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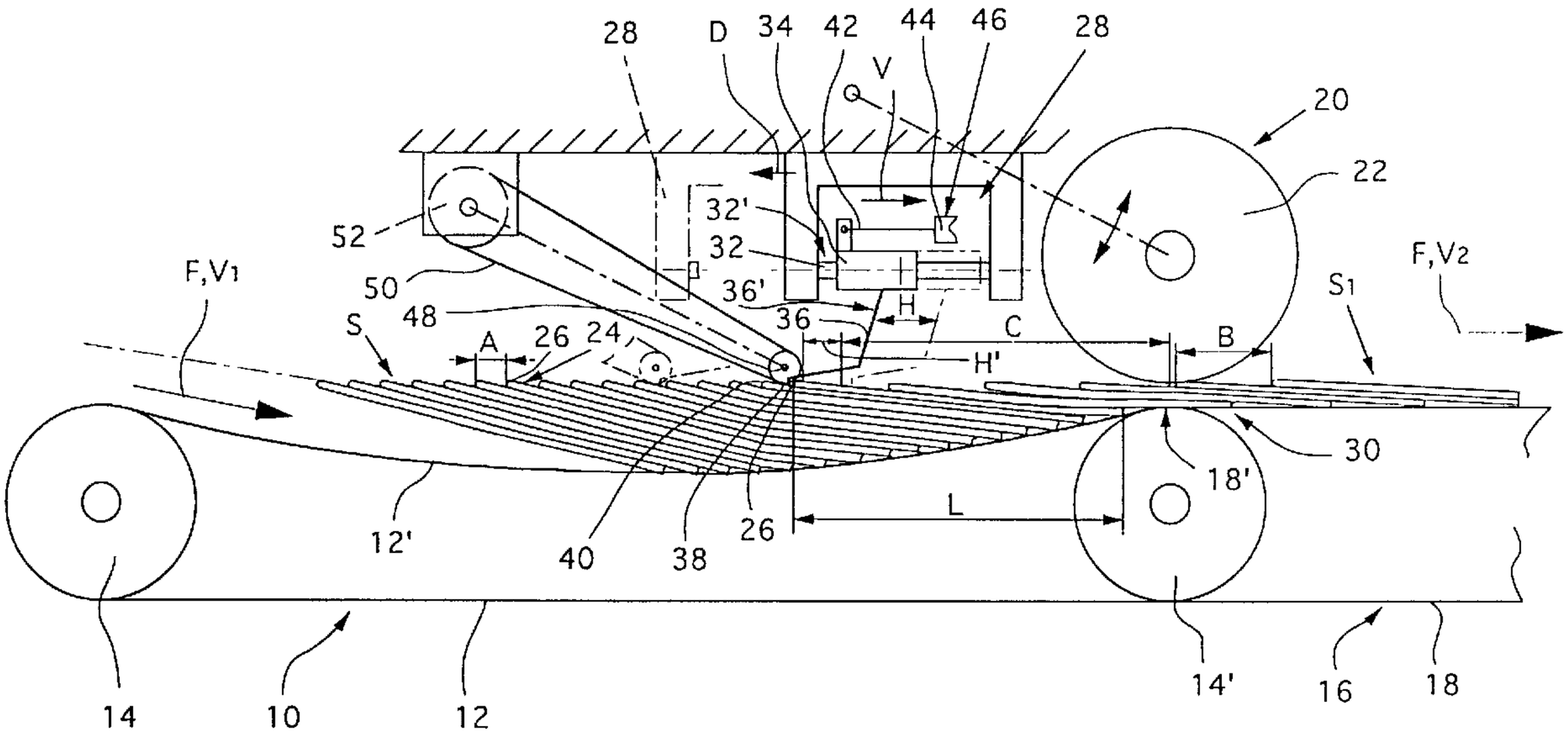
(54) Titre : DISPOSITIF POUR TRANSFORMER UNE PILE D'OBJETS RECOUVRANTS EN UNE FORMATION A RECOUVREMENT

(54) Title: DEVICE FOR TRANSFORMING AN OVERLAPPING STACK OF OBJECTS INTO AN OVERLAPPING ARRANGEMENT



(57) Abrégé/Abstract:
According to the invention, the second conveyor (16) which is driven in the direction of conveyance (F) at a second conveying speed (v_2) is mounted downstream from the first conveyor (10) which is driven in the direction of conveyance (F) at a first conveying speed (v_1). The second conveying speed (v_2) is greater than the first conveying speed (v_1). The displacement device (28) comprises a displacement element (36) which is guided on a guiding rail (32) and has a hook (38). Said displacement element (36) is driven by the drive (46) in such a way that per time unit the number of working strokes it carries out in the direction of conveyance (F) exceeds the number of objects (24) arriving. Because the speed (v) at which the displacement element (36) moves in the direction of conveyance (F) is greater than the first conveying speed (v_1) the objects (24) are fed to the second conveyor (16) separately and at an increased distance.

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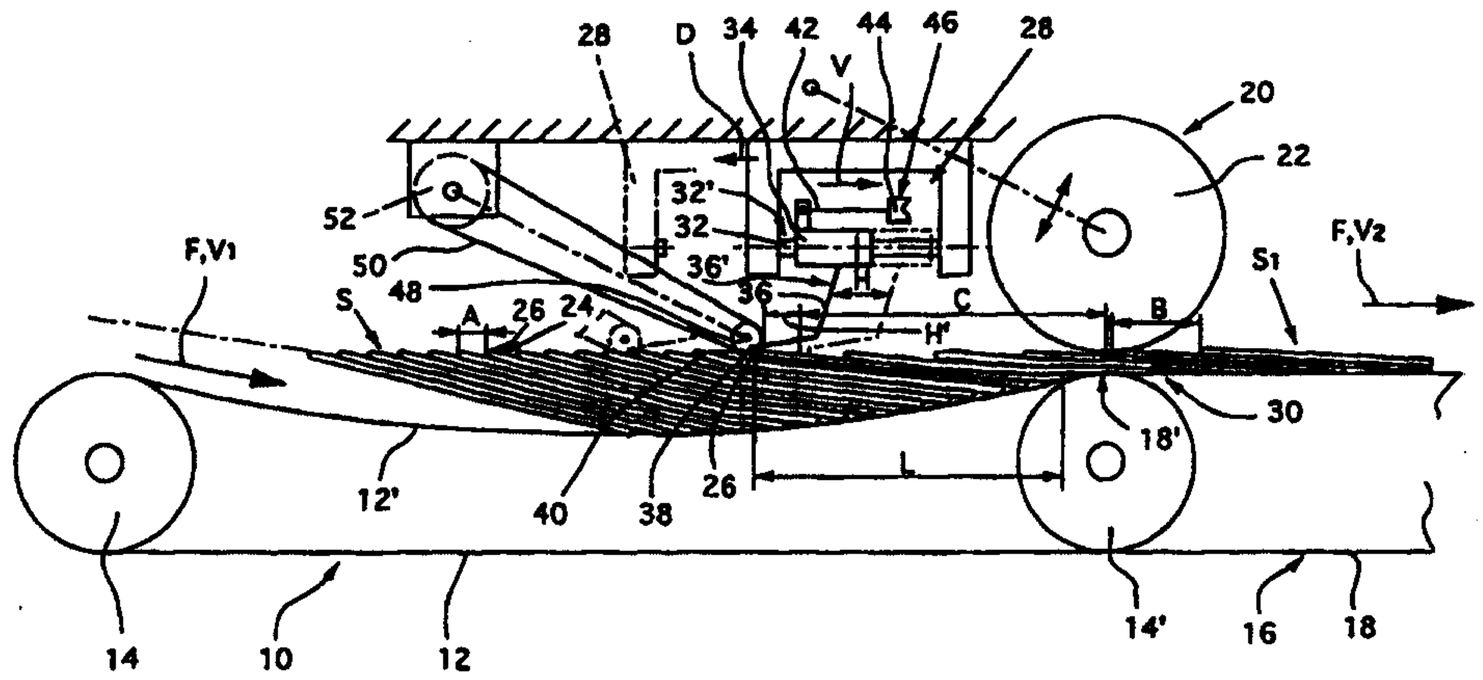
(54) Title: DEVICE FOR TRANSFORMING AN OVERLAPPING STACK OF OBJECTS INTO AN OVERLAPPING ARRANGEMENT

