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(54) A straightener machine for bars and the like.

(57) In a straightener machine for bars and the like, such as flat and section bars of various description, the straightening operation is performed by pressure members (24) entrained by two endless flat link chains (14,15) juxtaposed with respect to a bar path (3a) defined through the machine (1).

The pressure members (24) of the working runs of said chains (14,15) are shifted operatively toward the bar path (3a) by adjustable guide cams (41-46); thus, the deformations normally brought about by traditional straighteners of the roller type are prevented to provide a higher proportion of bars having an acceptable degree of straightness.

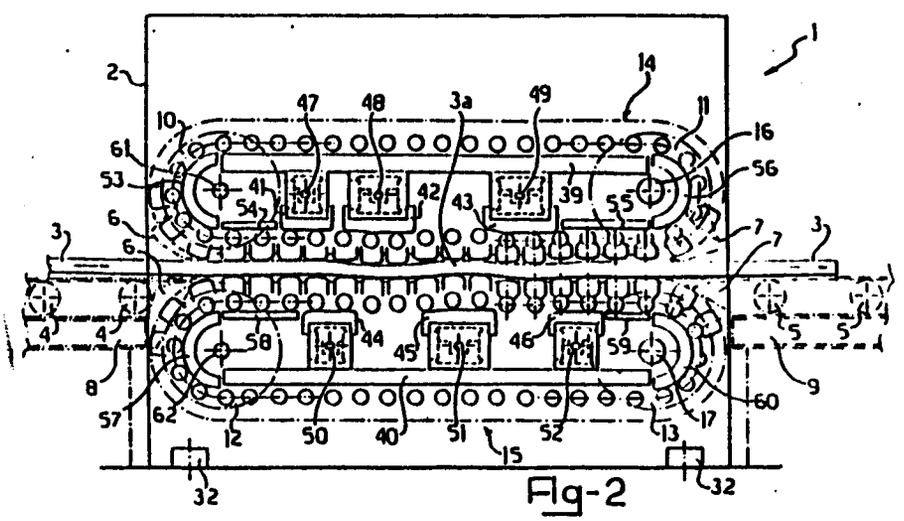

Fig-2

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DESCRIPTION

This invention relates to a straightener machine for bars and the like, such as flat and section bars of various description, wherein a bar path extending between a bar inlet end and a bar outlet end is defined within a parallelepipedic frame.

In order to provide bars with an acceptable degree of straightness according to governing international standards, it is notoriously necessary to correct the effects of deformations brought about in the blanks by certain mechanical operations, such as rolling or drawing, or those distortions which frequently occur while cooling after hot working processes, such as extrusion or rolling processes.

The corrective operation for such deformations is usually carried out by subjecting bars to be straightened to sequential bending and stretching steps which are accurately set up in relation to the characteristics and the size of the material involved.

To carry out this operation, it is common practice to employ straighteners which operate at a constant rate in the semi-

automatic working mode, and which act on a bar through straightening rollers disposed alternately on opposed sides of the bars and being offset with respect to one another.

The Hertzian pressure applied by the rollers to a bar to be straightened is quite high, since the contact area bearing the working load is much restricted; as a result, in order to avoid excessive upsetting, it becomes necessary to limit the applied load to the rollers within a value only slightly above that at which stretching begins.

A significant drawback brought about by this limitation is that bars having different degrees of initial bending cannot be straightened adequately, thereby additional straightening steps are required which aggravate costs.

Furthermore, owing to the near-permanent deformations brought about by successive passes between the rollers, there exists a limit beyond which a bar can no longer be straightened on traditional roller equipment.

In addition, bars of a large size forbid roller-type straighteners because, in order to keep the working load low, rollers of too large a diameter and spacing must be provided.

The ensuing problems, i.e. a high ratio of the non-straightenable leader and tail length to the straightened bar portion, discourage or forbid their use.

With large size bars, it is thus common practice to arrange for manual straightening by means of straightening presses.

However, the use of straightening presses is in many ways objectionable, mainly on account of the manual straightening operation being a difficult and time-consuming one and of the

high production costs involved.

Also well known are the problems encountered with conventional straighteners where "slim" flat bars are to be straightened edgewise, as serious warping is likely to be induced.

The problem underlying this invention is to provide a straightener machine for bars and the like, which has such constructional and operational features as to obviate the prior art drawbacks mentioned above.

This problem is solved, according to the invention, by a straightener machine characterized in that it comprises:

at least three outfits carried movingly on said frame alternately on opposed sides of said path;

means of moving said three outfits along said path from the bar inlet end to the bar outlet end, and vice versa;

a pressure member on each outfit, having a working surface of a preset area confronting said path and being movable on slideways formed in the outfit in a direction toward and away from said path; and

drive means for operatively driving said pressure member in said direction toward said path.

On a straightener machine according to this invention, bars would be straightened without deforming and upsetting their edges, since the specific load is much diminished, but without hindering the bar straightening action.

Further features and advantages of the invention will become apparent from the following description of a preferred embodiment thereof, given herein with reference to the accompanying illustrative and not limitative drawings.

In the drawings:

Figure 1 is a perspective view showing schematically a straightener machine according to the invention;

Figure 2 is a schematical side view of the machine of Figure 1;

Figure 3 is an enlarged perspective view showing schematically a detail of Figure 2;

Figure 4 is a plan view, out of scale and part-sectional, of a detail of Figure 2;

Figure 5 is a part-sectional schematical side view, as taken along the line V-V in Figure 4, of a detail of Figure 2;

Figure 6 is a sectional view taken along the line VI-VI in Figure 5;

Figure 7 is a schematical perspective view of two straightener machines according to the invention, as disposed serially;

Figure 8 is a schematical, part-sectional and out of scale, side view of a detail of Figure 7;

Figure 9 is an enlarged sectional view taken along the line IX-IX in Figure 8; and

Figure 10 is an enlarged perspective view of a detail of Figure 8.

With reference to the drawing figures, comprehensively designated 1 is a straightener machine according to this invention.

Said machine 1 comprises a parallelepipedic metal frame 2, wherein a path 3a for a bar 3 to be straightened is defined, which bar path extends from a bar inlet end 1a to a bar outlet end 1b.

The frame 2 is provided with receptacles 32 for anchoring

means (not shown) to a foundation, and with a lateral inspection port 33 at the bar path 3a.

With reference to said path 3a, as shown in Figure 2, a roller feedway 4 is provided upstream of the straightener machine, a removal roller way 5 being provided at a downstream location.

Said roller ways or tracks 4 and 5 further comprise carrier elements 8 and 9, respectively.

The machine 1 is equipped with protective shields 6 and 7 supported on the frame 2 at the roller ways 4 and 5.

