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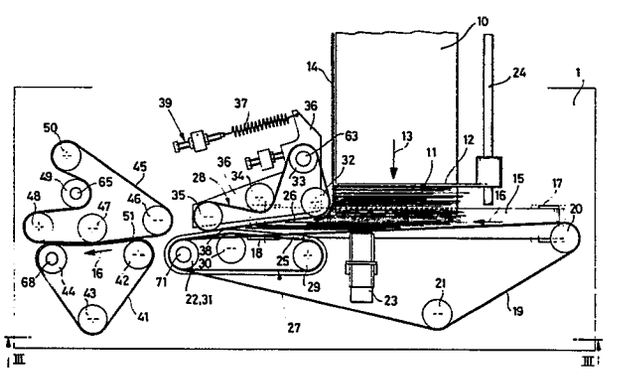
(54) Device for individually separating flat objects, especially postal correspondence and the like, and spacing them at constant distances apart.

(57) A separator-spacer device for flat objects, such as postal correspondence, in which the objects to be handled are fed into the V space formed by the opposing branches (25, 26) of two bands (27, 28), which are urged resiliently against each other, in order to define a first pinch point (38). One band (27) has a high coefficient of friction and moves in feed direction (16) of the objects, the other band (28) moves at a lower speed in opposite direction and has a lower coefficient of friction. Downstream of the bands (27, 28) there is provided a belt conveyor (41, 45) moving at a greater speed than the first band (27), and forming a second pinch point (51) spaced apart from the first by a distance less than the minimum length of the objects.



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"Device for individually separating flat objects, especially postal correspondence and the like, and spacing them at constant distances apart"

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

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 to form them into a regular stream of individual objects which are spaced at constant distances apart.

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 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.

The conventional methods for carrying out these operations are generally based on the use of slotted permeable belts or perforated drums which with the aid of vacuum created by a suitable pump draw one objects at a time from a stationary pack to cause it to adhere to the moving belt or drum, which then releases the object withdrawn from the pack and inserts it into the conveying line.

The known devices are also fitted with appropriate auxiliary equipment, for example for preventing a number of objects being withdrawn or extracted at a time, this equipment making the operation of said devices extremely complicated.

In general, these conventional systems always provide for withdrawing the individual objects while stationary, to then raise them instantaneously to the speed of the conveying line.

As the available times are small, even though the speeds concerned are not very high, the acceleration which the objects undergo on being withdrawn is very large, and because, as stated, the mass of the objects can differ considerably, the extraction obtained, which is based on a constant accelerating force, is strongly influenced by the physical characteristics of the objects handled.

The object of the present invention is therefore to provide a constructionally simple and operationally reliable device for individually separating flat objects and spacing them at constant distances apart, which carries out the individual separation without the need for using suction means, in which the effect of the mass difference between the objects is minimised, and which is also able to operate on a stream of arriving objects in addition to stationary packs or heaps. These objects are attained according to the invention by a device characterised by comprising two endless motorised 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 first pinch point, means for feeding a plurality of flat objects to be handled into the V space defined by said opposing branches of the two bands, and, at a predetermined distance downstream of the contact zone of the opposing branches of the two bands, a conveyor constituted by a pair of motorised belts the opposing branches of which move in the same direction and at the same speed and are kept yieldably adhering to each other to form a second pinch point, one of said two bands being of a material of high coefficient of friction and being driven in such a manner that that branch thereof which opposes the branch of the second band moves in the same direction as, but at a smaller speed than, the opposing branches of the conveyor belts, whereas

the other of the two bands is of a material having a lower coefficient of friction than the first and is driven in such a manner 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.

The means for feeding a plurality of objects to be handled into the V space formed by the opposing branches of the two bands can be constituted by a band conveyor which conveys a stream of objects from any other machine upstream of the device, or which withdraws the objects from a pack.

The distance between the two pinch or gripping points formed by the two bands and by the conveyor belts is chosen at a value less than the minimum length of the flat objects to be handled.