(54) Bezeichnung: VORRICHTUNG ZUM UMWANDELN EINES GESCHUPPTEN HAUFENS AUS GEGENSTÄNDEN IN EINE SCHUPPENFORMATION

(57) Abstract

According to the invention, the second conveyor (16) which is driven in the direction of conveyance (F) at a second conveying speed (v_2) is mounted downstream from the first conveyor (10) which is driven in the direction of conveyance (F) at a first conveying speed (v_1). The second conveying speed (v_2) is greater than the first conveying speed (v_1). The displacement device (28) comprises a displacement element (36) which is guided on a guiding rail (32) and has a hook (38). Said displacement element (36) is driven by the drive (46) in such a way that per time unit the number of working strokes it carries out in the direction of conveyance (F) exceeds the number of objects (24) arriving. Because the speed (v) at which the displacement element (36) moves in the direction of conveyance (F) is greater than the first conveying speed (v_1) the objects (24) are fed to the second conveyor (16) separately and at an increased distance.



Apparatus for transforming an overlapping stack of objects into an overlapping formation

The present invention relates to an apparatus for transforming an overlapping stack formed of flat objects, in particular printed products, arriving on a first conveyor into an overlapping formation.

It is often the case that flexible flat objects, in particular printed products, for the purpose of further processing are unwound from a storage coil, in which they are arranged in a closely overlapping formation, or they are deposited on a belt conveyor, arranged in a horizontal stack, a so-called bar and are tilted. The corresponding edges of adjacent object have a relatively small spacing. This spacing is subject to considerable scatter. For the further processing of these objects arranged in a stack it is then often necessary to increase the spacing between the mutually corresponding edges of the objects. This is where the present invention intervenes.

Apparatuses to even out the spacing between successive products of an overlapping formation are known from CH-PS 631 410 and EP 0 254 851 A.

An apparatus for increasing the spacing between successive products of an overlapping formation and for transforming the overlapping formation of printed products respectively, which are supplied on a first conveyor operated at a conveying speed, transferred individually by a displacement device from a first into a second overlapping formation and into the active region of a second conveyor, is known from DE 39 03 610 A1. This apparatus has two disc-shaped supports, each provided with a cam, which are driven by shafts arranged perpendicularly to the conveying direction of the printed products. With each rotation of the discs an individual printed product is picked up by the cams and conveyed further. As the circularly moving cams are not carried alongside the conveying direction of the printed

products, there exists during the conveying process always a relative movement between the cams and the printed products, which, during picking up and transporting the printed products may be undesirable.

It is an object of the present invention to provide an apparatus for transforming an overlapping stack formed of flat objects arriving on a first conveyor into an overlapping formation, said apparatus ensuring the reliable formation of the overlapping formation with a simple construction.

This object is achieved with an apparatus which have [sic] the features of claim 1.

Preferred embodiments of the apparatus according to the invention are specified in the dependent claims.

In order to form the overlapping formation, each object is displaced individually, being carried along positively, as far as the downstream end of the operating region.

The number of operating strokes per unit time of a displacement means intended to act on the rear edge of the arriving objects is greater than the possible number of objects arriving per unit time. At a

given conveying speed of the overlapping stack, this is given in the case of objects whose rear edges have a permissible minimum distance. Since the displacement means themselves execute more than one operating stroke, as referred to a single object, it is ensured that each of the objects is displaced individually and fed to a second conveyor, which is driven at a higher conveying speed.

The present invention will be explained in more detail using exemplary embodiments which are illustrated in the drawing, in which, in purely schematic form:

Fig. 1 shows a side view of a first embodiment of the apparatus for enlarging the distance between the rear edges of successive objects which arrive in a compacted overlapping formation, in which each object rests on the following one;

Fig. 2 shows, likewise in side view and enlarged with respect to Fig. 1, part of the apparatus shown there;

Fig. 3 shows a side view of part of an apparatus for enlarging the distance between the rear edges of successive articles which arrive in a compacted overlapping formation, in which each object rests on the preceding one;

Fig. 4 shows a side view of a further embodiment of the apparatus according to the invention; and

Fig. 5 shows, in plan view and partly sectioned, the embodiment according to Fig. 4.

The apparatus shown in Figs 1 and 2 has a first conveyor 10 constructed as a belt conveyor, which is driven in the conveying direction F at a first conveying speed v_1. At its upstream and its downstream end, the conveyor belt 12, which is formed from a number of endless tapes made of resilient material arranged beside one another, is led around turn rollers 14 and 14'. Connected immediately downstream of the first conveyor 10 is a second conveyor 16, which is likewise constructed as a belt conveyor and whose

conveyor tapes 18, arranged beside one another, are guided at the upstream start around turn wheels, which are arranged between the downstream turn rollers 14' of the first conveyor 10 and are mounted coaxially with the latter. The second conveyor 16 is driven in the conveying direction F at a second conveying speed V_2, which is higher than the first conveying speed v_1.

Interacting with the second conveyor 16, at its upstream start 18', is a pressing element 20. This has two weighted rollers 22 which are arranged spaced apart in the direction of the axis of the turn rollers 14' and which, together with the corresponding conveyor tapes 18, form a conveying gap at the turn wheels.