The straightener machine 1 also comprises, within the frame 2, two endless flat link chains, an upper one 14 and a lower one 15, juxtaposed to the bar path 3a and each having a working run which extends along and proximate to said path 3a and is driven to move from the bar inlet end 1a to the bar outlet end 1b, as made clear hereinafter.

The chains 14 and 15 are trained and driven in quite a conventional manner by means of respective sprocket wheel pairs 10, 11 and 12, 13 having mutually parallel axes across the path 3a and being journalled on the frame 2.

The sprocket wheels 10 and 12 are located close to the roller way 4, whereas the sprocket wheels 11 and 13 are placed in the proximity of the roller way 5.

Furthermore, the sprocket wheels 11 and 13 are rigid with respective shafts 16 and 17 coaxial with the sprocket wheels and connected, in a manner known per se, to conventional motors, not shown in the drawing, whereas the sprocket wheels 10 and 12, in turn connected rigidly to shafts 61 and 62, are idler wheels.

The chains 14 and 15 comprise a plurality of articulated links 18 having the same pitch and including parallel cylindrical

pins 19, connecting plates 20, and guiding plates 21 lying parallel to one another and further discussed hereinafter.

Wheels 37, journalled at the ends of the pins 19, are guided on tracks 38 carried by the frame 2 and extending along sides of said flat link chains 4 and 5.

Each pin 19, lying transversely to the bar path 3a, is tied to its preceding and following pins by the connection plates 20 and the guide plates 21, located inwardly with respect to the links 18 of the plates 20, said plates 20 and 21 being journalled close to respective ends of the pins 19.

As a result, in each link 18, there is defined a spacing 63 delimited by two parallel pins 19 and two plates 21, also parallel to each other and set mutually apart.

On each side of the plates 21 facing inwardly of the link 18, there is formed a slideway 23 formed of two parallel ribs lying perpendicularly to the link.

The straightener machine 1 of this invention further comprises a plurality of pressure members 24, distributed along the chains 14 and 15, each supported in freely slidable manner by a respective link 18 of said chains and having a working surface 26 with a preset area facing outward of its respective flat link chain, thereby the pressure members of the working runs of said chains 14 and 15 will have said working surfaces 26 arranged to face the bar path 3a.

A liner 26a is secured detachably by means of clamps 27 at said working surface 26 of preset area.

Each pressure member 24 is provided with two slides 25, formed on opposite sides of the pressure member and fitting slidingly in their respective slideways 23. Further, the slides

25 are made longer than the slideways 23.

Consequently, the pressure members 24 are supported on the links 18 of the working runs of the chains 14 and 15, slindingly in a direction toward and away from said bar path 3a.

Each slide 25 is slidable in the slideway 23 between two stop elements 35 and 36 formed on the pressure member 24 itself; more specifically, a lower stop 36 is comprised of a raised edge of said liner 26 at a first end of the slide, and an upper stop 35 is formed by a plate 34 attached to the pressure member 24 on a remote side from the surface 26, at a second end of the slide 25.

Pins 28 having their axes laid transversely to the bar path 3a fit slidingly into respective ones of the pressure members 24 and related slides 25.

Radial rolling bearings 29, five for each presser 24 in the example shown, are mounted rotatably on the pins 28 and fit in respective seats 31 formed in the pressure members on the remote side from the working surface 26; the seats 31 are, moreover, separated from one another by partitions 30 formed in the pressure members 24 and through-penetrated by the pins 28.

Relatively to that side of the pressure members 24 remote from the working surface 26, the bearings 29 stand proud of both the plates 34 and ends of the partitions 30.

The pressure members 24 are shifted operatively in said direction toward said bar path 3a by appropriate drive means 41 to 46.

In a preferred embodiment, said drive means comprise cams 41,42,43 and 44,45,46 for guiding the pressure members of the working runs of the flat link chains 14 and 15, respectively.

Such guiding cams, which are juxtaposed to the bar path 3a and offset from one another, are supported slidingly in a conventional manner on crosspieces 39 and 40 extending along the bar path in a parallel direction to the working run of the chain 14 and the chain 15, respectively, and fast with the frame 2. The guide cams have respective adjustment devices 47,48,49 and 50,51,52 for positional adjustment both in the direction toward and away from the bar path, and along said crosspieces 39 and 40, said devices being known per se and only shown schematically in Figure 2.

The pressure members 24 located at said guide cams engage the latter via bearings 29 mounted thereon, and act on the bar path 3a in pressure contact relationship through said working surfaces 26, as provided with liners 26a.

Located in the vicinity of the sprocket wheels 10,11,12 and 13, there also are tracks (53-54, 55-56, 57-58 and 59-60, respectively) for guiding the pressure members 24, also made rigid with the frame 2.

It should be noted that the sprocket wheels 10 and 11, with their shafts, the chain 14 with its guide cams, track and crosspiece 39, may be mounted on an outfit movable on runways formed in the frame 2 in a perpendicular direction to the bar path, and equipped with adjustment means and lifting means known per se.

This in order to position the working run of the chain 14 at a suitable distance from its corresponding working run of the chain 15 to accommodate the dimensions of a bar 3 to be straightened.

The use of articulated chain links as outfits carried

movably on the frame 2 alternately and on opposite sides of the bar path, and carrying the pressure members, and the use of endless flat link chains as the means to shift such outfits along the bar path from the bar inlet end to the bar outlet end, constitute a preferred but not limitative feature of this invention.

It is understood that other outfits and means of shifting them may be utilized for the same purpose.

The straightener machine of this invention operates as follows.

The two driving sprocket wheels 11 and 13 are caused to rotate at the same speed, but in opposite directions, such that the pressure members 24 and the working runs of the chains 14 and 15 are also driven at the same speed along the bar path 3a from the bar inelt end to the bar outlet end.

A bar 3 requiring straightening is then started into the machine 1 from the roller feedway 4 and inserted between the flat link chains 14 and 15 in the bar path 3a.

The pressure members of the chain working runs are urged, under the action of the guide cams, toward the bar and pressed thereagainst with a set force by the cam position adjustment devices; these devices also enable the spacings of the guide cams to be changed to accommodate the dimensions and characteristics of the bar 3.

Thus, the bar is straightened by subjecting it a number of bending and stretching steps of decreasing intensity as it moves along the bar path, until it exits the straightener machine on the removal roller way 5.

It is important to observe that the pressure members

which act on the bar in pressure contact therewith are movable and drag the bar along the bar path at a constant rate, regardless of the resistance developed in the course of the straightening operation, by virtue of the bearings 29.

It is then highly advantageous, in order to prevent deformation and upsetting of the bar, that the bar being straightened is only subjected to perpendicularly directed pressure forces, thus preventing excessive frictional resistance, and of course, that pressure members are employed which have a broad working surface and readily replaceable liners.

