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CA 2110228 C 2002/11/19

(11)(21) 2 110 228

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1993/11/29

(41) Mise à la disp. pub./Open to Public Insp.: 1994/06/18

(45) Date de délivrance/Issue Date: 2002/11/19

(30) Priorité/Priority: 1992/12/17 (3 861/92-0) CH

(51) Cl.Int.^{5}/Int.Cl.^{5} B26F 1/02

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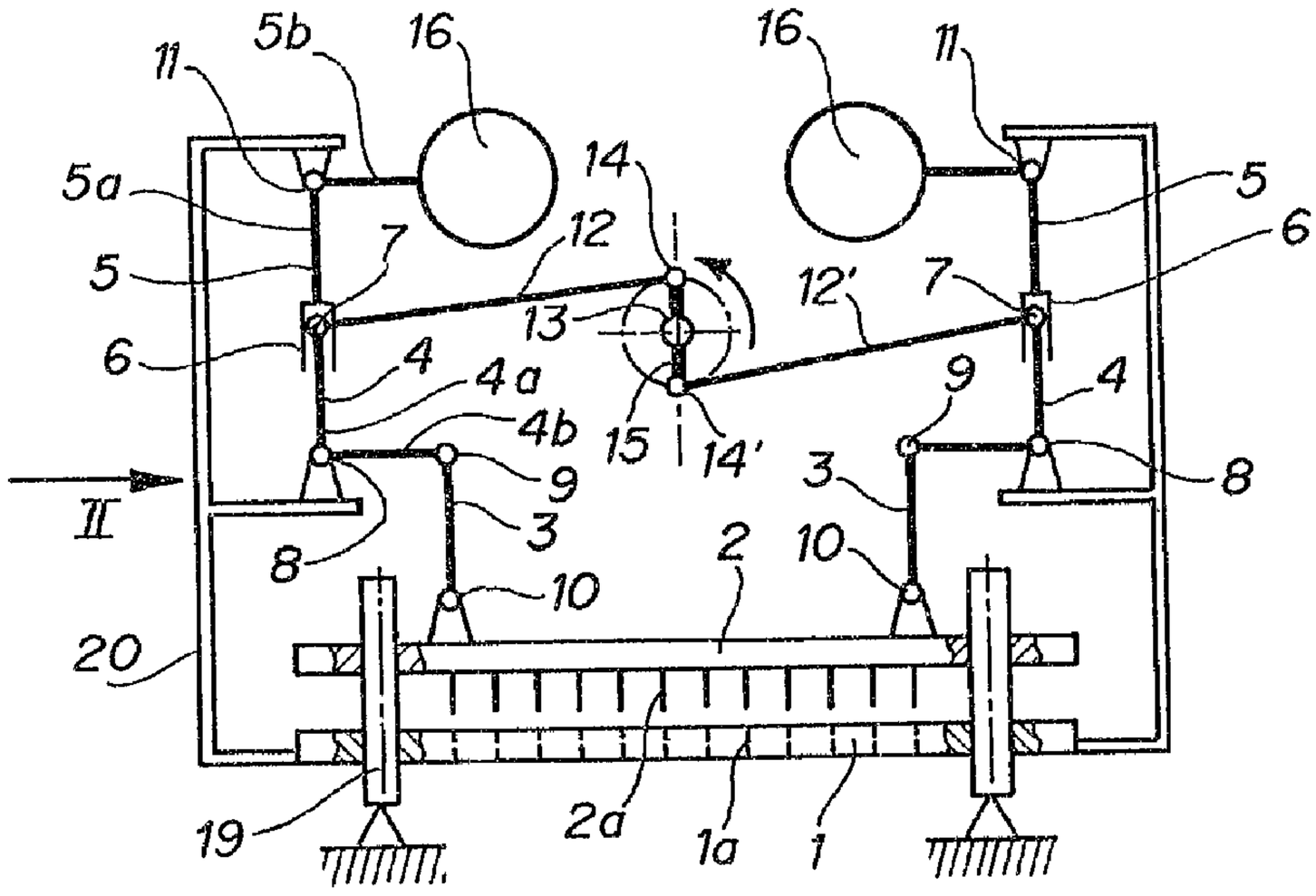
(54) Titre : MODULE DE POINCONNAGE SERVANT A PERFORER DES ARTICLES EN FEUILLES
(54) Title: PUNCHING UNIT FOR THE PERFORATION OF SHEET-LIKE ARTICLES



