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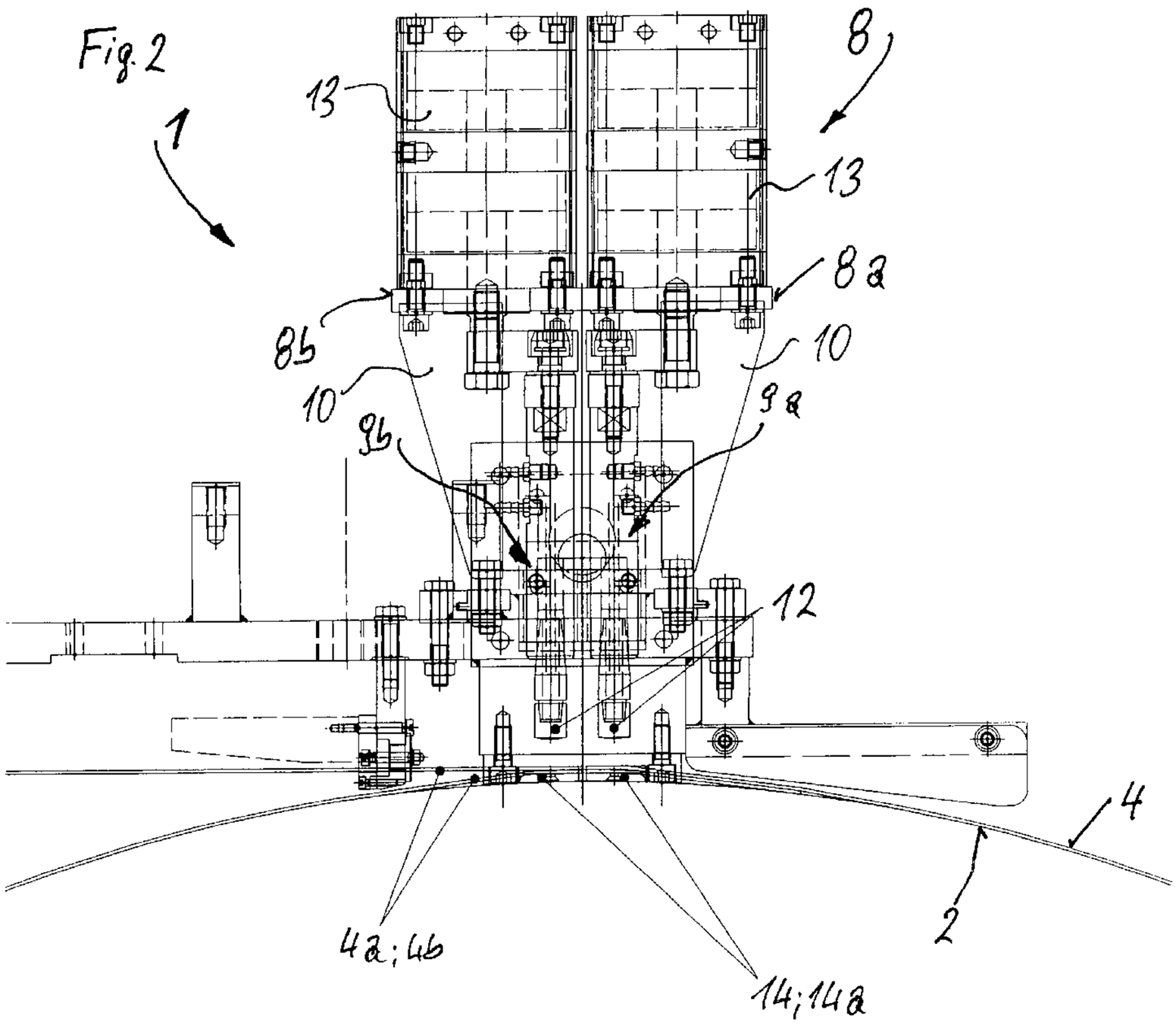
(54) Title: STRAPPING MACHINE FOR TYING PACKAGES, IN PARTICULAR METAL STRIPS WOUND TO FORM COILS

Fig. 2



(57) Abrégé/Abstract:
The invention relates to a strapping machine (1) for tying packages (2), in particular metal strips wound into coils, using at least one strapping band (4; 4a, 4b) guided around a package (2), wherein a tying head (8, 8a, 8b) can be placed against the package. The

CA 2777027 A1 2011/04/14

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(57) Abrégé(suite)/Abstract(continued):
strapping machine comprises a tensioning device and a welding device (9a, 9b) for connecting the ends (4a, 4b) of the strapping bands (4) that are stretched under tension, said welding device comprising at least one upper advanceable welding electrode (12) in an electrode chamber (10). The strapping machine also comprises a counter electrode that temporarily interacts with said welding electrode. A sliding plate (14) is associated with the welding device (9a, 9b) towards the package (2).Since the sliding plate (14) is also designed as the counter electrode, is used in the region of the mutually overlapping ends (4a, 4b) of the strapping band (4) on the lower face thereof and is directly supported on the package (2), strapping and tying are simpler and more secure.