Where slim flat bars are to be straightened edgewise, or at any rate where conditions are encountered which may result in the bars to be straightened becoming warped, a machine 101 according to the invention, as schematically illustrated in Figure 7, would be used.

In this machine 101, similar components to those already discussed in connection with the machine 1, previously described and shown in Figures 1-6, are identified by the same reference numerals.

In Figure 7, generally indicated at 1 and 101 are two straightener machines according to the invention, which are laid in series to first straighten on the flat and then edgewise, on the machine 101, a bar 3.

In the machine 101, the flat link chains 14 and 15, trained around their respective sprocket wheels 10, 11 and 12, 13, are carried on the frame 2 rotated 90° from their lay in the machine 1.

Comprehensively designated 91 is a warp-preventing device supported on the frame 2 and further described hereinafter.

In Figure 8, there is shown that warp-preventing device 91, in a schematical, part-sectional side view from which the flat link chain 15 and its related structures and devices have been omitted for clarity. In the figure, the bar path 3a extends through the machine 101 from a bar inlet end 101a located downstream of the machine 1, and a bar outlet end 101b.

The warp-preventing device 91 includes suitable warp-preventing guides 70 to 73, which are perpendicular to the direction toward and away from the bar path 3a along which the pressure members are shifted in operation.

According to a preferred embodiment, said warp-preventing guides comprise endless roller flat link chains, that is two side-by-side upper chains 70 and 71, and two lower chains 72 and 73, also laid side-by-side, which are juxtaposed with respect to the bar path 3a and perpendicular to said direction, and have respective working runs extending along and at the path 3a, being driven from the bar inlet end 101a to the bar outlet end 101b, as made clear further in this description.

The chains 70 to 73 are trained around and driven, in quite a conventional manner, by pairs of upper 79,80 and lower 81,82 sprocket wheels, respectively, which are journalled on the frame 2.

Said sprocket wheels have their axes parallel to one another and orthogonal to the bar path 3a, the sprockets 79 and 81 being idler wheels placed in the proximity of the bar inlet 101a, whereas the driving sprocket wheels 80 and 82 are located at the bar outlet 101b.

The endless roller flat link chains 70-73 are formed of a plurality of articulated links including cylindrical parallel

pins 75 and plates 74 laid parallel to each other in spaced apart relationship and being journalled in the proximities of upset ends of the pins 75.

Inwardly of the articulated links, hollow cylindrical rollers 76 fit over the pins 75 in a freely rotatable manner.

The chains 70 to 73 are supported slidingly and guided within cavities 96 formed at the ends of support and guide uprights lying parallel to one another, such as the upper uprights 92,93 and lower uprights 94,95, which are supported, in turn, on the frame 2.

Each, upper or lower, upright is thus formed with two cavities 96, one of which confronts and is open toward the bar path 3a, accomodating the working run of a respective roller chain guidingly therein, whereas the other, wherein a return run of said chain is stretched, faces an upper crosspiece 77 for the uprights 92 and 93 and a lower crosspiece 78 for the uprights 94 and 95, to which crosspieces each upright is secured rigidly; the crosspieces 77 and 78, extending along the path 3a and being parallel to each other, are also supported on the frame 2.

It should be noted that, in the direction toward and away from the bar path 3a, the roller chains 70-73 are guided in each cavity 96 by a respective rail 97 formed on the supporting upright and lying along the bar path, and that all these rails 97, as suitably dimensioned, would only contact the rollers 76 of the chains (see Figures 9 and 10).

Furthermore, on the lower crosspiece 78, there are formed rails 98, similar to the rails 97, bearing the return runs of the lower roller chains 72 and 73.

Advantageously, the crosspieces 77 and 78 to which the

uprights 92-95 are attached, and the sprocket wheels 79-82, are supported on the frame adjustably toward and away from the bar path by means of conventional hydraulic drive cylinders, indicated in Figure 8 at 83,84,85 for the upper cylinders and at 86,87 and 88 for the lower cylinders.

The two crosspieces 77 and 78 are, moreover, held in a set mutual position by ties 89 and 90 having respective ends attached to such crosspieces.

The working runs of the roller chains 70-73 are so positioned as to be in contact with the bar 3 and are moved by the driving sprockets from the bar inlet end 101a to the bar outlet end 101b; the rollers 76 of such chains, being allowed to turn freely around their respective cylindrical pins 75, roll over blocks 97 and 98.

Since on account of the supporting and guiding uprights 92-95, said working runs would form guides proper contacting a bar to be straightened, any warping of the bar which might occur during the straightening operation is effectively prevented.

Of course, best results are to be obtained by driving the working runs of the roller chains 70-73 at a speed equal to the speed of forward feed of the bar 3, and accordingly, at the same speed as the working runs of the chains 14 and 15.

Using a straightener machine according to the invention, the proportion of the bars exhibiting an acceptable degree of straightness can be increased considerably, while achieving good production rates. In addition, by arranging two or more straighteners with differently oriented work planes serially, one can effect automatically and successively straightening in several planes.

CLAIMS

1. A straightener machine for bars and the like, through a parallelepipedic frame (2) whereof there is defined a bar path (3a) extending from a bar inlet end (1a) to a bar outlet end (1b), characterized in that it comprises:

at least three outfits (18) carried movingly on said frame (2) alternately on opposed sides of said path (3a);

means (14,15) of moving said at least three outfits (18) along said path (3a) from the bar inlet end to the bar outlet end, and vice versa;

a pressure member (24) on each outfit (18), having a working surface (26) of a preset area confronting said path (3a) and being movable on slideways (23) formed in the outfit (18) in a direction toward and away from said path (3a); and

drive means (41 to 46) for operatively driving said pressure member (24) in said direction toward said path (3a).

2. A straightener machine according to Claim 1, characterized in that said means of moving said at least three outfits (18) comprise two endless flat link chains (14,15), each said chain being trained around sprocket wheels (10,11 and 12,13), one (11,13) is a driving wheel, journalled on said frame (2), said chains (14,15) being also arranged juxtaposed with respect to said path (3a) and having respective working runs extending along and close to said path and driven from said bar inlet end (1a) to said bar outlet end (1b).

3. A straightener machine according to Claims 1 and 2, characterized in that said chains (14,15) comprise a plurality of articulated links (18) with the same pitch, being each provided with slideways (23) perpendicular to said link, said

pressure members (24) being supported on said links (18) slidingly within said slideways (23), said links (18) accordingly forming said outfits (18).

4. A straightener machine according to claim 1, characterized in that said drive means comprise guide cams (41 to 46) carried on said frame (2) and acting on radial rolling bearings (29) equipping said pressure members (24) at a remote side from said working surface (26) of preset area.