(57) Abrégé/Abstract:
The vertically upwardly and downwardly movable tool plate (2) of the punching unit is suspended on each of mutually opposite sides from a lever system which has two lower angle levers (4) and one upper angle lever (5), each with a vertical and a horizontal lever arm. The two lower angle levers (4) and the upper angle lever (5) are each rotatable at their angle corners about a fixed axis (8, 11), and their vertical lever arms (4a, 5a) are connected to one another by means of a sliding joint (6). The horizontal lever arms (4b) of the lower angle levers (4) carry the tool plate (2), and the horizontal lever arms (5b) of the upper angle levers (5) carry counter-weights (16). Mounted between the two lever systems is a double eccentric (15) having diametrically opposite eccentric pins (14, 14') which are connected by means of links (12, 12') to the sliding joint (6) of one lever system or the other respectively, in such a way that, during the rotation of the double eccentric, the tool plate (2) and the counterweights (16) are moved upwards and downwards in opposite directions in order to achieve mass compensation.

ABSTRACT

The vertically upwardly and downwardly movable tool plate (2) of the punching unit is suspended on each of mutually opposite sides from a lever system which has two lower angle levers (4) and one upper angle lever (5), each with a vertical and a horizontal lever arm. The two lower angle levers (4) and the upper angle lever (5) are each rotatable at their angle corners about a fixed axis (8, 11), and their vertical lever arms (4a, 5a) are connected to one another by means of a sliding joint (6). The horizontal lever arms (4b) of the lower angle levers (4) carry the tool plate (2), and the horizontal lever arms (5b) of the upper angle levers (5) carry counterweights (16). Mounted between the two lever systems is a double eccentric (15) having diametrically opposite eccentric pins (14, 14') which are connected by means of links (12, 12') to the sliding joint (6) of one lever system or the other respectively, in such a way that, during the rotation of the double eccentric, the tool plate (2) and the counterweights (16) are moved upwards and downwards in opposite directions in order to achieve mass compensation.

Punching Unit For The Perforation Of Sheet-Like Articles

The invention relates to a punching unit for the perforation of sheet-like articles, especially of mail-stamp sheets, with a horizontal cutting plate and a vertically-movable tool plate parallel thereto, and with a drive mechanism, by means of which the tool plate is displaceable upwards and downwards in oscillation.

In such a punching unit, the cutting plate, unto which the articles to be perforated are laid, has holes in a desired arrangement, and the tool plate is provided with corresponding perforating pins. While the punching unit is in operation, large masses are moved rapidly in oscillation, and considerable mass forces are generated as a result of the accelerations occurring at the reversal points of the movement. These mass forces can cause operating problems in the punching unit itself and problems of vibration and of stability at the place of installation.

An object on which the invention is based is to provide a punching unit which generates no or only slight mass forces relative to the outside.