ABSTRACT

The invention relates to a strapping machine (1) for tying packages (2), in particular metal strips wound into coils, using at least one strapping band (4; 4a, 4b) guided around a package (2), wherein a tying head (8, 8a, 8b) can be placed against the package. The strapping machine comprises a tensioning device and a welding device (9a, 9b) for connecting the ends (4a, 4b) of the strapping bands (4) that are stretched under tension, said welding device comprising at least one upper advanceable welding electrode (12) in an electrode chamber (10). The strapping machine also comprises a counter electrode that temporarily interacts with said welding electrode. A sliding plate (14) is associated with the welding device (9a, 9b) towards the package (2).Since the sliding plate (14) is also designed as the counter electrode, is used in the region of the mutually overlapping ends (4a, 4b) of the strapping band (4) on the lower face thereof and is directly supported on the package (2), strapping and tying are simpler and more secure.

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STRAPPING MACHINE FOR TYING PACKAGES, IN PARTICULAR METAL STRIPS WOUND TO FORM COILS

The invention relates to a strapping machine for securing at least one strap around a package, in particular a coil of metal strip, comprising a binding head engageable against the package, a cincher, and a welder for connecting ends of the tightened strap and having at least one upper advanceable welding electrode in an electrode housing and a counter electrode temporarily interacting therewith, the welder being movable toward the package on a slide plate.

The basic principle of such strapping machines from the prior art in various embodiments is based on positioning a binding head or a strapping or closure head on a package that is to be strapped, to guide strapping around the package, to tighten or cinch the strapping and to connect its ends one behind the other inside the binding head. The overlapping ends of the prestressed strap are connected to one another by adhesive force or in another positive manner. The strapping pulled off a supply reel is cut and the binding head is lifted from the package, these steps all being carried out in an automated manner.

A strapping machine of this type with a cincher and closure device of the type mentioned above is known from EP 10194627 [US 4,689,938]. The slide plate that can be moved with the counter electrode like a carriage in the plane of the overlapping region below the welding electrodes is formed by an upper plate and a lower plate that slide against one another or over one another. The upper

plate is thus guided on the lower slide plate in which the counter electrode is embedded. With the electrodes pressing the strap ends against one another, an electric circuit initiating the welding operation is closed. This happens when the upper plate has been moved so far away that it exposes the counter electrode embedded in the lower plate, with the strapping lying immediately above the counter electrode and below the advanceable welding electrode. After the welding operation, the upper plate then carrying the lower plate along simultaneously is shifted so far that the welded loop of strapping is released and exposed.

During transport of the packages, for example coiled rod-like or tubular metal products or metal strips wound to form coils, the strapping is subject to very great, sometimes dynamic stresses that it has to absorb. Depending on the material quality and material properties of the packages, one to three straps are placed around the outer surface of the packages to secure it against bursting open and/or to prevent displacement. In any case the strapping must be strongly prestressed, close to the limits of its tensile strength and the breaking strength of the material of the strapping, which can lead to strap impressions on the package.

These problems are further intensified by the counter electrode embedded in the steel slider according to the prior art. The slide plate guided in a groove of a mounting plate must be fairly large, in particular in terms of thickness, in order to be able to absorb the considerable forces employed during the welding operation due to the pressure of the welding electrodes. Since the welded strap after cutting and drawing out the steel slide plate

with the embedded counter electrode in the closure region or overlapping region according to the thickness of the slide plate includes the additional height due to the groove guidance snaps back to the outer surface of the package, the strap bearing against the surface of the package in a circumferentially closed manner must be additionally prestressed to compensate for this.

The object of the invention is therefore to create an automated strapping machine that in a structurally simpler manner makes possible a secure attachment of strapping that withstands high stresses.

This object is attained according to the invention in that the slide plate also forms the counter electrode and engages underneath the overlapping ends of the strapping and directly on the package. The slide plate shielding the electrode housing in which, depending on the welding process, the resistance electrodes for welding or tungsten electrodes for inert gas applications are located, during the welding process according to the invention is provided directly between the package and the strapping, so that no current can flow through the package, and itself forms the counter electrode that with the forces occurring makes possible in an advantageous manner support directly on the package, so a much higher strap tension of the strapping can be achieved after the plate is pulled out or removed from the welding region to secure the package with constant tensile force. The distance that the welded strap has to cover during placement on the package is namely determined only by the slight thickness of the slide plate. While the strapping springs back about 10 mm with the known slide plates

with an embedded counter electrode and additional guide during placement on the outer surface of the package, with the slide plate according to the invention this dimension is only about 2 mm.

A preferred embodiment of the invention provides that the slide plate has a projecting tongue spaced from the welding electrode and a plate end part connected to a positioning mechanism. There is therefore system separation, which on the one hand makes possible the unimpeded positioning of the projecting tongue relative to the welding electrode or the welding electrodes and, on the other hand, makes possible movement by a pneumatic cylinder unit serving as the positioning mechanism, advantageously for advancing or pushing the welding electrodes, spaced from the location where welding takes place, namely the rear end of the slide plate.

The system separation furthermore opens up the possibility that at least the projecting tongue of the slide plate formed by copper can be made to conform elastically to the surface of the package. The projecting tongue or the slide plate can namely have a small thickness, about 6 mm, since due to the direct support on the package it does not need to absorb any forces, which instead are introduced and absorbed in the binding head housing and/or the chamber-like electrode housing.