The band of material having the lower coefficient of friction is suitably mounted on a swivel-mounted support on which there act resilient means which are adjustable so as to create in the contact zone between the opposing branches of the two bands a pressure which is substantially constant independently of the thickness of the object which is passing between said two branches at any given time.

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 fac-ing vertical branch of the belt 19, so that some of the initial objects of tha 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 the 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, be-

cause 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 posi-tion 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, indepen-

dently 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 device 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 at constant distances apart, charcaterized by comprising two endless motorized 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 first pinch point, means for feeding a plurality of flat objects to be handled into the V space defined by said opposing branches of the two bands, and, at a predetermined distance downstream of the contact zone of the opposing branches of the two bands, a conveyor constituted by a pair of motorized belts the opposing branches of which move in the same direction and at the same speed and are kept yieldably adhering to each other to form a second pinch point, one of said two bands being of a material of high coefficient of friction and being driven in such a manner that that branch thereof which opposes the branch of the second band moves in the same direction as, but at a smaller speed than, the opposing branches of the conveyor belts, whereas the other of the two bands is of a material having a lower coefficient of friction than the first and is driven in such a manner 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.

2. A device as claimed in claim 1, characterized

in that the distance between the two pinch points formed by the two bands and by the belts of the downstream conveyor is less than the minimum length of the flat objects to be handled.

3. A device as claimed in claim 1, characterized in that the band of material having the lower coefficient of friction is mounted on a swivel-mounted support subjected to the action of adjustable resilient means.

4. A device as claimed in claim 1, characterized in that a single drive motor is provided for operating said bands and said belts of the conveyor by way of transmission means, with a predetermined speed ratio and direction of movement.

5. A device as claimed in claim 1, characterized in that for feeding the objects into the V space defined by the opposing branches of the two bands there is provided a conveyor band with a support branch for the objects to be conveyed as far as the first pinch point.

6. A device as claimed in claim 5, characterized in that a guide cooperates with said conveyor band and is spaced apart from said branch of the band in order to cause a limited number of flat objects to enter the V space.

7. A device as claimed in claim 5, characterized in that a second conveyor band with a branch parallel to the first but disposed perpendicular thereto is associated with said conveyor band.

8. A device as claimed in claim 7, characterized

in that the branch of the first conveyor band is vertical and that of the second conveyor band is horizontal, and an arrival table for the objects is provided which is coplanar with the branch of the second conveyor band and is disposed at a right angle thereto.

9. A device as claimed in claim 8, characterized in that said table is stationary, and a pusher member is provided in order to move the objects towards the two conveyor bands.

10. A device as claimed in claim 9, characterized by a sensor for sensing the presence of objects at the two conveyor bands and for controlling said pusher member.

11. A device as claimed in claim 8, characterized in that said table is mobile or is constituted by a conveyor belt.

12. A device as claimed in claim 1, characterized in that the branch of the second band is taut between two deviation rollers, and a tensioning roller acts on the opposing branch of the first band guided over two deviation rollers such that it urges this branch against the opposing branch of the second band in the vicinity of that deviation roller thereof which is disposed downstream in the feed direction of the objects.

