in the diagram of Figure 4, in which the abscissae indicate the spaces and the ordinates the times. The two lines 38 and 51 indicate the two pinch points for the objects between the bands 27, 28 and belts 41, 45.

At time *a*, there are three objects A, B and C of different length with their front edges (in the direction of movement) at rest at the first pinch point 38. At time *b*, the object A is advancing under the thrust of the band 27 of high coefficient of friction, while the other two objects B and C

remain at rest.

At time *c*, the front edge of the object A reaches the second pinch point 51, while the object is still gripped by the bands 27 and 28. At time *d*, it can be seen that because of the greater speed and gripping force of the belts 41 and 45, the object A is made to advance rapidly although its rear end is still gripped by the bands 27 and 28, so that the objects B and C still remain at rest. At time *e*, the object A is free from the bands 27 and 28, so that the first of these now causes the next object B to advance. At time *f*, it can be seen that the gap between the objects A and B has increased because of the greater forward speed of the first, the rear end of which has left the second pinch point 51, whereas the following object has not yet reached this point, so that the gap between the two objects A and B increases further. Finally, at time *g*, the object B has reached and passed beyond the second pinch point 51, and now moves forward at the same speed as the object A, while because of the fact that its rear end has been released from the grip at the first pinch point 38, the third object C can now move forward under the thrust of the band 27.

The aforegoing description clarifies the operation of the devices according to the invention, which is based on the concept of utilising the friction which develops between the surface of the flat object and a rubberised band of high coefficient of friction.

It should be noted that instead of using a stationary table on which a loose pack of objects is moved forward by a pusher, a mobile table could be used, or even a conveyor belt which feeds a continuous stream of flat objects. In this case, the objects could be fed in packs or heaps, or even individually, for example directly in the feed direction 16 on to that branch of the band 19 which carries the objects into the V space between the two bands 27 and 28. If the device feeds in this latter manner, it can be advantageous to dispose the band 19, the pair of bands 27, 28 and the downstream conveyor comprising the belts 41 and 45 horizontally instead of vertically. In this case, the device again operates in the same manner as heretofore described.

Claims

1. A device for individually separating flat objects, especially postal correspondence and the like, and spacing them apart, comprising two endless driven bands (27, 28) with their opposing branches (25, 26) forming an acute angle between them and resiliently kept in mutual contact at a vertex zone of said angle to form a first pinch point (38) and means (15, 19) for feeding a plurality of flat objects to be handled into the V-space defined by said opposing branches (25, 26) of the two bands (27, 28), one (27) of said two bands being of a material of high coefficient of friction, whereas the other (28) of the two bands is of a material having a lower coefficient of friction than the first (27) and is driven in a manner such that that branch (26) thereof which opposes the branch (25) of the first band (27) moves in the opposite direction to, and at a smaller absolute speed than this latter, characterized in that downstream of the contact zone of the opposing branches (25, 26) of said two bands (27, 28) there is provided a conveyor consisting of a pair of driven belts (41, 45) the opposing branches of which move in the same direction as, but at a greater absolute speed than, the said branch (25) of said first band (27), the said opposing branches of the two belts (41, 45) being kept yieldably adhering to each other to form a second pinch point (51) and to apply to the objects passing between them a gripping force which is greater than that exerted by said first band (27), the said two pinch points (38, 51) having a distance between them which is less than the minimum length of the flat objects to be handled.

2. A device as claimed in claim 1, characterized in that the second (28) of the two bands (27, 28) is guided on rollers (29—31) carried by a swivel-mounted support (36) subjected to the action of an adjustable resilient means (37) which rotates the support (36) in such a direction as to move the front end, with reference to the feed direction (16) of the objects, of the branch (26) of said band (28) into contact with the opposing branch (25) of the first band (27), said branch (26) of the second band (28) being taut between two deviation rollers (32, 35) and a tensioning roller (30) acting on the opposing branch (25) of the first band (27) guided over two deviation rollers (29, 31) in such a manner that it urges this opposing branch (25) of the first band (27) against the branch (26) of the second band (28) in the vicinity of that deviation roller (35) thereof which is disposed at said front end of said branch (26) of the second band (28).