The elastic grip can be further promoted by providing the outer edges of the slide plate in the circumferential direction of the package with a curvature or a convexity.

A further advantageous embodiment of the invention lies in that the plate end part carries a cooling block formed with coolant passages and connectable to a coolant supply. The coolant passages

can be produced in a simple manner by drilling holes that can be closed by filler plugs when not required for a coolant supply. The cooling block, which can be attached to the plate end part via screws having countersunk heads on the side facing toward the package, guarantees a temperature level that is as constant as possible during the welding operation, so that electrode wear or electrode burnoff is reduced and unnecessary heat transfer into the package is prevented.

Another advantageous embodiment of the invention provides a support frame accommodating the plate end part, which support frame is provided with an orthogonal vertical guide provided with an integrated compression spring means so that the positioning mechanism acts on the vertical guide. The positioning mechanism thus acts indirectly on the slide plate, which can be shifted above the package via the support frame in the binding head housing. The integrated compression spring means is used to return to the starting end position, i.e. after lifting of the welding electrode or the welding electrodes, it brings the slide plate back into its starting position.

According to one proposal of the invention, a downwardly projecting stop bears against the surface of the package, is spaced from the projecting tongue in the adjustment direction, and is provided on the housing of the binding head. This limits the maximum stroke of the slide plate and moreover absorbs forces or transmits them to the binding head housing, which can be a stable welded construction or casting.

If preferably one positioning cylinder acting horizontally on the electrode housing is provided, offset spot welds with a variable spot geometry can be achieved. For example, four, five or six spot welds can be made that with a preferred spot weld diameter or electrode diameter of 6 - 9 mm should be about 18 - 30 mm apart in order to avoid current or voltage shorts between the individual spot welds.

According to the invention at least two binding head units with respective slide plates thereto are arranged individually next to one another. This is the system in particular when the strapping necessary for the product requires a dimension that goes beyond a maximum width, commercially usually 32 mm.

Further details and features of the invention are shown by the claims and the following description of embodiments of the invention shown in the drawings. Therein:

FIG. 1 is a schematic view of a strapping machine;

FIG. 2 as a front detail view of a strapping-machine binding unit formed by two binding head units next to one another;

FIG. 3 is a side view of the structure of FIG. 2;

FIG. 4 is a simplified sectional view taken along line IV-IV of FIG. 3;

FIG. 5 is a partly sectional schematic view in the welding region of ends of the strapping overlapping one another with a slide plate arranged according to the invention between the strapping and the outer surface of the package as a counter electrode; and

FIG. 6 shows the welding region as above without welding electrodes according to the prior art.

FIG. 1 shows very diagrammatically a strapping machine 1 for binding a package 2, here a metal-strip coil. Strapping 4 is unwound from a direct coiler 3 with continuous control and brake and conveyed by a strapping guide 5 around the package 2. A deflection roller 6 downstream of the direct coiler guides the strapping 4 first into a roller straightener 7 that ensures that on the one hand the leading end of the strap is conveyed straight and without kinks through the strapping guide 5 up to a binding head 8 and on the other hand the strapping 4 with declining reel radius always extends in a straight line to the strapping guide 5. In the binding head 8 the leading end of the strap is clamped and the excess strap is reversed until the strapping loop is cinched against the outer surface of the package 2. The excess strap is wound up again by reversing the direct coiler 3.

The binding head 8 shown in the embodiment is formed by two binding head units 8a and 8b next to one another and equipped for connecting the overlapping ends 4a and 4b of the tightened strap 4 with respective welders 9a and 9b having respective electrode housings 10 accommodating respective welding electrodes 12 mounted on respective electrode holders 11. The binding head 8 or the binding head units 8a and 8b and the welding electrodes 12 can be moved against the outer surface of the package 2. To this end the electrode holders 11 are acted on by respective cylinders 13, here pneumatic cylinders, bolted to the electrode housings 10 (see FIGS. 2 and 3).

For welding, slide plates 14 are temporarily positioned opposite the welding electrodes 12. These slide plates are formed

of thin copper and, since they are supported or bear directly on the surface of the package 2, also form counter electrodes. As can be seen from FIGS. 3 and 4, each slide plate 14 has a projecting tongue 14a and a plate end part 14b. For welding, the slide plates 14 can be employed or positioned such that the projecting tongues 14a lie opposite the respective welding electrodes 12 in the welding region of the overlapping ends 4a and 4b of the cinched strapping 4.

As can be seen from FIGS. 3 and 4, a cooling block 16 is attached to the plate end parts 14b by countersunk headed screws 15. It is provided with coolant passages 17 formed by bores that have connections 18 for the input and output of a coolant (water). The unneeded outlet openings of the bores of the coolant passages 17 are closed by filler plugs 19. The plate end part 14b of the slide plate 14 and the cooling block 16 is held by a support frame 20, mounted for straight-lint adjustment in a binding head housing 21 (see FIG. 3).

To adjust the support frame 20 and thus to position the slide plate 14, a pneumatic cylinder unit forms a positioning mechanism 22 having a piston rod 23 that acts on a column-like vertical guide 24 extending orthogonally to the support frame 20.

FIG. 3 shows that the binding head housing 21 has an end stop 25 projecting downward and spaced from at a distance opposite the projecting tongue 14a of the slide plate 14 and a positioning cylinder 26 acting horizontally on the electrode housing 10. The positioning cylinder 26 makes possible variable, in particular offset, spot welds.