5. A straightener machine according to Claim 4, characterized in that said guide cams (41 to 46) are provided with respective devices (47 to 52) for adjusting the cam positions both in the direction toward and away from said bar path (3a) and along said path.

6. A straightener machine according to Claim 1, characterized in that said pressure members (24) are provided with respective liners (26a) secured detachably at said working surfaces (26) of preset area.

7. A straightener machine for bars and the like, through a parallelepipedic frame (2) whereof there is defined a bar path (3a) extending from a bar inlet end (101a) to a bar outlet end (101b), characterized in that it comprises:

at least three outfits (18) carried movingly on said frame (2) alternately on opposed sides of said path (3a);

means (14,15) of moving said at least three outfits (18) along said path (3a) from the bar inlet end to the bar outlet end, and vice versa;

a pressure member (24) on each outfit (18), having a working surface (26) of a preset area confronting said path (3a) and being movable on slideways (23) formed in the outfit

(18) in a direction toward and away from said path (3a);

drive means (41 to 46) for operatively driving said pressure member (24) in said direction toward said path (3a); and

warp-preventing guides (70 to 73) lying perpendicularly to said direction and being supported movably on said frame (2) on opposed sides of said bar path (3a).

8. A straightener machine according to Claim 7, characterized in that said warp-preventing guides comprise endless flat link chains (70 to 73) trained around idler (79,81) and driving (80,82) sprocket wheels journalled on said frame (2), said chains being juxtaposed with respect to said bar path (3a) and perpendicular to said direction, and having respective working runs laid along and at said path (3a) and driven from said bar inlet end (101a) to said bar outlet end (101b).

9. A straightener machine according to Claim 8, characterized in that said chains (70 to 73) are carried slidingly on supporting and guiding uprights (92 to 95), in turn supported on said frame (2).

10. A straightener machine according to Claim 9, characterized in that said uprights (92 to 95) and said sprocket wheels (79 to 82) are supported adjustably toward and away from said bar path (3a) on the frame (2).

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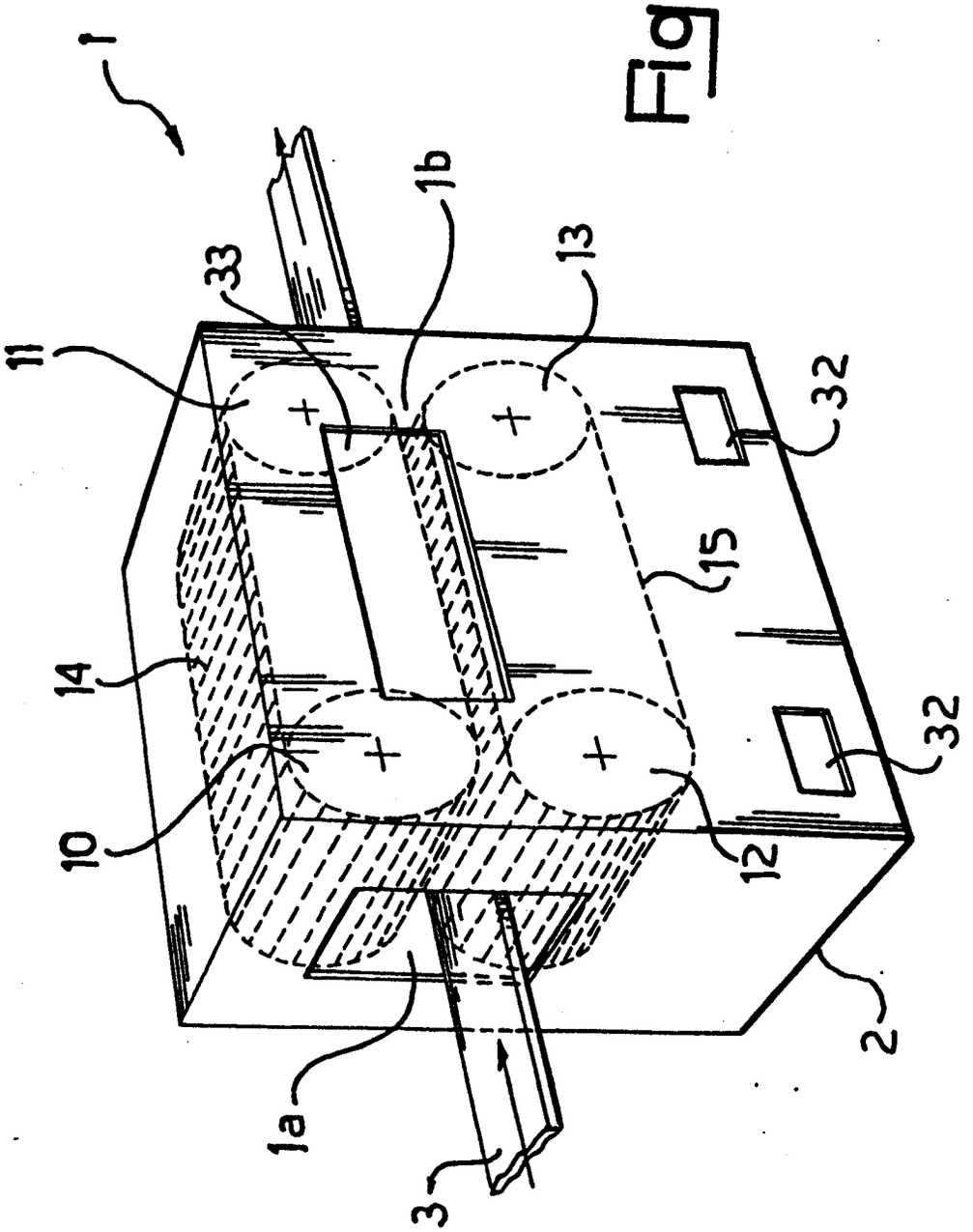
Fig-1