Patentansprüche

1. Vorrichtung zum Vereinzeln und Auseinanderlegen von flachen Gegenständen, insbesondere Briefumschlägen und ähnlichem, bestehend aus zwei angetriebenen Endlosbändern (27, 28), wobei deren einander gegenüberliegende Bandbereiche (25, 26) zwischen sich einen spitzen Winkel bilden und an der Spitze des Winkels federnd aneinander gehalten werden, um einen ersten Klemmpunkt (38) zu bilden und bestehend aus einer Anordnung (15, 19) zum Zuführen einer großen Anzahl flacher Objekte, die in dem V-förmigen Zwischenraum, der durch die beiden einander gegenüberliegenden Bandbereiche (25, 26) der beiden Bänder (27, 28) gebildet wird, erfaßt werden, wobei das eine (27) der beiden Bänder aus einem Material mit hohem Reibungskoeffizienten besteht, und das andere (28) der beiden Bänder aus einem Material mit niedrigerem Reibungskoeffizienten als das erste Band (27) und das so angetrieben ist, daß der Bandbereich (26), der dem Bandbereich (25) des ersten Bandes (27) gegenüberliegt, sich zu die-

sem in der Gegenrichtung bewegt und zwar mit einer geringeren absoluten Geschwindigkeit als letzteres, dadurch gekennzeichnet, daß nach der Berührungszone der einander gegenüberliegenden Bandbereiche (25, 26) der beiden Bänder (27, 28) ein Förderer angeordnet ist, bestehend aus zwei angetriebenen Bändern (41, 45), wobei die einander gegenüberliegenden Bandbereiche sich in der selben Richtung bewegen, jedoch mit einer größeren Absolutgeschwindigkeit als der Bandbereich (25) des ersten Bandes (27) und wobei die einander gegenüberliegenden Bandbereiche der beiden Bänder (41, 45) nachgiebig aneinander haften, um miteinander einen zweiten Klemmpunkt (51) zu bilden und auf die zwischen ihnen durchlaufenden Gegenstände eine Greifkraft aufzubringen, die größer ist als die durch das erste Band (27) aufgebrachte, und dadurch, daß die beiden Klemmpunkte (38, 51) einen Abstand haben, der kleiner ist, als die Mindestlänge der zu handhabenden flachen Gegenstände.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das zweite (28) der beiden Bänder (27, 28) über Rollen (29—31) geführt wird, die auf einer schwenbaren Wippe (36) sitzen, abhängig von der Wirkung einer einstellbaren Spannvorrichtung (37), die die Wippe (36) so dreht, daß das vordere Ende, bezogen auf die Transportrichtung (16) der Gegenstände, des Bereiches (26) des Bandes (28) in Berührung mit dem gegenüberliegenden Bereich (25) des ersten Bandes (27) kommt, wobei der Bereich (26) des zweiten Bandes (28) zwischen zwei Umlenkrollen (32, 35) gespannt ist und eine Spannrolle (30), die auf den gegenüberliegenden Bereich (25) des ersten Bandes (27) wirkt, der so über die zwei Umlenkrollen (29, 31) läuft, das er den gegenüberliegenden Bereich (25) des ersten Bandes (27) gegen den Bereich (26) des zweiten Bandes (28) in der Nähe der Umlenkrolle (35) drückt, die am vorderen Ende des Bereichs (26) des zweiten Bandes (28) sitzt.

Revendications

1. Dispositif pour separer individuellement des objets plats, en particulier de la correspondance postale et similaire, et pour les espacer, comprenant deux bandes sans fin entraînées (27, 28) dont les branches opposées (25, 26) forment un angle aigu entre elles et sont maintenues élastiquement en contact mutuel au sommet de cet angle pour former un premier point de pincement (38), et des moyens (15, 19) d'introduction d'une pluralité d'objets plats à traiter dans l'espace en V délimité par lesdites branches opposées (25, 26) des deux bandes (27, 28), l'une (27) de ces bandes étant réalisée en un matériau à coefficient de frottement élevé, tandis que l'autre bande (28) est faite d'un matériau à plus faible coefficient de frottement que la première (27) et est entraîné de manière telle que la branche (26) de celle-ci opposée à la branche (25) de la première bande (27) se déplace dans la direction opposée et à une vitesse inférieure en valeur absolue à celle de cette dernière, caractérisé en ce que, en amont de la zone de contact entre les branches opposées (25, 26) des deux bandes (27, 28), il est prévu un convoyeur constitué d'une paire de courroies entraînées (41, 45) dont les branches opposées se déplacent dans la même direction que ladite branche (25) de la première bande (27), mais à une vitesse supérieure en grandeur absolue, et les branches opposées des deux courroies (41, 45) sont maintenues en adhérence l'une à l'autre de manière souple pour former un second point de pincement (51) et pour appliquer aux objets qui passent entre celles-ci une force de serrage supérieure à celle qui est exercée par la première bande (27), les deux points de pincement (38, 51) étant séparés par une distance inférieure à la longueur minimum des objets plats à traiter.