The first conveyor 10 is intended to convey flat flexible objects 24, which are arranged in a closely overlapping formation - forming a stack S - and in which each object rests on the following one, covering it virtually completely. In the example shown, the objects 24 are thin printed products, which are arranged in the closely overlapping formation with a minimum distance A between the rear edges 26 of successive objects 24.

Arranged above the first conveyor 10 is a displacement device 28. This is intended to displace the objects 24 conveyed by means of the first conveyor 10 in the closely overlapping stack S one after another individually in the conveying direction F at a speed V that is higher than the first conveying speed V_1 and, enlarging the distance from the next object, to feed it to the active region 30 of the second conveyor 16. As a result, an overlapping formation S_1. The active region 30 of the second conveyor 16 begins at its start 18', which is defined by the conveying gap defined by the conveying tapes 18 and the weighted rollers 22. The enlarged distance between the rear edges 26 of successive objects 24 is designated by B in Fig. 1.

The displacement device 28 has a guide means 32' which extends in the conveying direction F and is constructed as a guide rail 32. Freely moveably guided

on the guide rail 32 is a slide 34, on which a displacement means 36' is arranged. The latter is constructed as a bow-like displacement element 36 and fastened at one end to the slide 36. At the free end, the displacement element 36, as emerges in particular from Fig. 2, is provided with a hook 38, which is intended to be displaced so as to slide along the upper flat side 40 of the objects 24, because of the spring action of the displacement element 36, and then to come into contact with the rear edge 26 of an object 24 in each case, and to displace this object 24 in the conveying direction F, carrying it along positively.

The slide 34 is connected via a rod 42 to a drive 46 constructed as a piston/cylinder unit 44. The said drive is intended to move the slide 34, together with the displacement element 36, from an upstream starting position, through an operating stroke H in the conveying direction F, into an end position, indicated by dash-dotted lines, and back again cyclically. The piston/cylinder unit 44 is constructed in such a way that it accelerates the displacement element 36 to a constant speed v within a very short section of the stroke H, moves it onward at this speed v and then brakes it to a standstill again likewise within a comparatively very short retardation section. The frequency with which the piston cylinder unit 44 moves the displacement element 36 to and fro in and counter to the conveying direction is selected such that the displacement element in each case executes at least two operating strokes in the conveying direction F within a time period which [lacuna] by the quotient of the permissible minimum distance A between the rear edges 26 of successive objects 24 transported by the first conveyor 10 and the first conveying speed v_1. An operating region H' of the displacement element 36, which is given by that section of the stroke H in which the displacement element 36 is moved at a speed v which is higher than the first conveying speed v_1, is greater than the permissible minimum distance A. Within this

operating region H', the displacement element 36 can catch up with the rear edge 26 of an object 24, come into contact with the rear edge 26 and displace this object 24 in the conveying direction F at the speed v.

A reference roll 48 is freely rotatably mounted so as to be fixed in relation to the guide rail 32; led around said roll is an endless belt 50, which runs around a further roll 52 which, in relation to the reference roll 48, is arranged upstream and at a greater distance than the reference roll 48 from the second conveyor 16. Together with the conveyor belt 12 of the first conveyor 10, the belt 50 forms an inlet for the overlapping formation S and, in that region of the reference roll 48 which faces the conveyor belt 12, forms a reference 54 for the upper edge of the overlapping formation S. As viewed in the conveying direction F, the reference roll 48 is located at least approximately at the upstream start of the stroke H. In addition, the mutual position of the reference roll 48 and the guide rail 32 - as viewed perpendicular to the conveying direction F - are coordinated with one another in such a way that the hook 38 of the displacement element 36 rests with prestress on the flat side 40 of the respective object 24 if the overlapping formation S is held in contact with the reference 54 by means of the first conveyor 10. For this purpose, the conveyor belt 10 is of resilient construction in order to form an appropriate sag, and the turn rollers 14, 14' are arranged in relation to the reference roll 48 in such a way that the objects 24 come into contact with the belt 50 in any case. In addition, the reference 54 is arranged in relation to the conveying plane defined by the second conveyor 16 in such a way that it is approximately aligned with a plane which is parallel to the conveying plane and touches the overlapping formation S_1 formed from above.

The downstream end of the operating range H' is spaced from the start 18' of the second conveyor 16 by a distance C which is equal to or slightly less than

the length L of the objects measured in the conveying direction F when they are acted on by the displacement element 36. As is indicated by the arrow D (Fig. 1) and the position shown with dash-dotted lines of the displacement device 28, the distance C can be adjusted to correspond to the format of the objects 24 to be processed.

In the embodiment shown in Fig. 3, the first conveyor 10, likewise constructed as a belt conveyor, is intended to transport the articles 24 arriving in a closely overlapping stack S, in which each object 24 rests on the preceding one, in the conveying direction F at the first conveying speed v_1.

The displacement device 28 is constructed in the same way as the apparatus according to Fig. 1, but arranged in a mirror-image manner. The hook 38, arranged at the free end of the self-sprung displacement element 36, rests with prestress on the flat side 40 of a respective object 24, which is now located at the bottom. It should be mentioned, for completeness, that the conveyor belt 12 is formed by conveying tapes arranged beside one another at intervals, and the displacement element 36 is located between two adjacent conveying tapes. The conveyor tapes, which in this case are not of resilient design, run over a reference roll 48, which is located in the vicinity of the upstream start of the stroke H.

A roll 48' is freely rotatably mounted, opposite the reference roll 48, on a weighted lever 56, which is mounted such it can be pivoted in relation to the conveyor belt 12. Led around this roll 48' and the further roll 52, which is similar to the apparatus according to Fig. 1, is the belt 50, which in turn, together with the conveyor belt 12, forms an inlet for the overlapping formation S and, in the same way as in the embodiment shown further above, prevents the objects 24 being carried along by frictional forces by a preceding object which is moved at a higher speed by means of the displacement element 36.

Figs 4 and 5 show an embodiment of the apparatus in which the displacement means 36' has a number of displacement elements 36, twenty-two in the specific case. Said elements are arranged to be distributed uniformly alternately on the two sides of a carrying disk 58, in the circumferential direction along a circle which is concentric with the axis 58' of the carrying disk. The carrying disk 58 is situated on a drive shaft 60 which is concentric with its axis 58' and freely rotatably mounted on the machine frame. Said drive shaft is driven so as to rotate continuously in the direction of rotation D by means of a drive 46.

Each displacement element 36 is constructed in the manner of a two-armed lever and freely pivotably mounted on a bearing shaft 62 which is parallel with the axis 58' and projects from the carrying disk 58. For this purpose, the displacement element 36 has a carrying part 64 of U-shaped cross section, to which the bow 36'', which is bent at the free end to form a hook 38 and is made of spring-steel sheet, is fixed. At that end of the carrying part 64 which faces away from the hook 38, a follower roller 68 is freely rotatably mounted on a pin 66 that is parallel to the bearing shaft 62, said roller being intended to interact with the circumferential surface of an associated control disk 70 fixed to the machine frame. In order to keep the follower roller 68 in contact with the control disk 70, one end of a tension spring 70, which runs in the radial direction, is fastened to the pin 66, and its other end is fixed to the carrying disk. The circumferential surface of the control disk 70 thus forms a control cam 74 for controlling the pivoting position of the displacement element 36 on the basis of its rotational position about the axis 58'.