As can be seen from FIG. 5, the outer edges of the slide plate 14 in the circumferential direction 27 or, in the case of two slide plates arranged next to one another, the outer edges of the projecting tongues 14a (see FIG. 4), have a convex curvature 28 that further promotes the conforming or engagement of the slide plate 14, or 14a, 14b, which is elastic due to its small thickness, to the outer surface of the package 2.

In a comparison with the known slide plate embodiment shown in FIG. 6, in which the counter electrode 114a shown by a dashed line is embedded in the lower steel slider 114 that in turn is guided in grooves of sidewalls, FIG. 5 clarifies the great advantage of the achieved gain in tensile force. According to FIG. 6, considerable slack is required in the strapping because a large spacing must be provided for the steel slider and the sidewall guides thereof, which then leads to a loss of tensile force when the closed loop springs back to rest on the outer surface of the package 2. The additional elongation here can be used completely as tensile force to the largest possible extent according to FIG. 5.

List of reference numbers

1 Strapping machine	7 Roller straightener
2 Package/metal strip coil	8 Binding head
3 Direct coiler	8a and 8b Binding head unit
4 Strap	9a and 9b Welder
4a and 4b Overlapping ends of the strapping	10 Electrode housing
5 Strapping guide	11 Electrode holder
6 Deflection roller	12 Welding electrode
	13 Cylinder/pneumatic cylinder

for welding electrode advance

14 Slide plate

14a Projecting tongue

14b Plate end part

15 Countersunk bolt

16 Cooling block

17 Coolant passages

18 Connection/coolant inlet or outlet

19 Filler plug

20 Support frame

21 Binding head housing

22 Positioning mechanism

23 Piston rod

24 Vertical guide

25 End stop

26 Positioning cylinder

27 Circumferential direction

114 Steel slider

114a Counter electrode

Claims

1. A strapping machine (1) for securing at least one strap (4; 4a, 4b) around a package (2), in particular a coil of metal strip, comprising a binding head (8, 8a, 8b) engageable against the package, a cincher, and a welder (9a, 9b) for connecting ends (4a, 4b) of the tightened strap (4) and having at least one upper advanceable welding electrode (12) in an electrode housing (10) and a counter electrode temporarily interacting therewith, the welder (9a, 9b) being movable toward the package (2) on a slide plate (14), characterized in that the slide plate (14) also forms the counter electrode and engages underneath the overlapping ends (4a, 4b) of the strapping (4) and directly on the package (2).

2. The strapping machine according to claim 1, characterized in that the slide plate (14) has a projecting tongue (14a) spaced from the welding electrode (12) and a plate end part (14b) connected to a positioning mechanism (22).

3. The strapping machine according to claim 2, characterized in that the plate end part (14b) carries a cooling block (16) that is formed with coolant passages (17) connectable to a coolant supply.

4. The strapping machine according to claim 2 or 3, characterized by a support frame (20) carrying the plate end part (14b) and provided with an orthogonal vertical guide (24) having a

compression spring means in an integrated manner, the positioning mechanism (22) acting on the vertical guide (24).

5. The strapping machine according to claim 4, wherein a pneumatic cylinder unit is the positioning mechanism (22).

6. The strapping machine according to one of claims 1 through 5, characterized in that the slide plate (14) is formed of copper and at least the projecting tongue (14a) is constructed to conform elastically to the surface of the package (2).

7. The strapping machine according to claim 6, characterized in that outer edges of the slide plate (14; 14a) in the circumferential direction (27) of the package (2) are formed with a curvature (28).

8. The strapping machine according to one of claims 1 through 7, characterized in that an end stop (25) projecting downward, bearing against the surface of the package (2) and spaced apart from the projecting tongue (14a) in the adjustment direction, is provided on the housing (21) of the binding head (8).

9. The strapping machine according to one of claims 1 through 8, characterized by a positioning cylinder (26) acting horizontally on the electrode housing (10).

10. The strapping machine according to one of claims 1 through 9, characterized in that at least two binding head units (8a, 8b) with respective slide plates (14; 14a, 14b) are provided individually next to one another.