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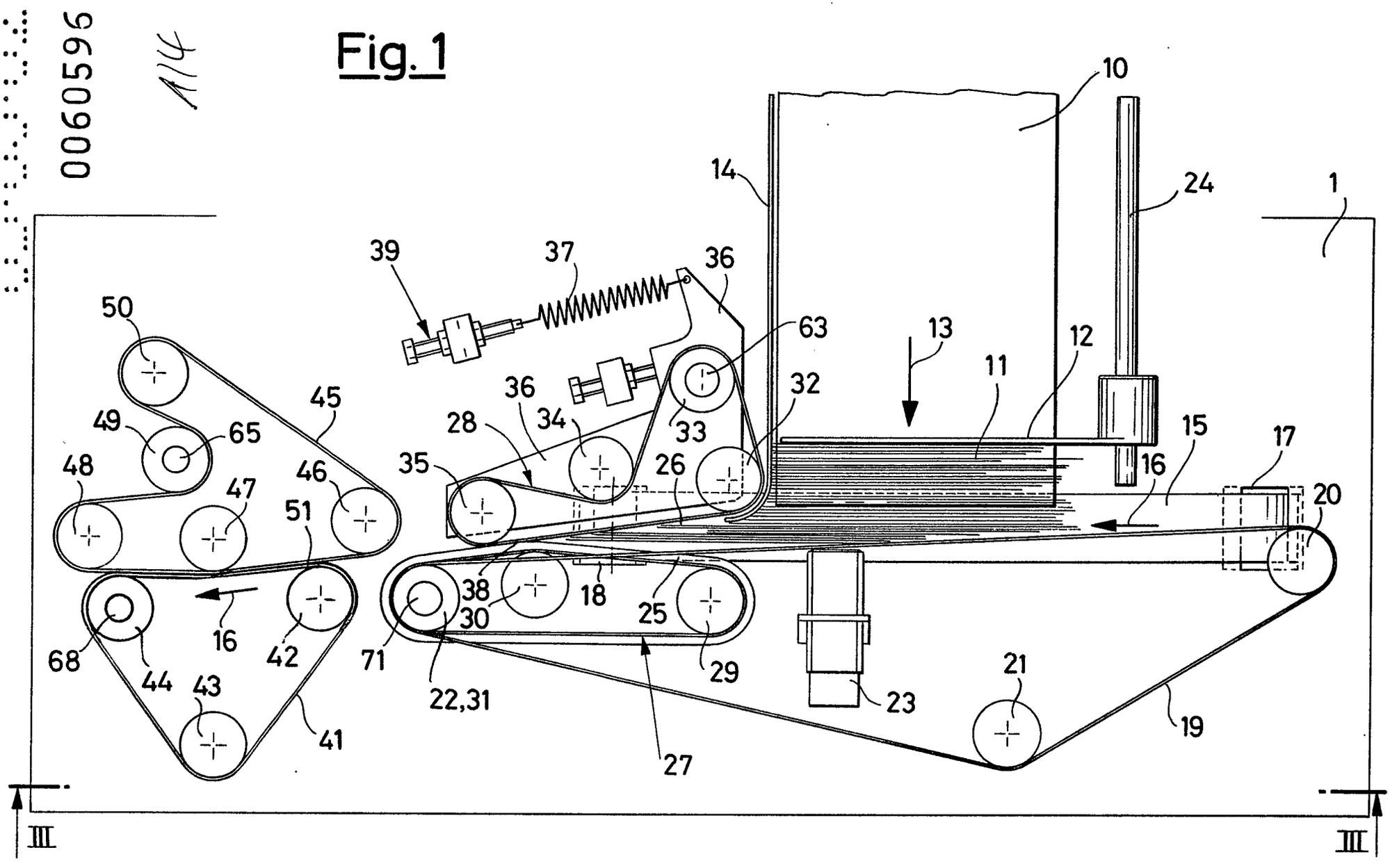
Fig. 1