The first conveyor 10, of which the active run 12' of the conveyor belt 12 is shown, runs underneath the displacement device 28. It is driven at the first conveying speed v_1 in the conveying direction F, which runs at right angles to the axis 58'. Connected

downstream of said first conveyor 10, as in the exemplary embodiments shown further above, is the second conveyor 16, which is driven at a higher conveying speed v_2. Here, too, the first conveyor 10 is intended to convey objects 24 arranged in the closely overlapping stack S into the active region of the displacement device 28, which displaces the objects 24 individually one after another in the conveying direction F at a speed v which is higher than the first conveying speed v_1 and, whilst enlarging the spacing from the following object 24, feeds them to the active region of the second conveyor 16, by which means an overlapping formation S_1 is formed.

Above the first conveyor 10 and below the carrying disk 58, a guide device 76 has two profiled guide elements 78, which are fixed to the machine frame. The guide elements 78 arranged on either side of the movement path of the displacement elements 36 have a rectilinear guide section 78′ which runs in the conveying direction F, and an inlet section 78′′ which is arranged at an oblique angle to said guide section 78′ and adjoins it upstream. In the free end region of the inlet section 78′′, an essentially rectangular spring-steel sheet 80 arranged between the guide elements 78 is fixed to the guide elements 78 at its laterally projecting lugs 80′. It projects in the downwards direction beyond the guide section 78′, forming an acute angle with the latter, and ends at the upstream start of the operating region H′. The guide section 78′ forms the reference 54 for the rear edges 26 of the objects 24 fed, which, because of the prestress of the first conveyor 10 in the upward direction, are held in contact with the guide section 78′. Together with the first conveyor 10, the inlet section 78′′ forms a wedge-like tapering inlet to the gap formed by the active run 10′ of the conveyor belt 12 and the guide section 78′.

As emerges from Fig. 4, the control cam 74 extends from about 2 o′clock - in the counter-clockwise

direction - to about 7 o'clock, concentrically with the axis 58'. In this region, the displacement elements 36 assume an attitude in relation to the circular carrying disk 58 in which the hook 38 trails the follower roller 68 in the direction of rotation D, and the displacement elements 36 approximately forms [sic] an angle of 45° with a tangent to the carrying disk 58. As viewed in the direction of rotation D, this region is adjoined tangentially by a rectilinear cam section 74_1. Since, as viewed in the direction of rotation D, the distance of the cam from the axis 58' increases, in this region the displacement elements 36 are pivoted counter to the direction of rotation D. As they pass through this cam section 74_1, displacement elements 36 come into contact with the free end of the hook 38 on the upper side of the spring-steel sheet 80, and act on the latter with a force which points in a downward direction.

The cam section 74_1 is adjoined continuously by a cam section 74_2, which has the form of an extended S and in which, as viewed in the direction of rotation, the increase in the distance between the control cam 74 and the axis 58' initially decreases and then increases again. While a follower roller 68 is passing through this cam section 74_2, the relevant displacement element 36 runs off the spring-steel sheet 80, comes into contact with the free end of the hook 38 on the upper flat side 40 of that object 24 on which the spring-steel sheet 80 is resting flat and then, because of the shape of the cam section 74_2, is pivoted in such a way that the hook 38, in the operating section H', is moved at least approximately along a rectilinear movement path extending in the conveying direction F, the bow 36'' being resiliently forced back slightly because of the countering force of the first conveyor 10. As it moves through the operating section H', the hook 38 comes into contact with the rear edge 26 of an object 24 and displaces the latter in the conveying direction F at a speed v which is higher than the speed v_1 of the first conveyor, and feeds this object to the

second conveyor 16, whilst enlarging the distance to the rear edge of the next object 24. Of course, this is only the case when there is an object in the operating region H'. Otherwise, the relevant hook 38 slides along the flat side 40 of the next object 24, until it is pivoted away by the latter.

The cam section 74_2 is followed by a cam section 74_3, in which the distance to the axis 58', as viewed in the direction of rotation D, increases sharply. The start of this cam section 74_3 coincides, for a displacement element 36, with the end of the operating region H'. This is because, in the cam section 74_3, the displacement elements 36 are pivoted sharply in the clockwise direction in a very short time, and the relevant hook 38 is lifted out of the movement path of the objects 24.

In the region of the control cam 74 which follows the cam section 74_3, it is ensured that the displacement elements 36 remain outside the movement path of the objects 24 and are subsequently brought into the pivoted position which they assume in the concentric region of the control cam 74.

In each case, before a hook 38 runs off the spring-steel sheet 80, a next hook 38 has already come into contact with the latter. The force exerted in the downward direction on the spring-steel sheet 80 by the displacement elements 36 reinforces the retaining action of the spring-steel sheet 80 on the object 24, on which it rests flat, and prevents the latter being carried along as a result of friction while the preceding object 24 is being accelerated.

In this embodiment, the same conditions apply to speeds, distances and frequency as in the embodiments shown further above. In this case, the frequency is to be understood as the number of displacement elements 36 which are moved into the operating region H' per unit time.

In addition, it should be mentioned that the guide sections 78' of the guide elements 78 prevent the

objects 24 being able to be bent up under the action of the hook 38. In addition, lateral hold-down rollers 82 prevent the objects 24 being able to lift up in their lateral edge regions.

By means of the embodiments shown of the apparatus, the closely overlapping stack S is "pulled apart" to form an overlapping formation S_1. The movement of the displacement element need not be coordinated with a system cycle rate, neither in relation to phase angle nor in relation to frequency. However, a condition is that the frequency of the movement of the displacement element is higher than the highest possible frequency at which the objects can arrive.

It is also conceivable for the displacement means 36' of the embodiments shown in Figs 1 to 3 to have two displacement elements 36, which are driven in antiphase at half the frequency, but at a higher speed v in the conveying direction F than the first conveying speed v_1. It is also conceivable to provide more than two displacement elements.

The apparatus is particularly suitable to enlarge the distance between objects occurring in an irregular, closely overlapping formation. Since neither synchronization with a system cycle rate, nor phase adaptation is necessary, the construction and the drive can be constructed extremely simply.

In a preferred way, the second conveying speed v_2 is approximately 3 to 4 times as high as the first conveying speed v_1. In addition, it is advantageous for the number of operating strokes of the displacement means 36' per time interval, defined by the quotient of the minimum distance A and the first conveying speed v_1, to be about 3 to 4. In addition, it has been shown that the operating region H' is preferably 1.5 times, advantageously about 2 to 3 times, as large as the minimum distance A.