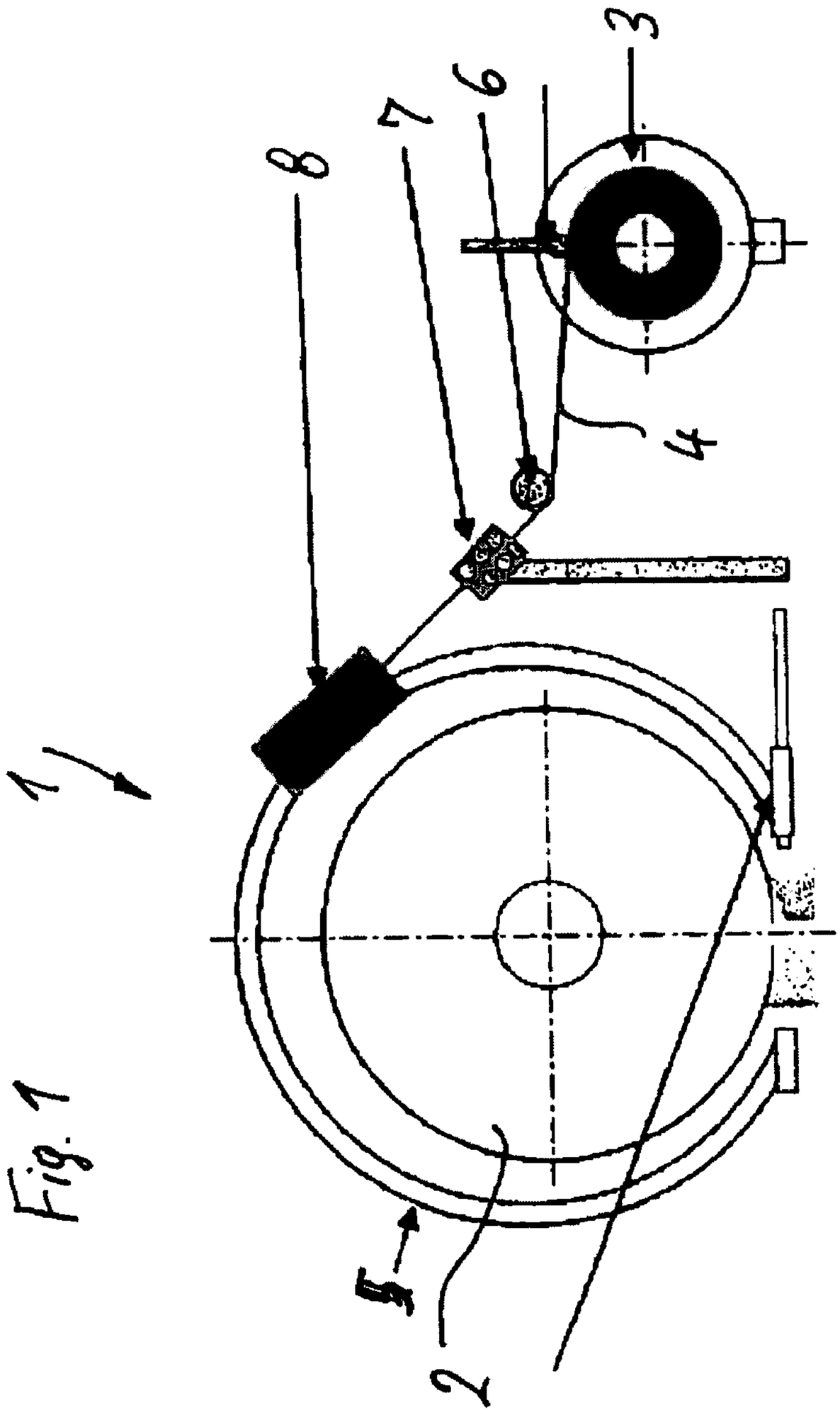


Fig. 1