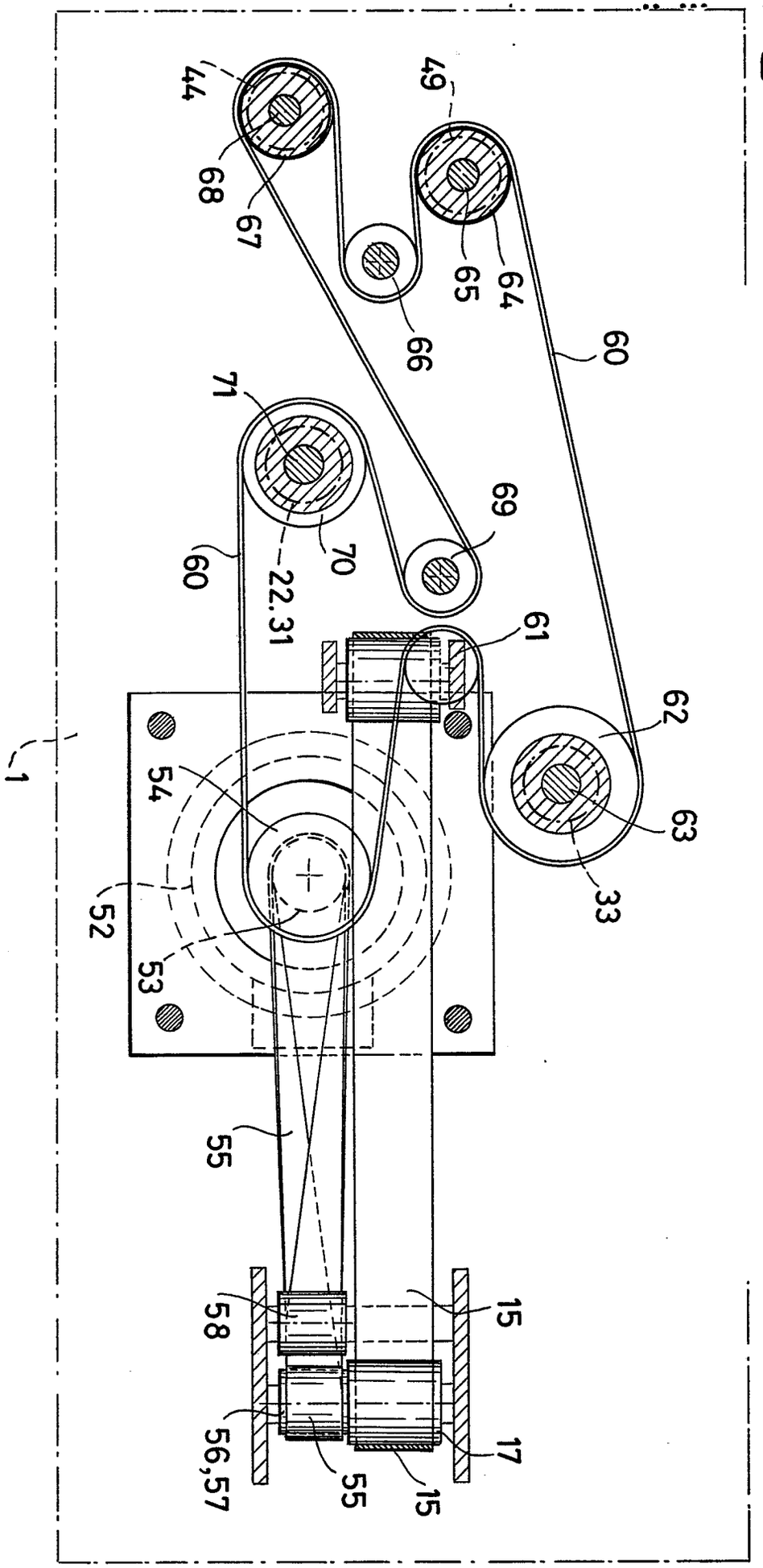

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Fig.2