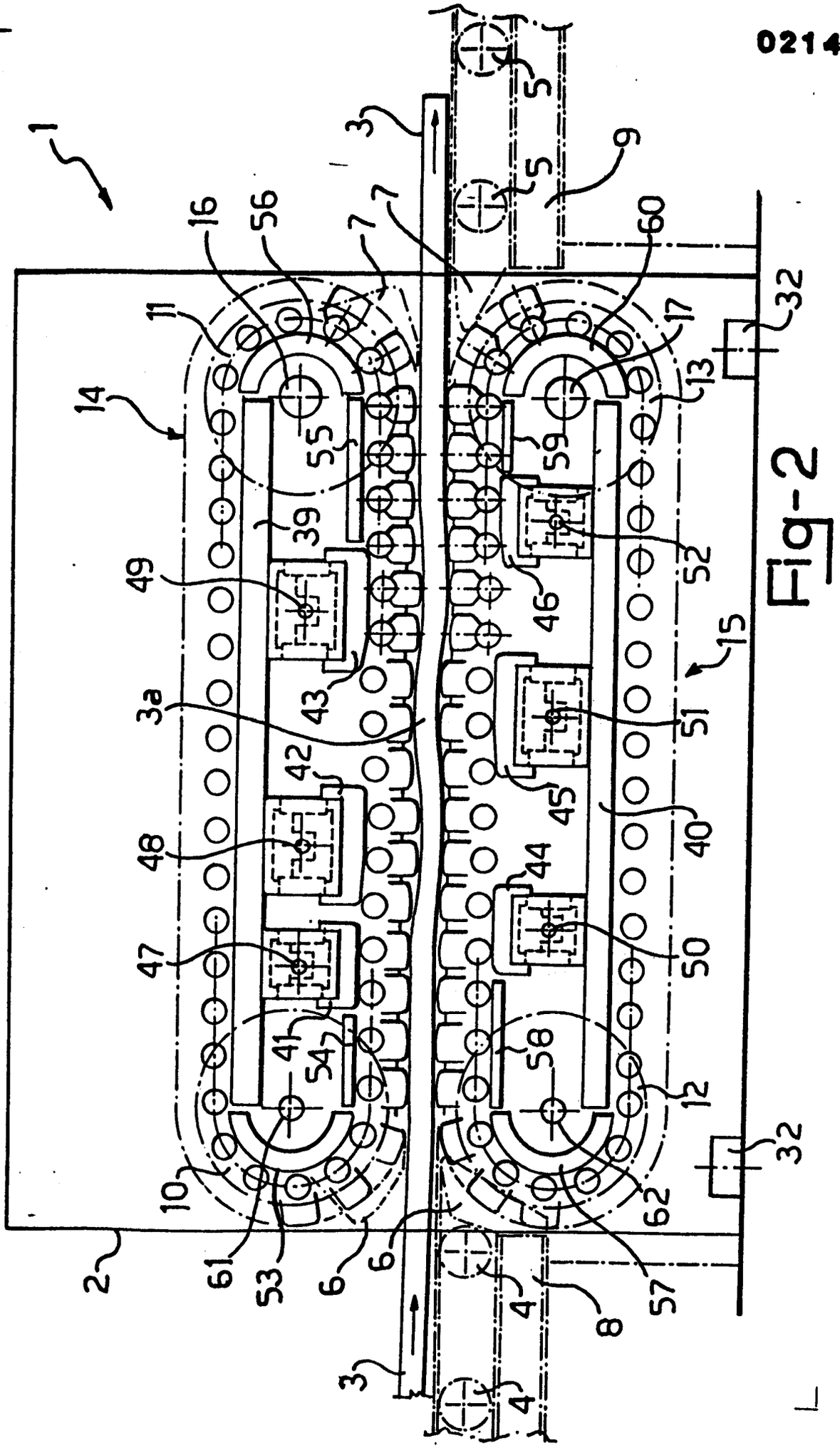

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Fig-2

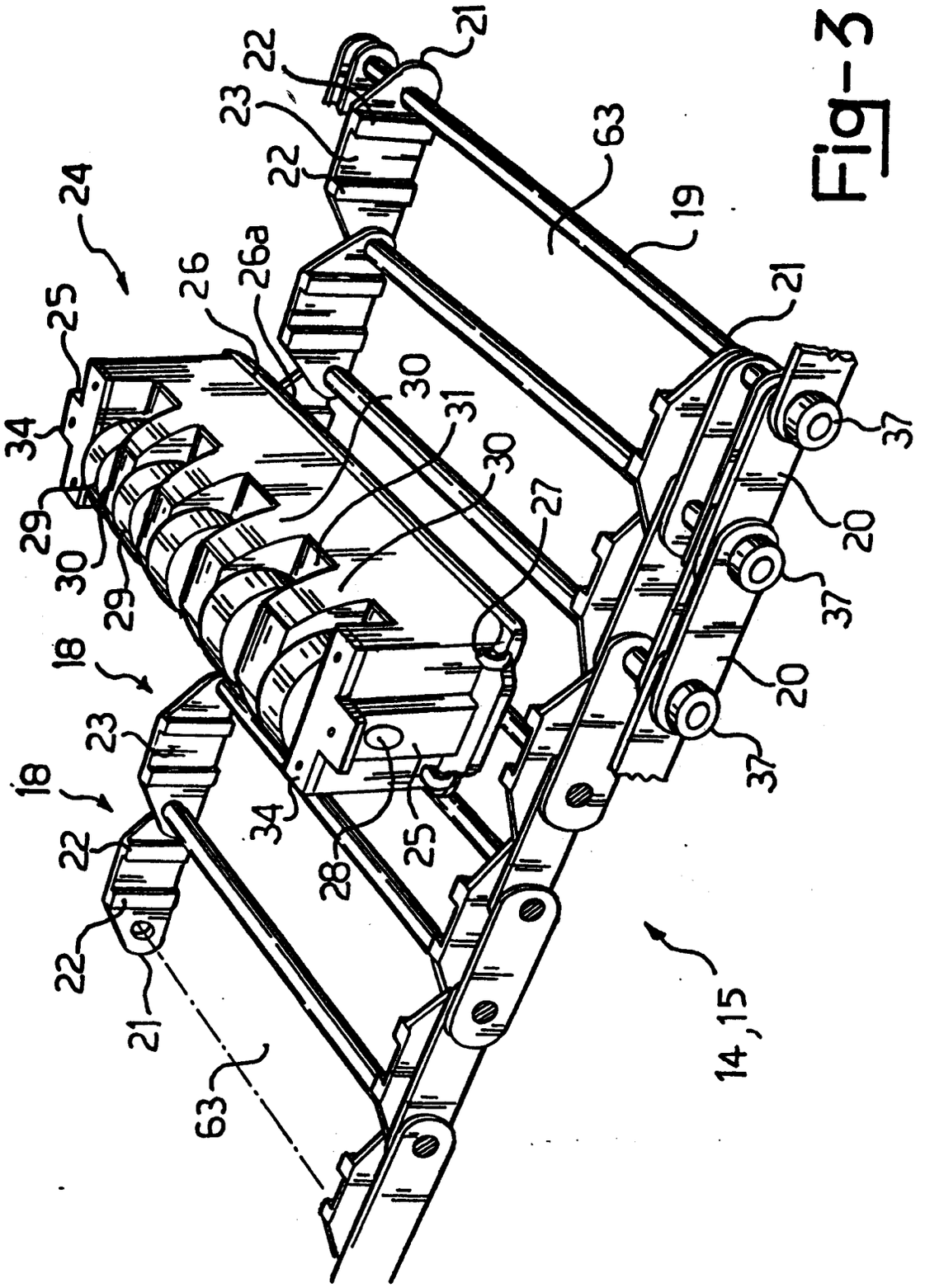
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Fig-3