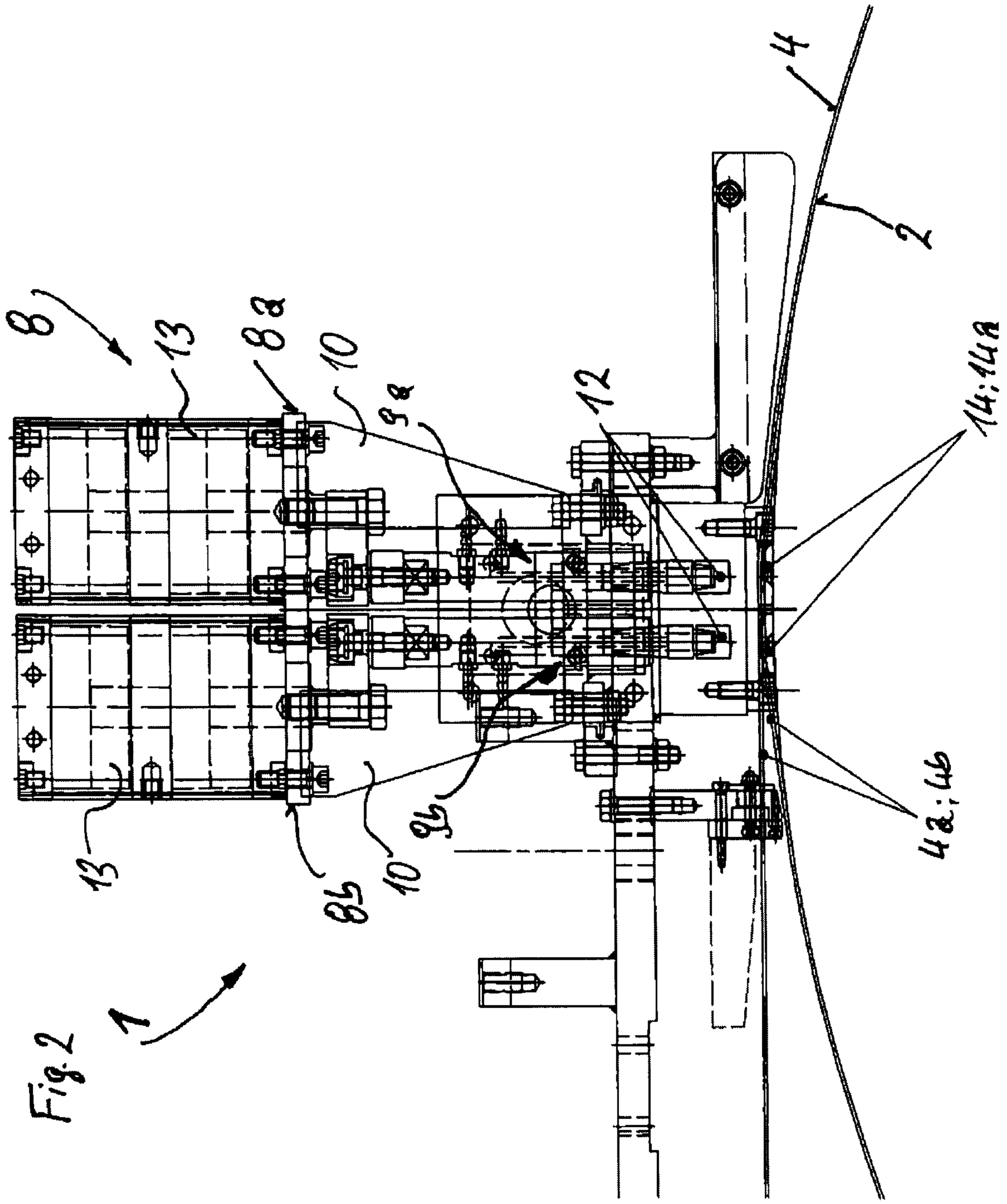
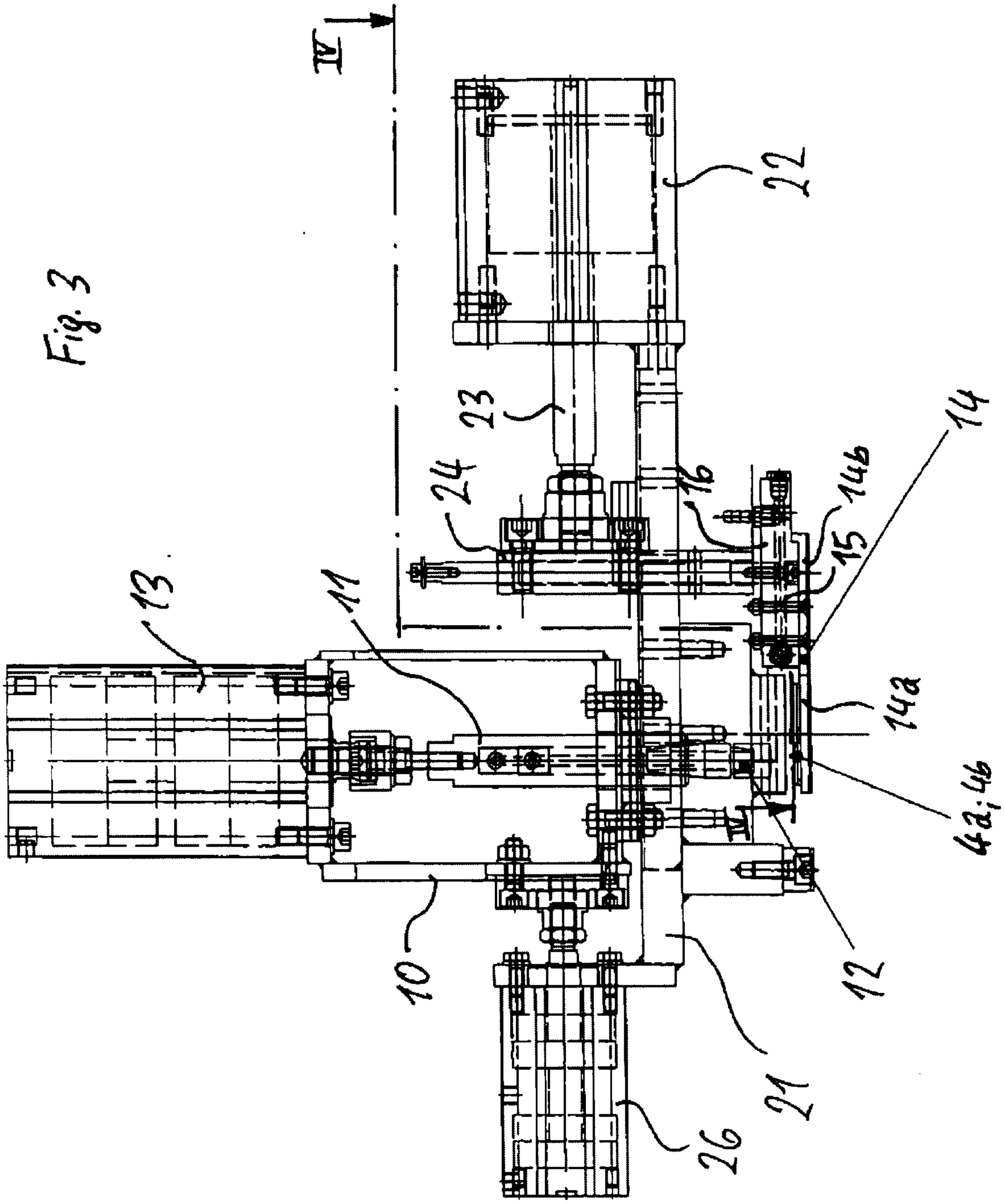