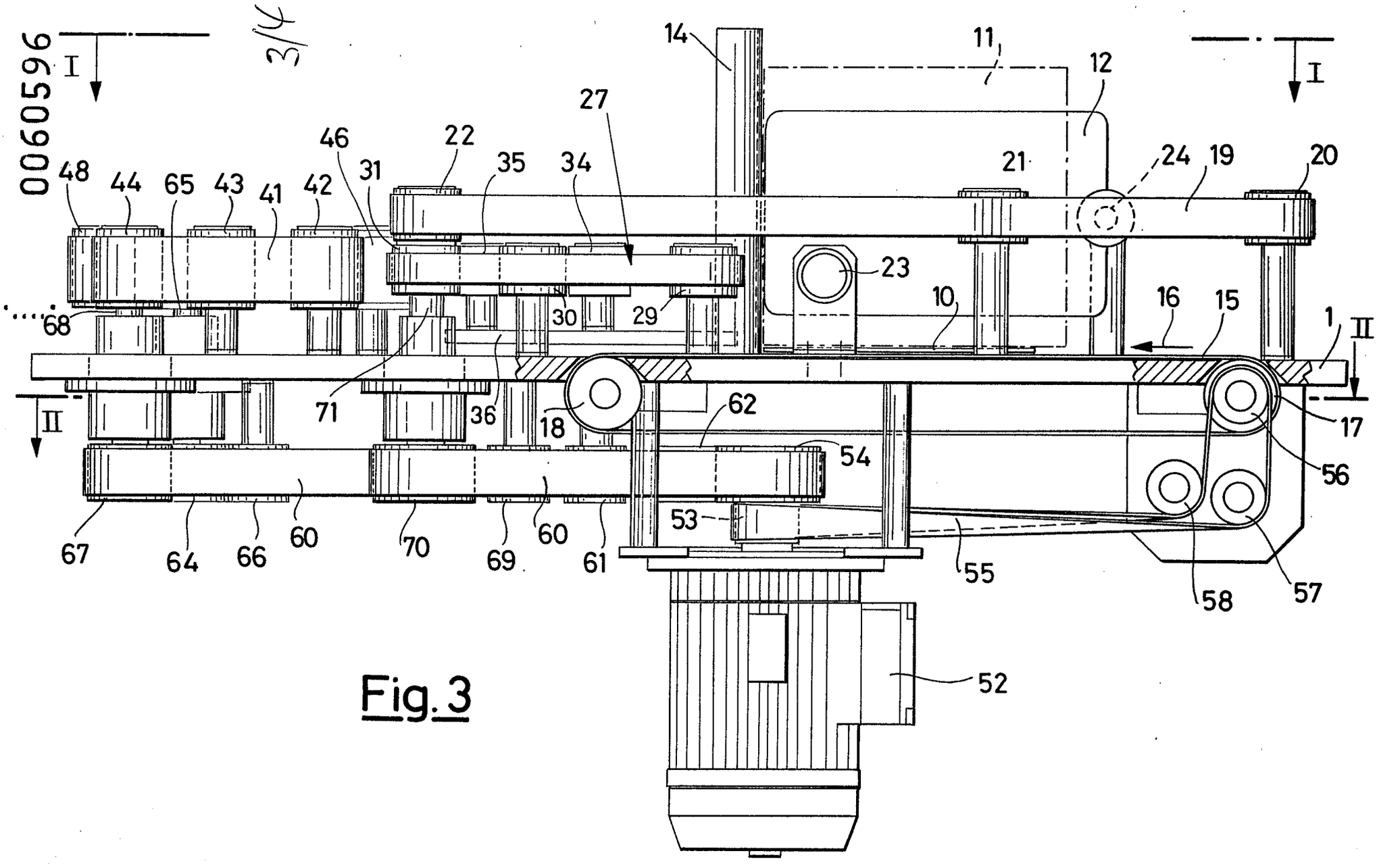
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Fig. 3