As a rule, the second conveying speed v_2 is predefined. The first conveying speed v_1 is then

adjusted in such a way that the displacement means 36' can with certainty never catch and displace two objects 24 with each other.

Patent claims

1. Apparatus for converting a formation of flat objects, in particular printed products, which are fed on a first conveyor, driven at a first conveying speed and, by a displacement arrangement, are transferred individually from a first formation into an imbricated formation and into an active region of a second conveyor, driven at a second conveying speed, which is higher than the first conveying speed, characterized in that the displacement arrangement has a displacement means which is provided with a hook and, by means of a drive and a guide means, are cyclically moveable in an operating region, at least approximately in the conveying direction of the first conveyor, at a speed which is higher than the first conveying speed, such that the sheet-like objects in the first formation, which forms an imbricated pile, can be gripped individually by the hook and transferred to the second conveyor, and into the imbricated formation.

2. Apparatus according to claim 1, characterized in that, over a period of time which is determined by the quotient formed by an admissible minimum spacing between the trailing edges of successive objects in the arriving pile and by the first conveying speed, the drive moves the displacement means through the operating region at least more or less twice in the conveying direction.

3. Apparatus according to claim 1 or 2, characterized in that the first conveyor has a belt conveyor of which the conveying strand, in the presence of a pile, can hang down such that the objects which is to be gripped by the displacement means in each case is located at least approximately in a position parallel to the movement path of the displacement means in the operating region.

4. Apparatus according to any one of claims 1 to 3, characterized in that the operating region of the displacement means is spaced apart from the active region of the second conveyor by a distance which corresponds at least approximately to the length of the objects, as measured in the conveying direction.

5. Apparatus according to any one of claims 1 to 4, characterized in that the operating region is larger than the admissible minimum spacing between the trailing edges of successive articles in the arriving formation.

6. Apparatus according any one of claims 1 to 5, wherein the displacement member is spring biased so as to rest under pre-stress on a flat side of an object which faces it.

7. Apparatus according any one of claims 1 to 6, wherein the displacement member comprises a self-biased, bow-like displacement element which is fixed at one end to a slide guided by the guide means extending at least approximately in the conveying direction, and is provided at the other end with a hook.

8. Apparatus according any one of claims 1 to 6, wherein the displacement member comprises a number of self-biased, bow-like displacement elements which are each provided with a hook, and which are driven so as to circulate along a closed circulation path, and whose position is controlled in such a way that the hooks, as they move through the operating region, are moved at least approximately rectilinearly and in the conveying direction.

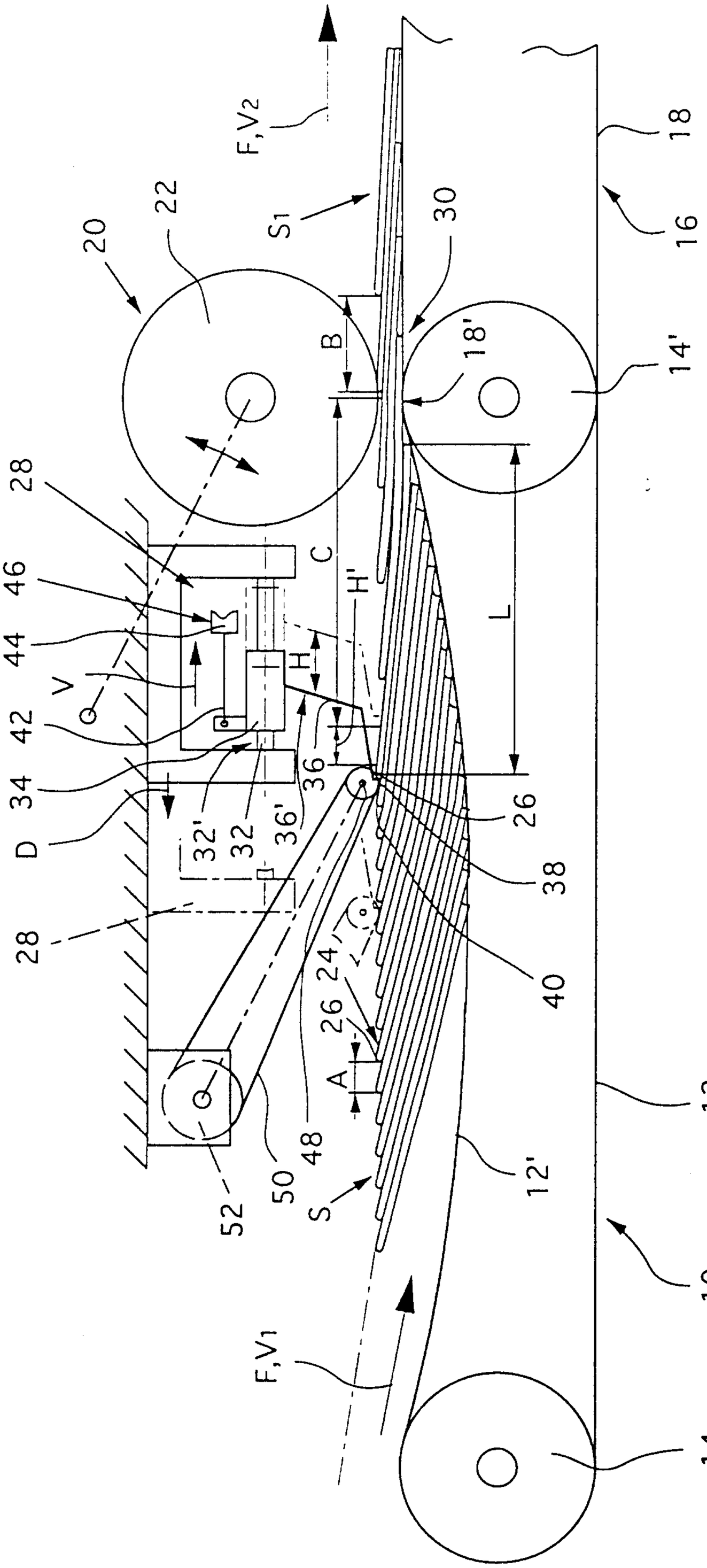
9. Apparatus according to claim 8, characterized in that the circulation path is a circular path.

10. Apparatus according to any one of claims 1 to 9, characterized in that the second conveyor has a belt conveyor and a pressure-exerting element, which interacts with said belt conveyor at the start of the active region, in order for the object fed by the displacement means in each case to be forced in the direction towards the belt conveyor such that it is carried along.

11. Apparatus according to any one of claims 1 to 10, characterized by a reference element which is arranged in a fixed manner in relation to the guide means, and upstream of the operating region, and is intended for butting against the first formation on the side which is directed towards the guide means.