Fig. 2

Fig. 3



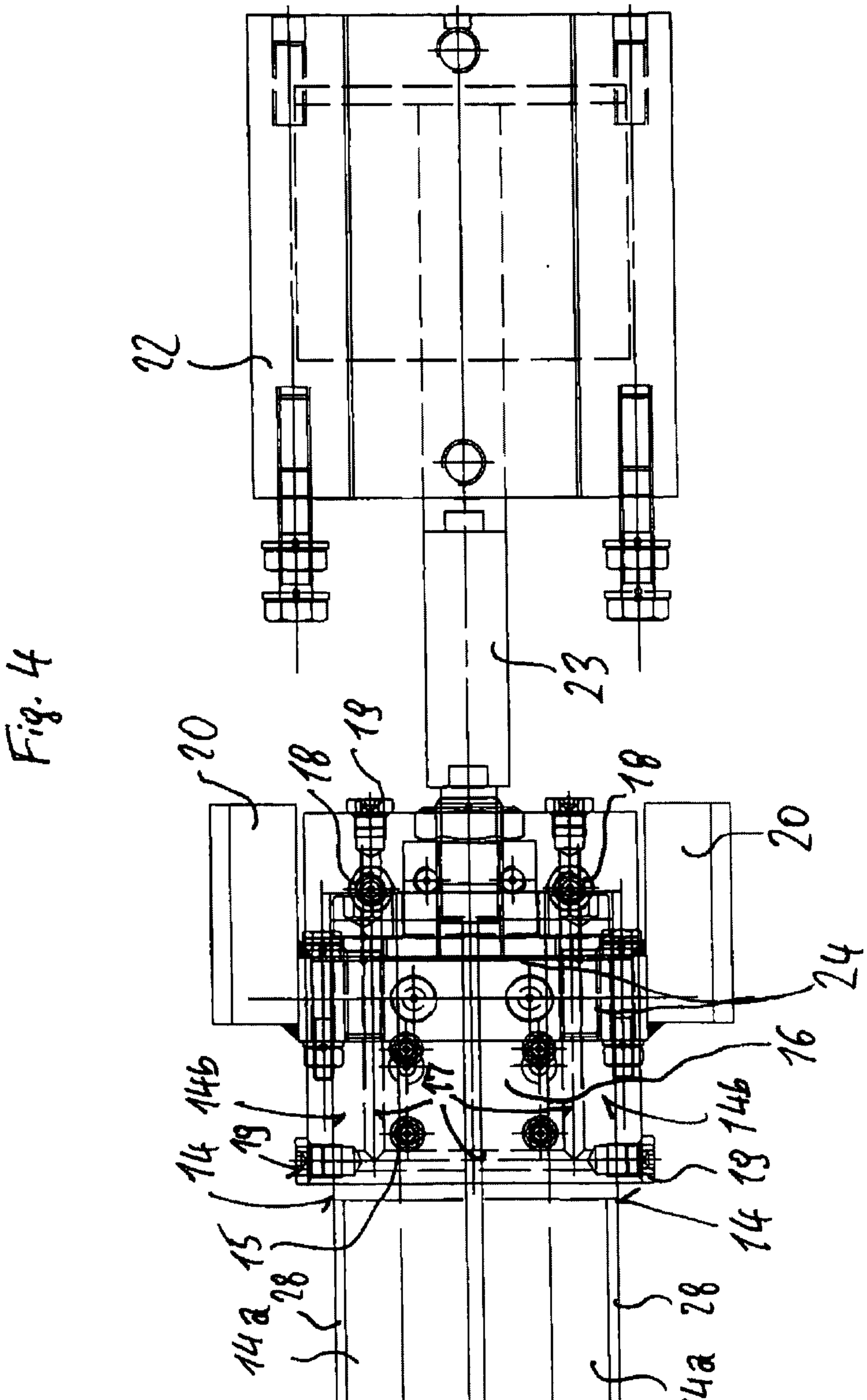


Fig. 4