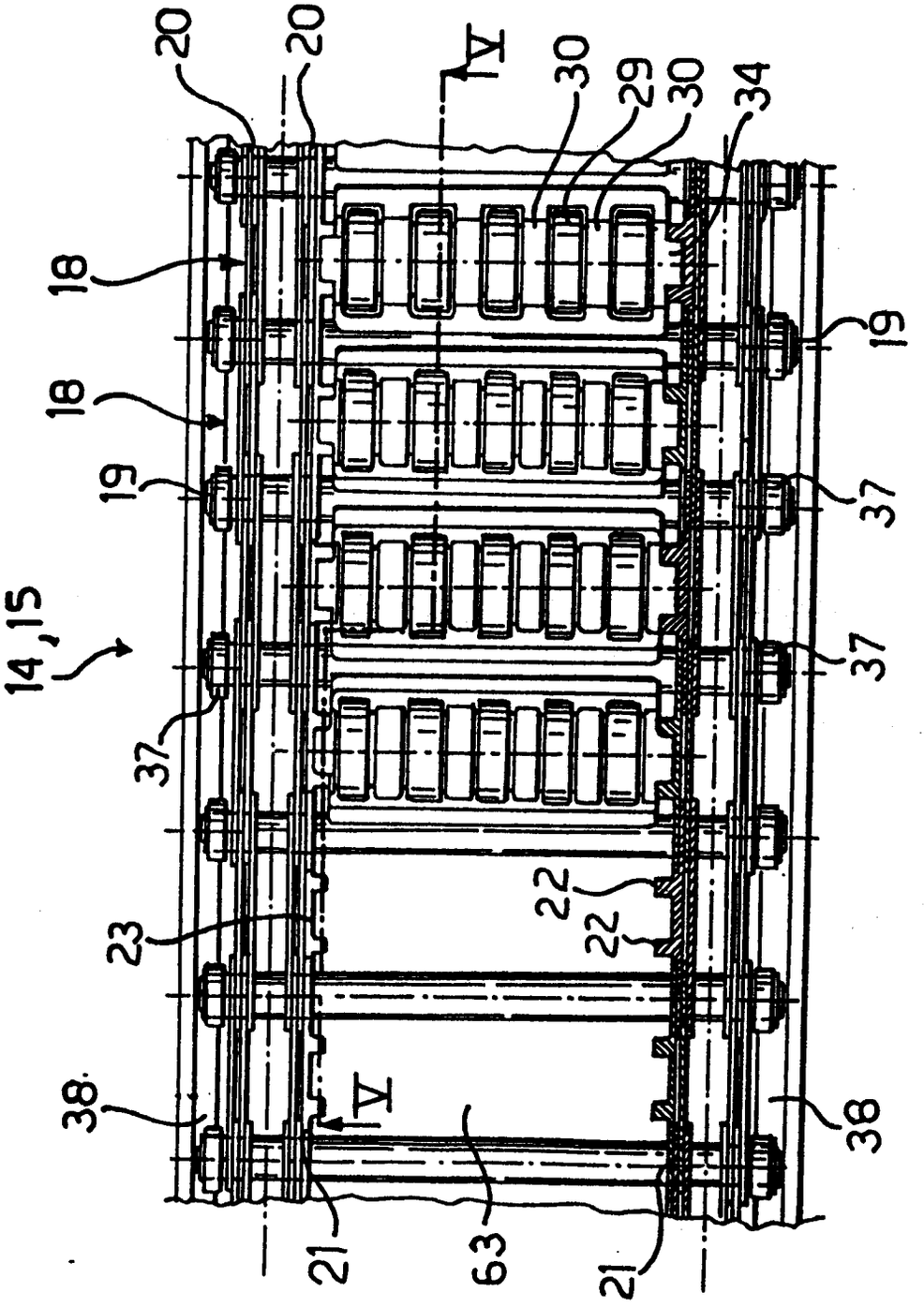

Fig-4

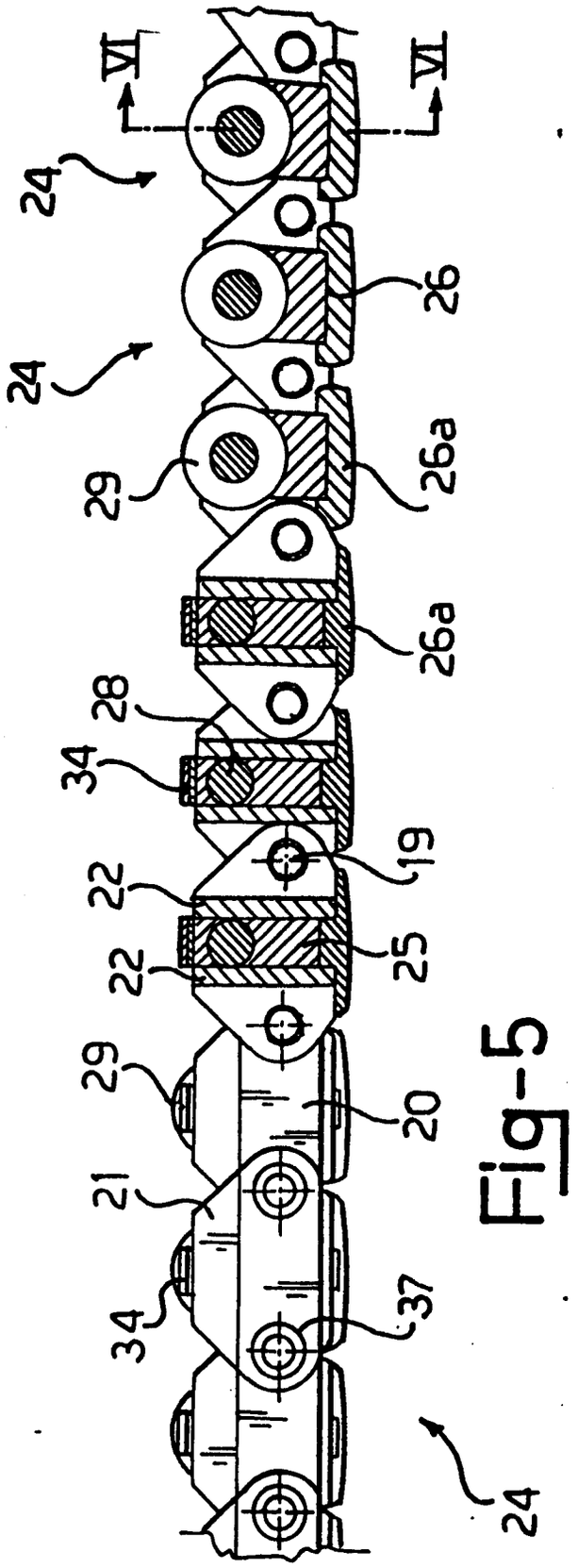
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Fig-5