12. Apparatus according to claim 11, characterized in that the reference element is intended to rest on the first formation via a belt-like intermediate layer.

13. Apparatus according to claim 11 or 12, characterized by a pressure-exerting means which forms a gap, adaptable to the first formation, with the reference element and by means of which the objects located in the gap can be forced against the first conveyor in order thus to prevent them from being carried along in the conveying direction at higher speed.


F,V2
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18'
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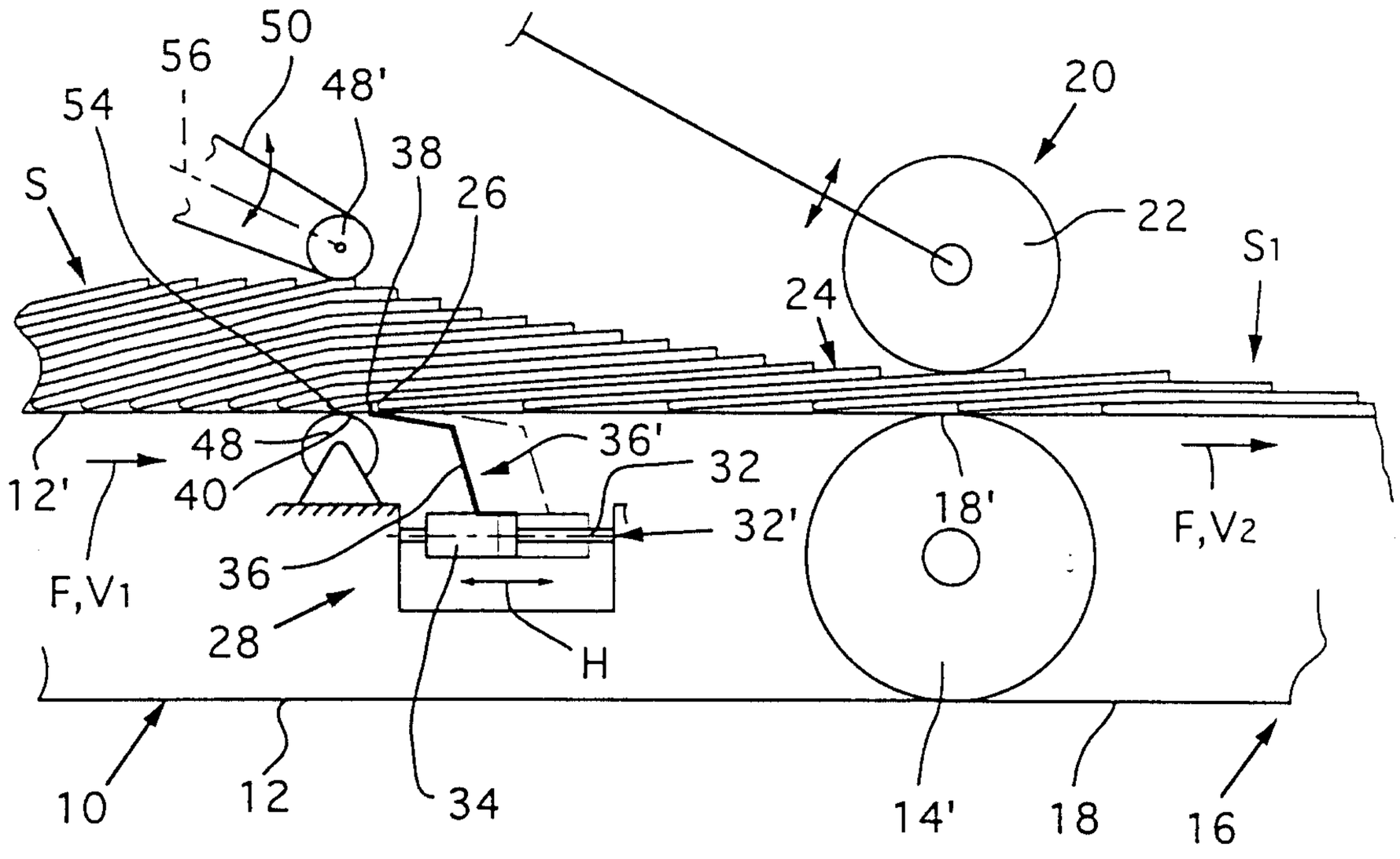
Fig.1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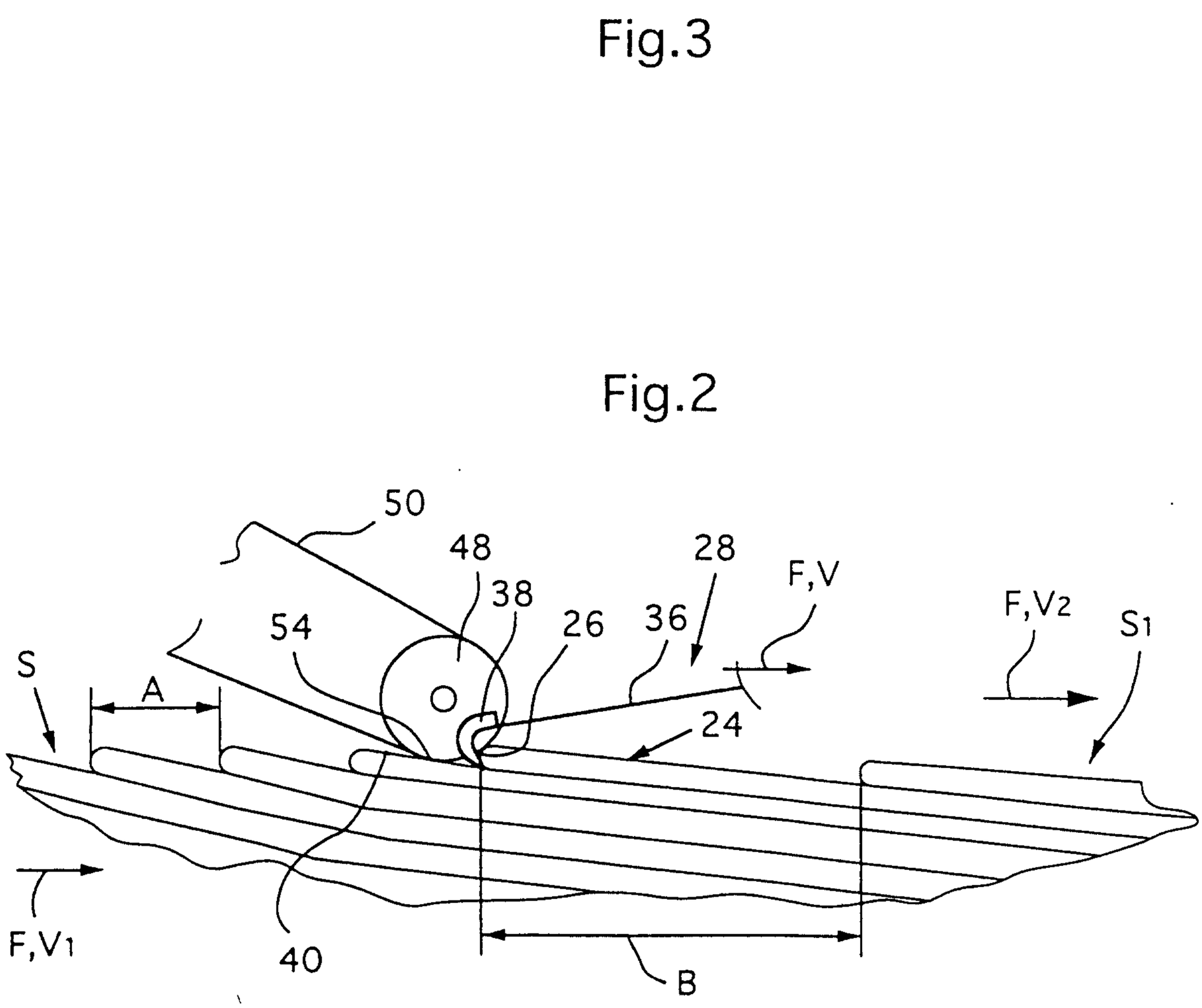
36
28
H
18'
F,V2
10
12
34
14'
18
16