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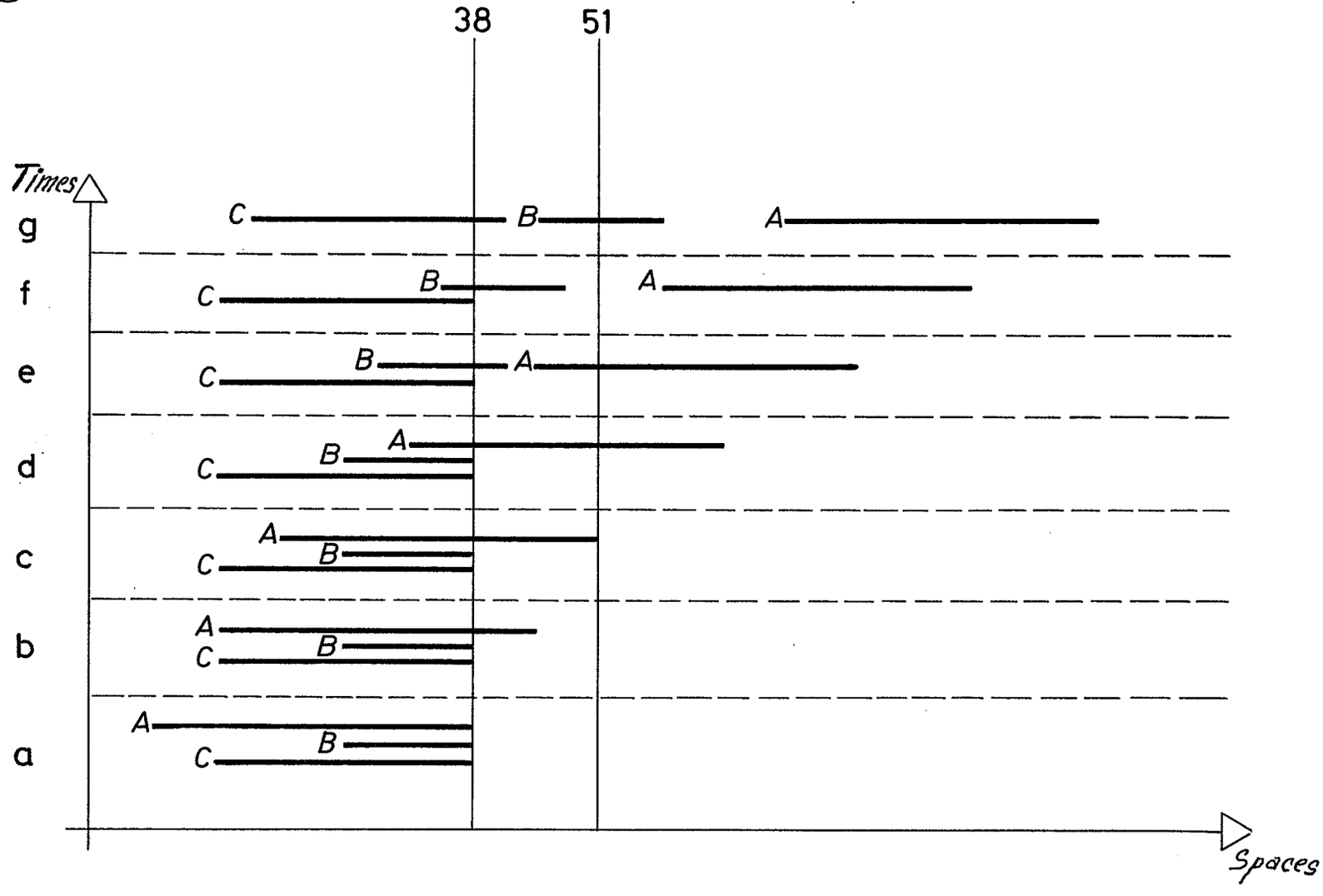
Fig. 4



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EUROPEAN SEARCH REPORT

0060596
Application number

EP 82 20 0288

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	US-A-3 048 393 (FURR) *Entire document*	1,3-10,12	B 65 H 3/52 B 65 H 3/04 B 07 C 1/04
Y	US-A-3 664 661 (WEEKS) *Entire document*	1,3,5-9	
A	GB-A-1 071 521 (STAAT DER NEDERLANDEN PTT) *From page 1, line 50 to page 2, line 29*	1,3,11	
A	GB-A-1 067 589 (TELEFUNKEN PATENTVERWERTUNGS GmbH) *Figures 1 and 2; page 1, lines 51 to 67*	1,10, 11	
A	CH-A- 373 945 (JAGENBERGWERKE AG)	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	DE-B-1 267 012 (TELEFUNKEN PATENTVERWERTUNGS GmbH) *Column 3, lines 60 to 68*	1,2,7	B 07 C 1/02 B 07 C 1/04 B 65 H 1/02 B 65 H 3/04 B 65 H 3/52 G 06 K 13/103

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-06-1982	PESCHEL W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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