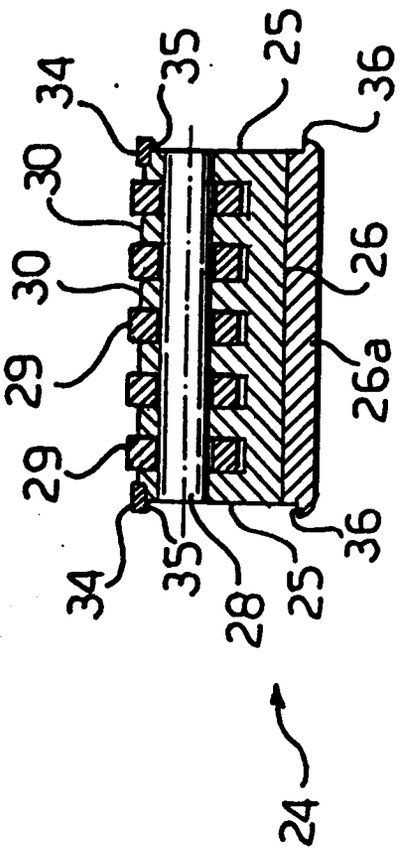
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Fig-6

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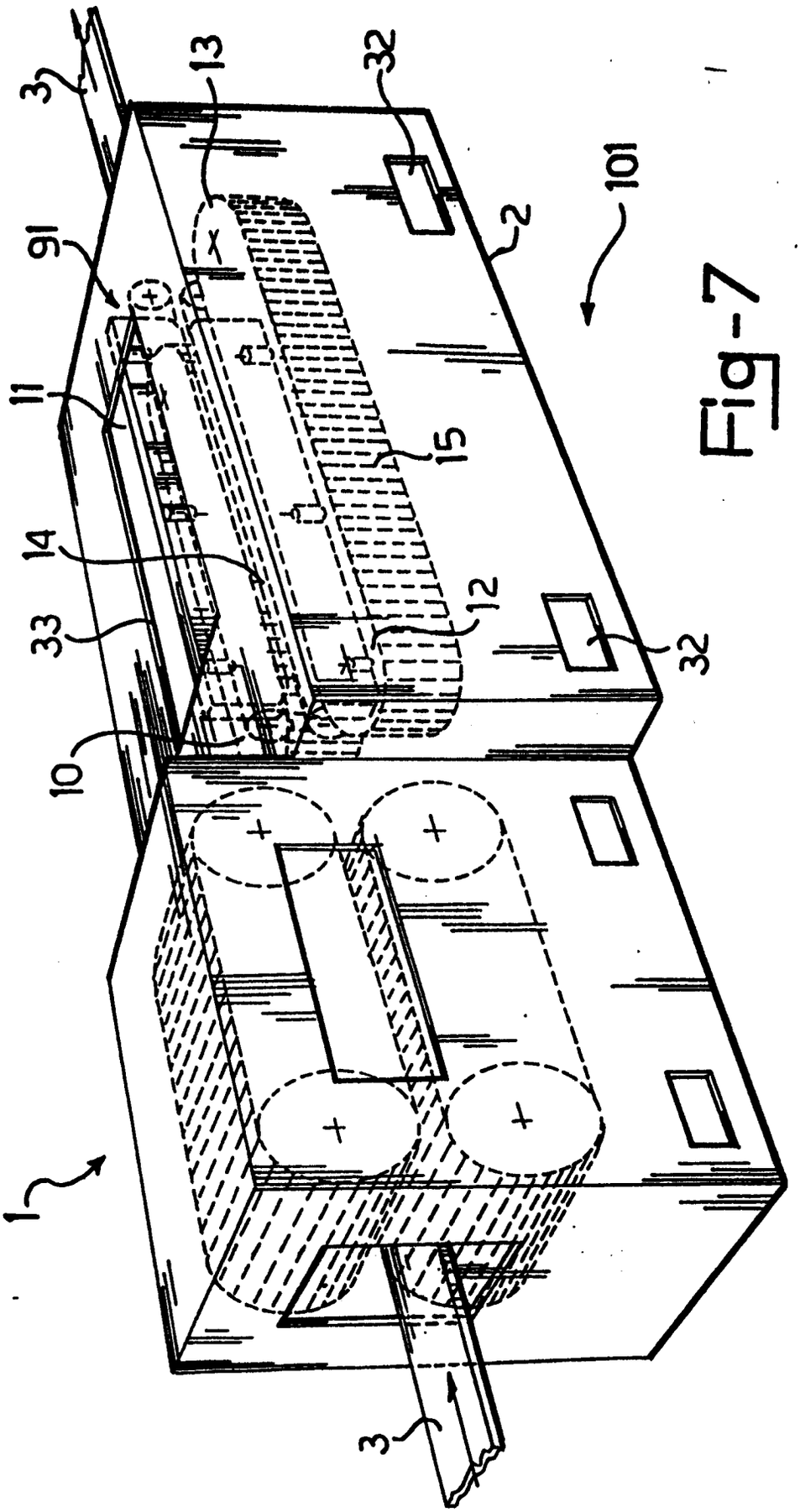