Fig.3

Fig.2


50
48
38
54
26
36
28
F,V
F,V2
S1
S
A
O
24
F,V1
40
B

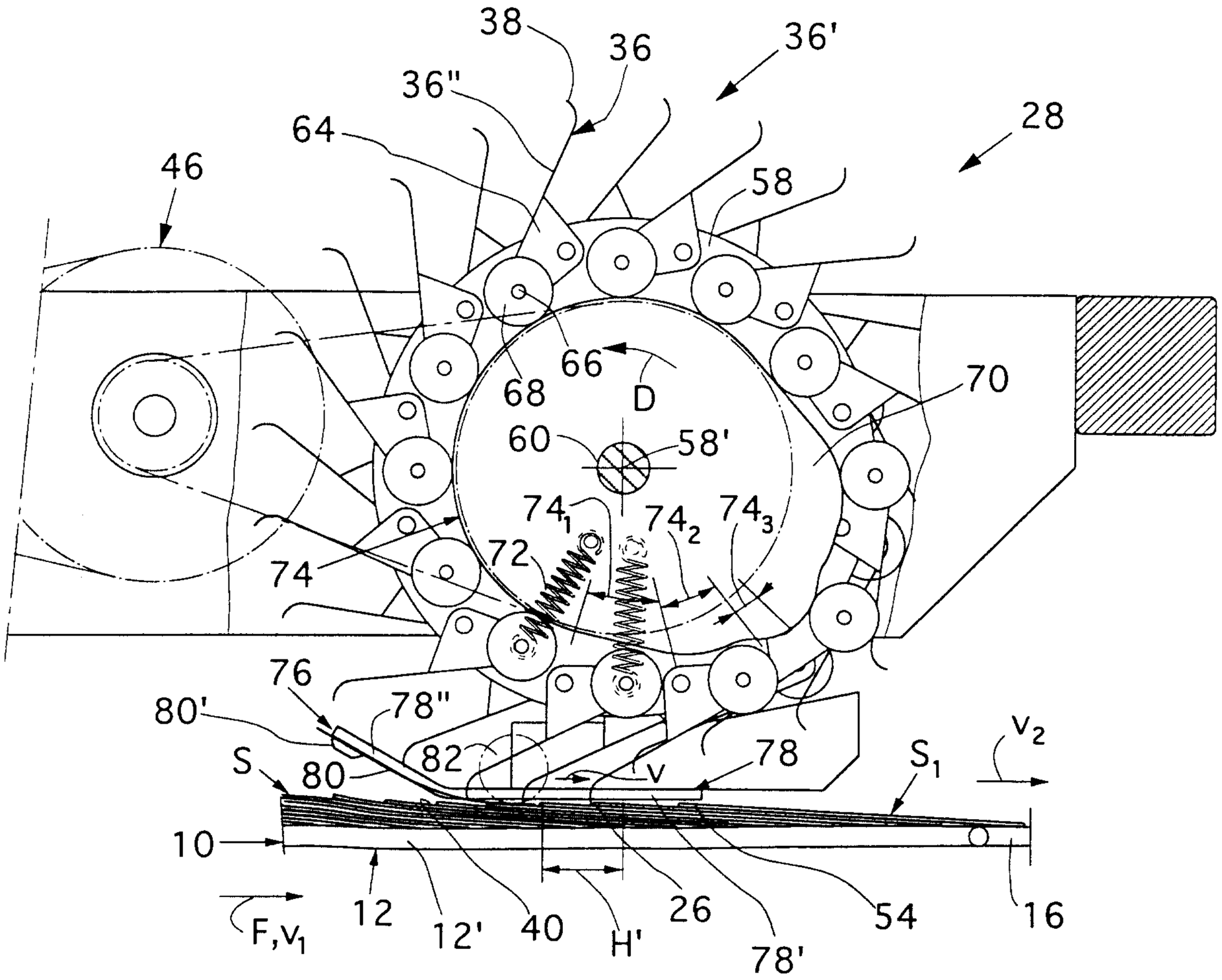

38
36
36'
36"
64
28
46
58
66
68
D
70
60
58'
74
1
74
2
74
3
72
74
76
80'
78"
82
V
78
S
80
S
1
V
2
10
12
12'
40
H'
26
54
16
F,v
1
78'