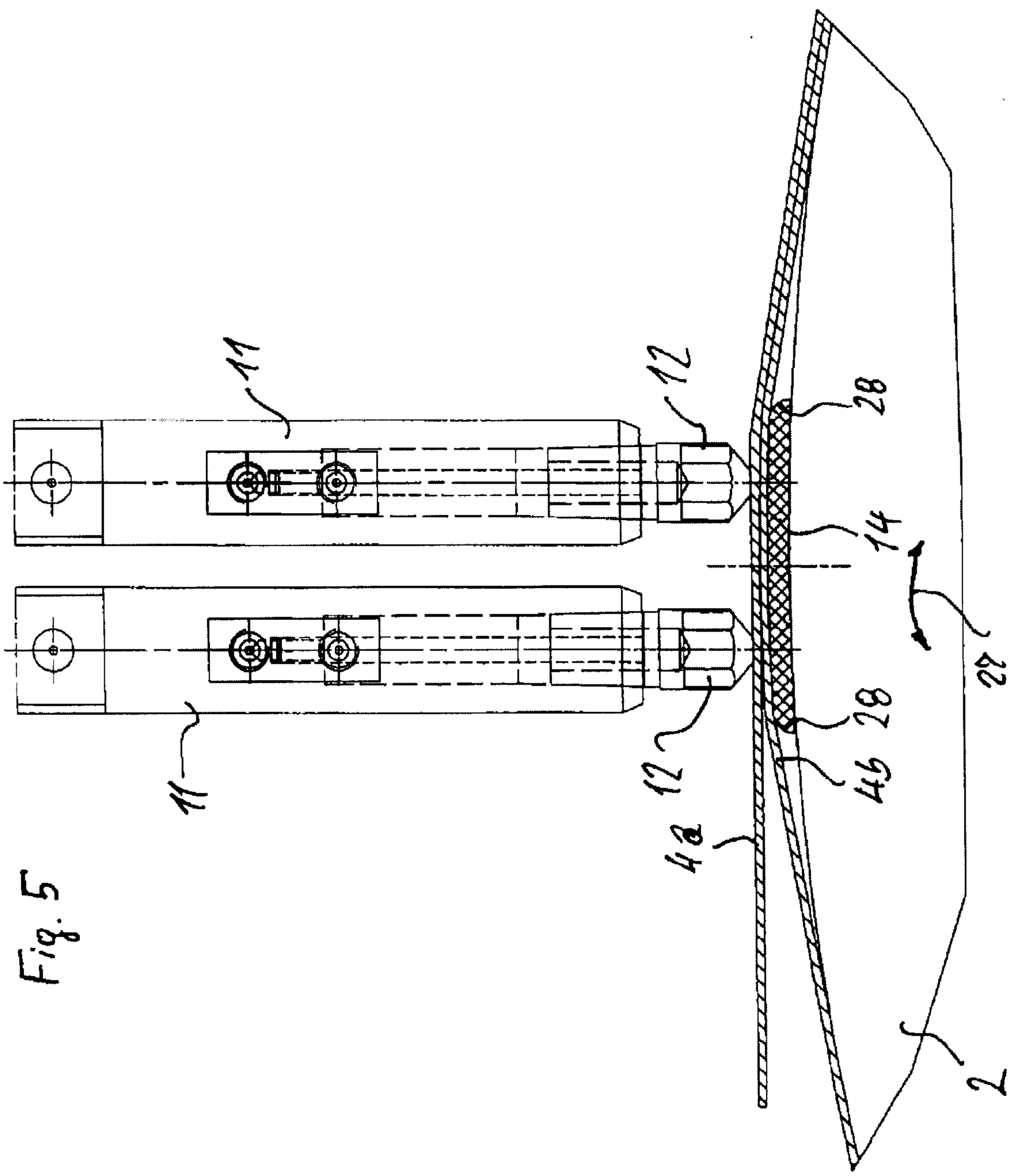


Fig. 5

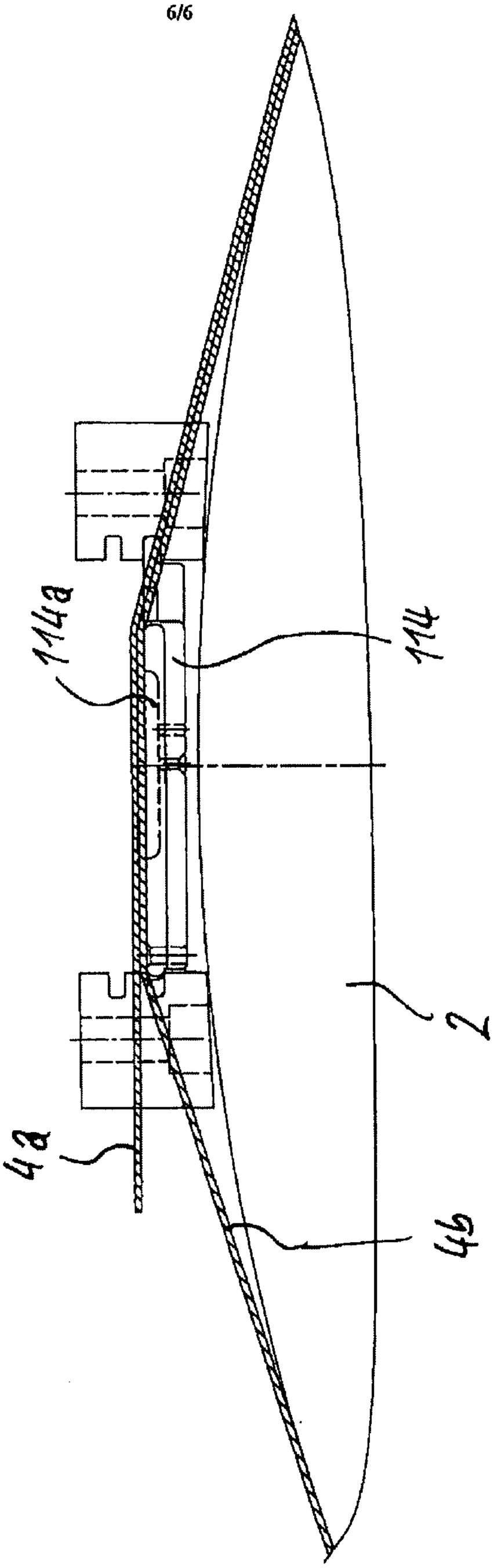


Fig. 6

Fig. 2