2. Dispositif selon la revendication 1, caractérisé en ce que la seconde (28) des deux bandes (27, 28) est guidée sur des galets (29—31) montés sur un support pivotant soumis à l'action d'un élémént élastique réglable (37) qui fait tourner le support (36) dans une direction telle que l'extrémité avant de la branche (26) de la bande (28), en se référant à la direction d'introduction (16) des objets, est déplacée pour venir en contact avec la branche opposée (25) de la première bande (27), cette branche (26) de la seconde bande (28) étant tendue entre deux galets de déviation (32, 35), et un galet de tension (30) agissant sur la branche opposée (25) de la première bande (27), guidée sur deux galets de déviation (29, 31) de telle manière qu'ils sollicitent cette branche opposée (25) de la première bande (27) contre la branche (26) de la seconde bande (28) au voisinage du galet de déviation (35) de celle-ci qui est disposée à ladite extrémité avant de la branche (26) de la seconde bande (28).

Fig.1

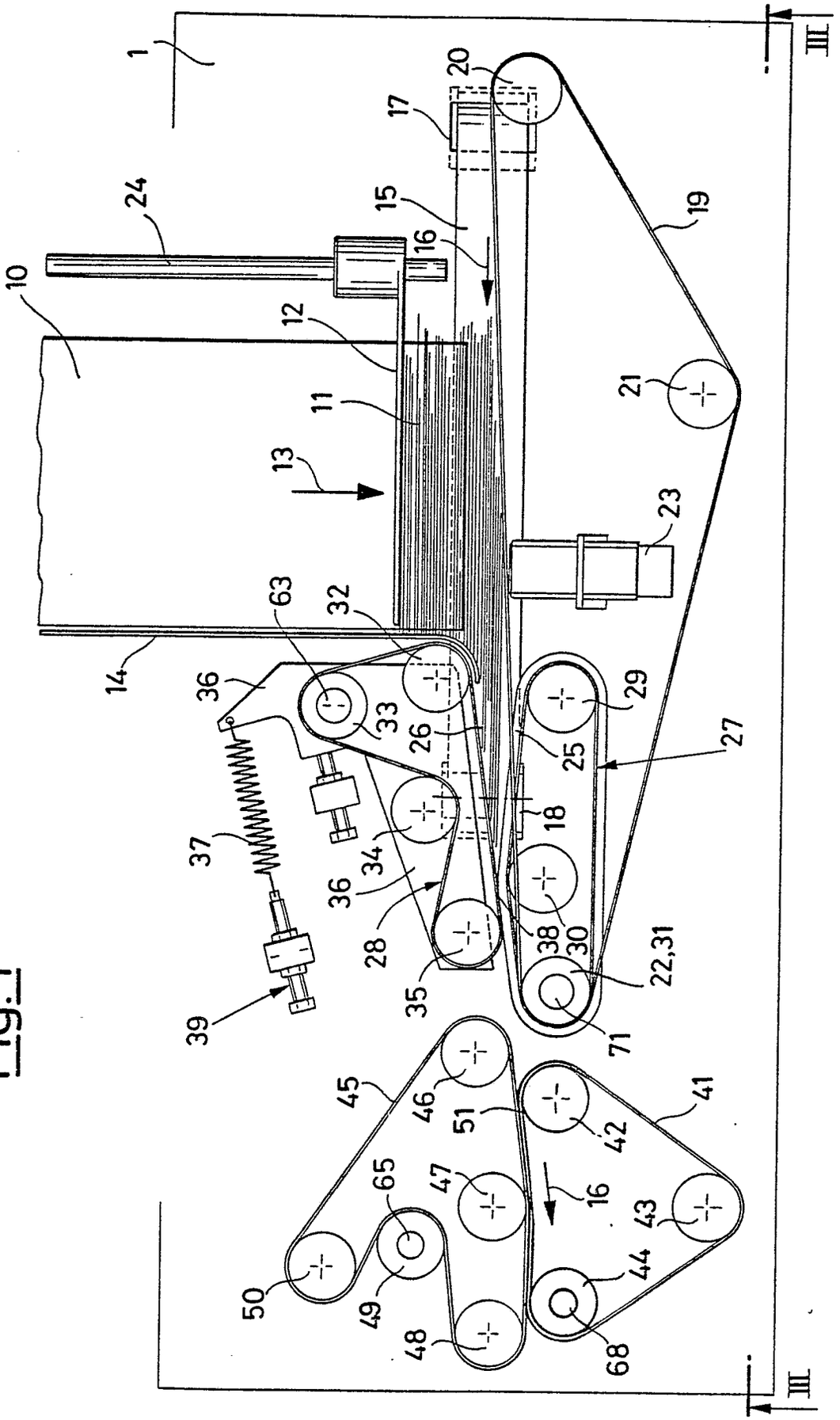
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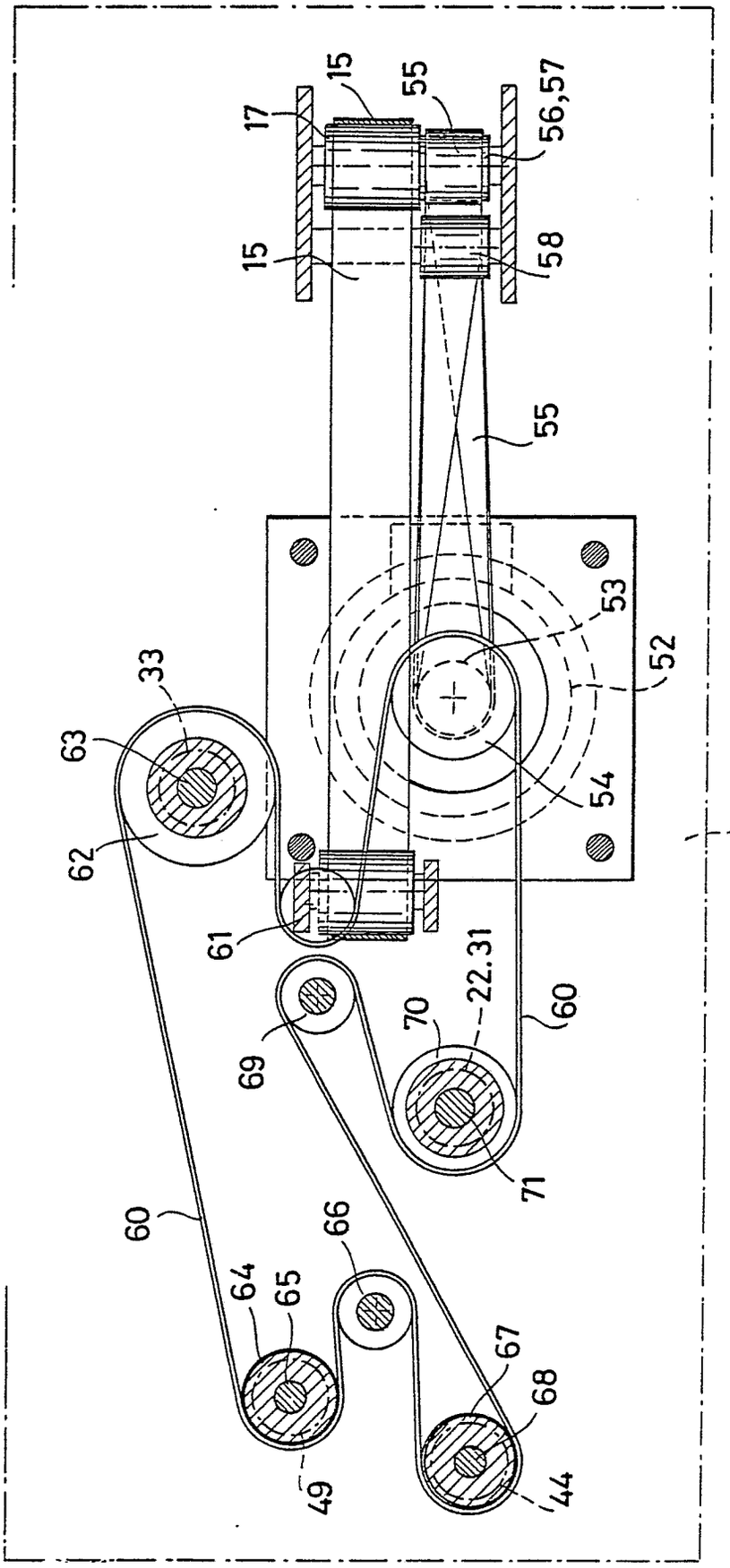
Fig.2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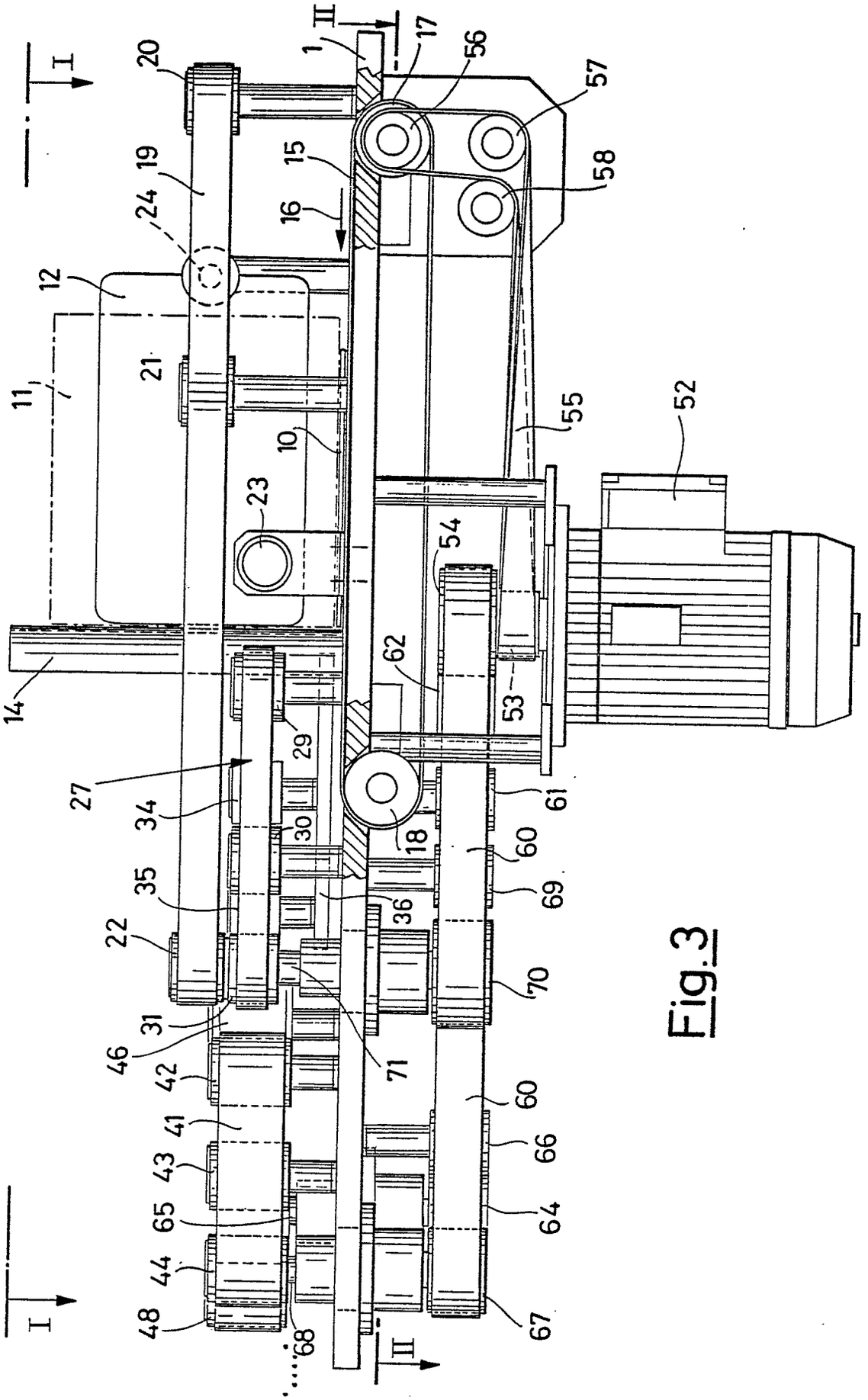
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Fig.3

Fig.4