Fig.4

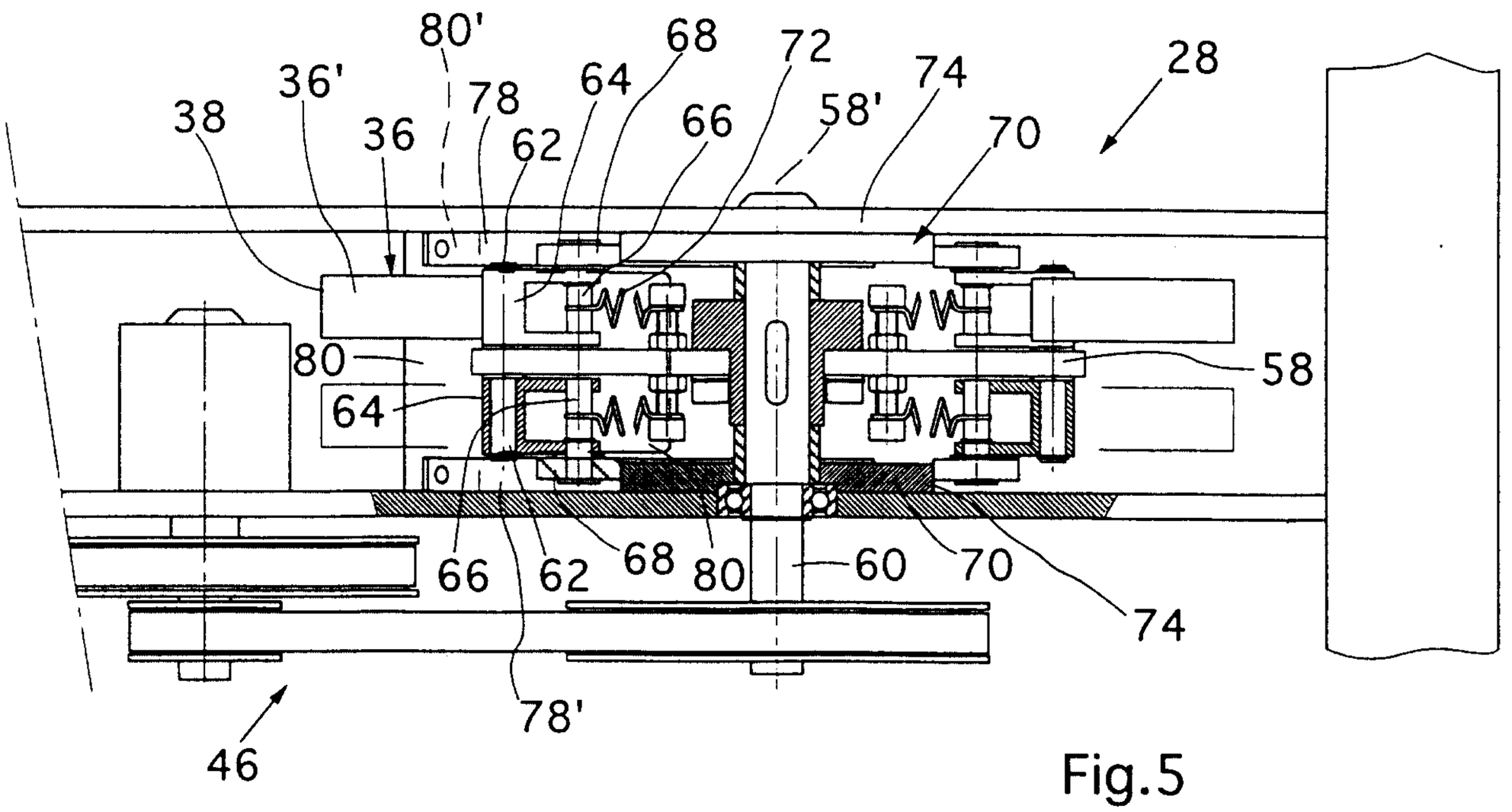
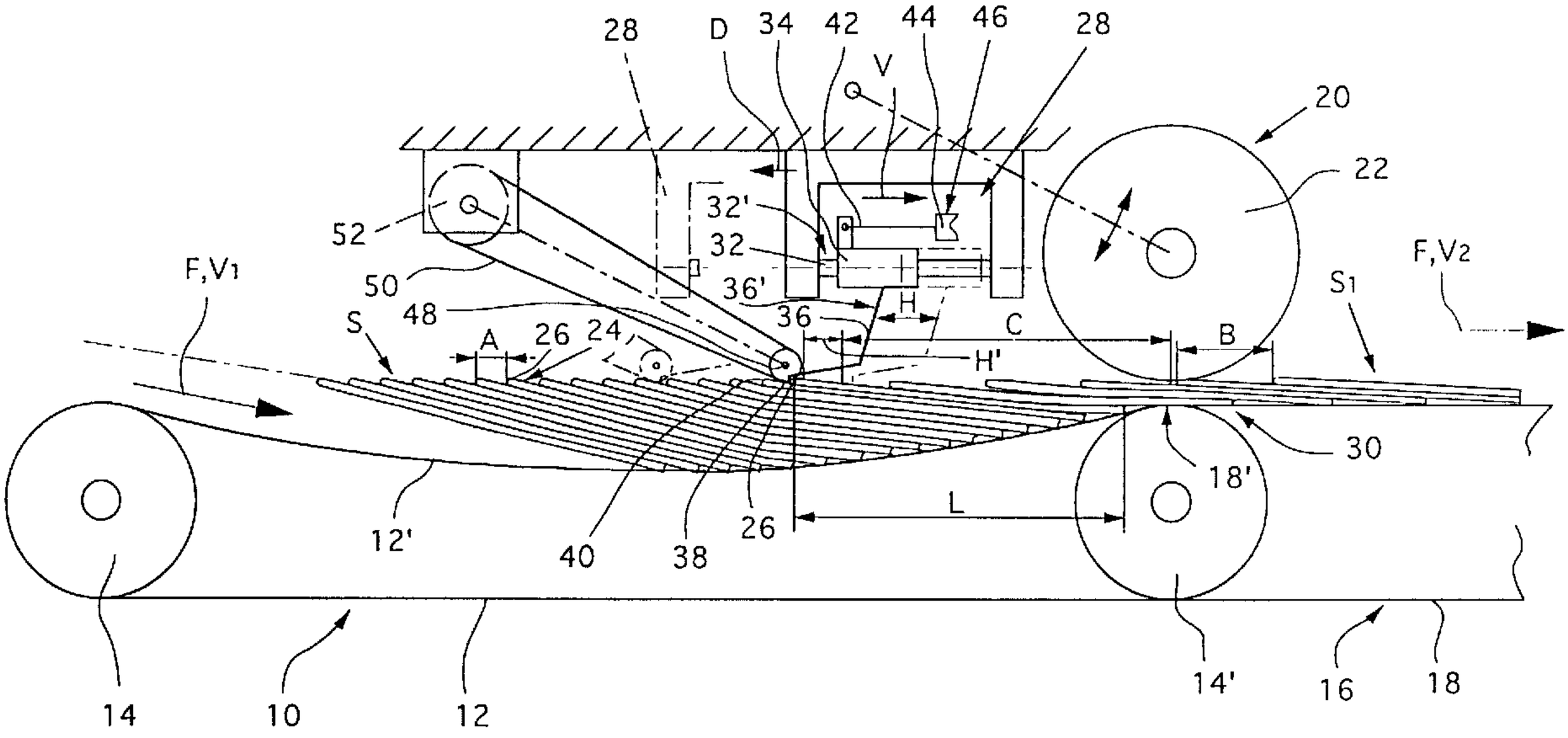

80'
68
72
74
28
36'
38
36
78
64
62
66
58'
70
80
58
64
66
62
68
80
60
70
74
78'
46

Fig.5


28
D
34
42
44
46
28
V
20
22
32'
32
52
F,V1
50
36'
H
48
36
C
B
F,V2
S1
S
A
26
24
H'
30
18'
12'
40
38
26
L
14
10
12
14'
16
18