Fig-7

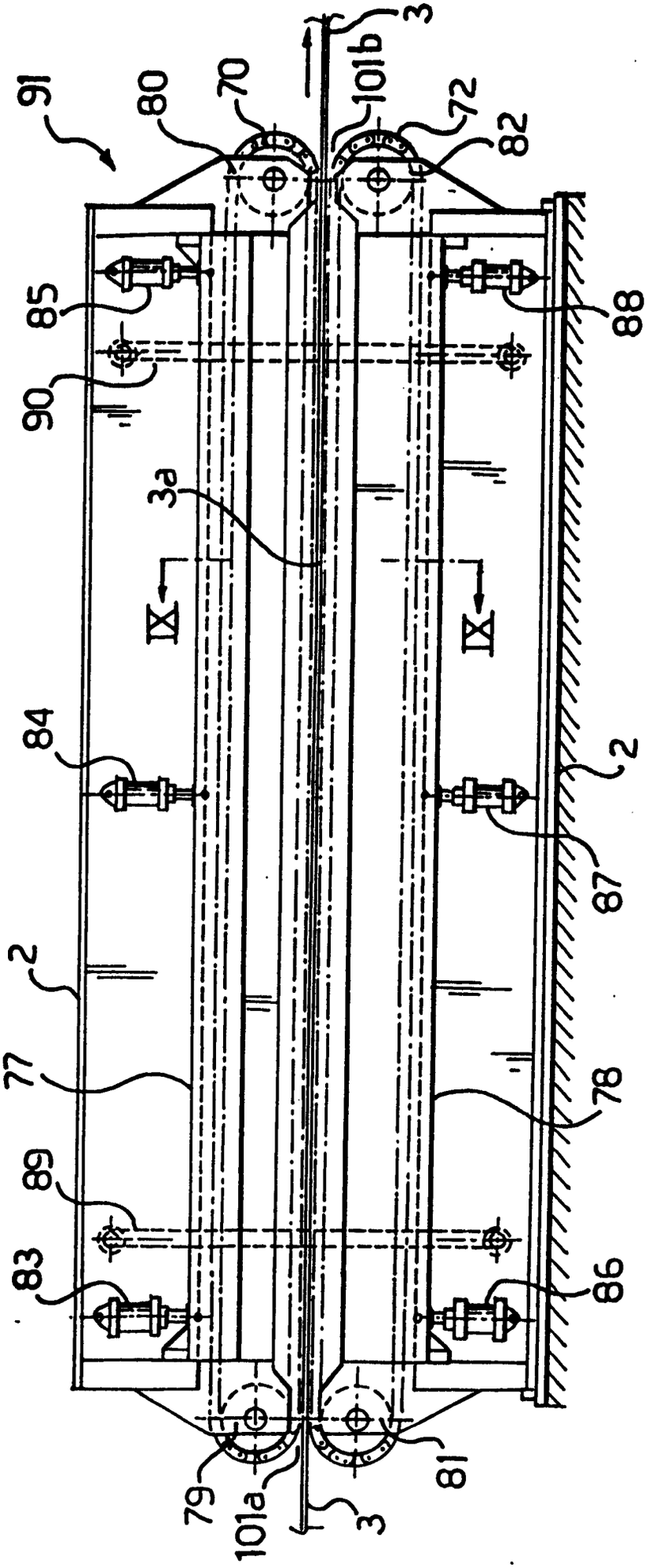
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Fig-8

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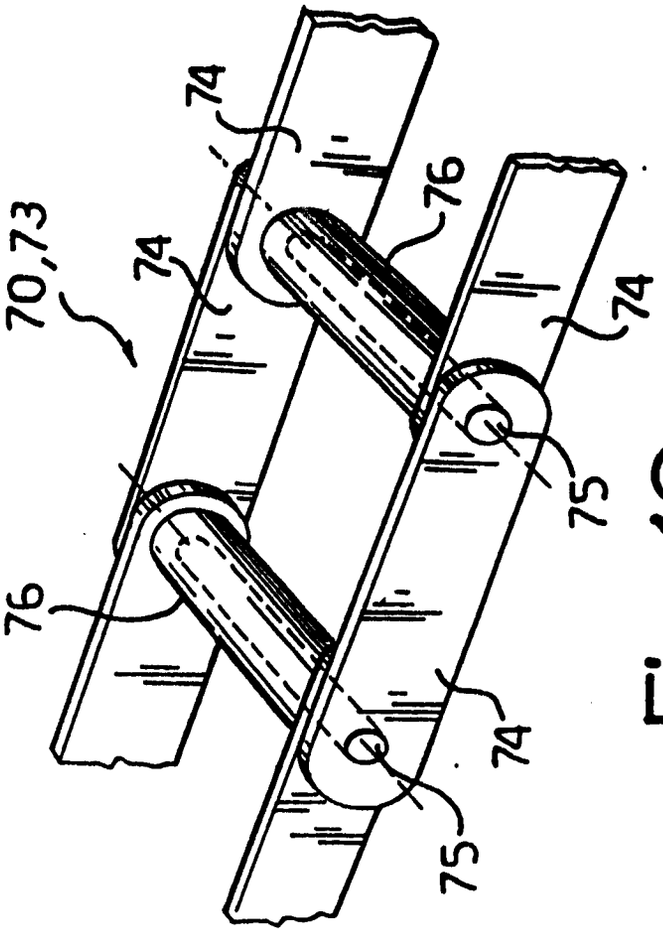

Fig-10

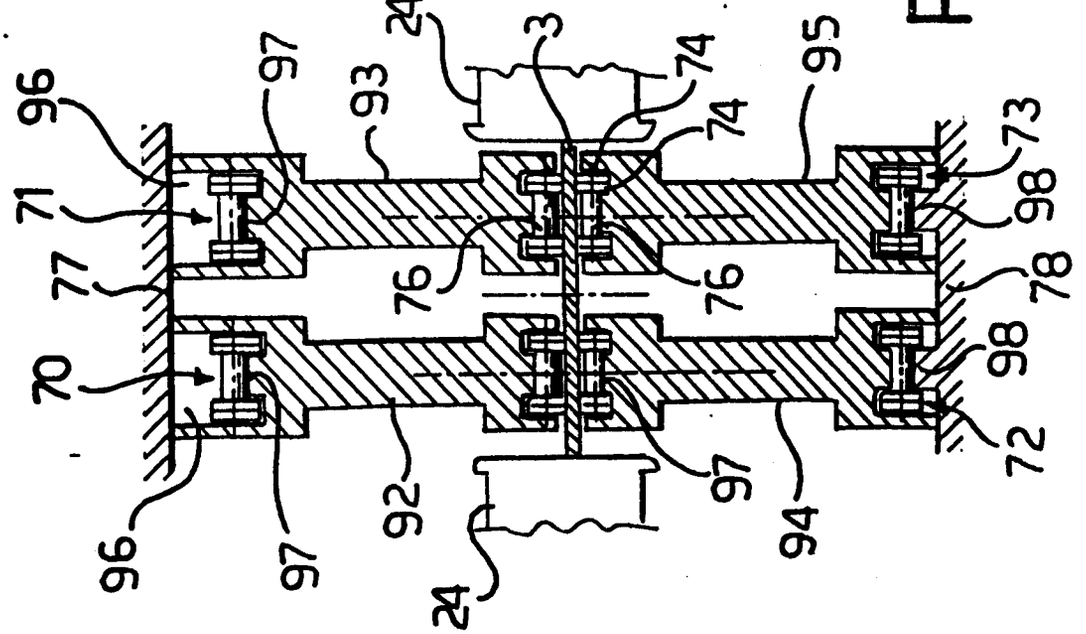

Fig-9