A punching unit for the perforation of sheet-like articles in accordance with this invention has a horizontal cutting plate, a vertically-movable tool plate parallel thereto and a drive mechanism by means of which the tool plate is displaceable upwards and downwards in oscillation. The tool plate is suspended on each of mutually-opposite

sides by means of articulated lifting rods from a lever system which has at least one lower-angle lever, mounted in its angle region so as to be rotatable about a fixed horizontal axis, and at least one upper-angle lever arranged above the lower-angle lever and mounted in its angle region so as to be rotatable about a fixed horizontal axis. Each angle lever has an essentially vertically-directed lever arm and an essentially horizontally-directed lever arm; the vertical lever arm of the lower-angle lever pointing upwards and the vertical lever arm of the upper-angle lever pointing downwards. The lifting rods are articulated on the horizontal lever arms of the lower-angle levers. The horizontal lever arm of the upper-angle lever of each lever system carries a counterweight. A drive device is provided for pivoting all the angle levers to and fro simultaneously and is designed for moving the angle levers located one above the other respectively in opposite directions of rotation to one another, and the angle levers on one side respectively in the opposite direction to the corresponding angle levers on the other side, in such a way that the counterweights can be driven in the opposite direction to the vertical movement of the tool plate.

It is thereby ensured that for each moving mass there is a symmetrically moving compensating mass, so

that the mass forces and mass moments are compensated in all the principal directions of the mechanical system.

Brief description of the drawings

The invention is explained in more detail by means of the drawings with reference to an exemplary embodiment. In these:

Figure 1 shows a diagrammatic side view of a punching unit according to the invention in an intermediate position,

Figure 1a shows the punching unit according to Figure 1 with its tool plate in its upper position, and

Figure 1b shows the same in its lower position,

Figure 2 shows a diagrammatic view in the direction of the arrow II according to Figure 1,

Figure 3 shows, on an enlarged scale, the part of the punching unit which includes the sliding joint, the counterweight and the lever arm carrying this counterweight being shown pivoted upwards through 90°, and

Figure 4 shows a part view in the direction of the arrow IV according to Figure 3.

Description of the preferred embodiment

As illustrated in Figures 1 and 2, a fixed horizontal cutting plate 1 with holes 1a mounted in the lower region of a machine stand 20, and a tool plate 2 provided with perforating pins 2a and oriented parallel to the cutting plate 1 is mounted above said cutting plate so as to be vertically movable upwards and downwards by means of vertical guide columns 19. The sheet-like articles to be perforated, especially mail-stamp sheets, are laid onto the top side of the cutting plate 1 and, during the downward movement of the tool plate 2, are perforated by the pins 2a which are aligned with the holes 1a and which engage into these holes 1a.

The tool plate 2 is suspended on each of mutually opposite sides by means of lifting rods 3 from a lever system which, according to Figure 1, is constructed identically on both sides and which consists essentially of angle levers 4 and 5 arranged one above the other. In the example under consideration, two lifting rods 3, two

lower angle levers 4 with the lever arms 4a, 4b and an upper angle lever 5 with the lever arms 5a, 5b are provided on each side (Figures 2 and 3). The lower angle levers 4 are mounted in the stand 20 so as to be rotatable at their angle corner about a horizontal fixed axis 8; in the example under consideration, their lever arms 4a and 4b are arranged at right angles to one another, and in the intermediate position of the punching unit shown in Figure 1 the lever arm 4a is oriented essentially vertically and the lever arm 4b essentially horizontally, the lever arms 4a pointing upwards.

The lifting rods 3 are fastened with their upper ends to the ends of the respective lever arms 4b in an articulated manner at 9 and are articulated with their lower ends on the top side of the tool plate 2 so as to be pivotable about a common horizontal axis 10.

The upper angle lever 5 is mounted in the stand 20 so as to be rotatable at its angle corner about a horizontal fixed axis 11 arranged vertically above the axis 8 and parallel thereto and has the two lever arms 5a and 5b which are likewise oriented at least approximately at right angles to one another. In the intermediate position of the punching unit shown in Figure 1, the lever arm 5a is oriented essentially vertically and the other lever arm 5b essentially horizontally, the lever arm 5a pointing downwards.

The ends of the lever arms 4a are connected to the end of the lever arm 5a in an articulated manner by means of a sliding joint 6 which has the free axis 7. The sliding joint, which is also explained in more detail with reference to Figures 2 to 4, is necessary, because the angle levers 4 and 5 must oscillate to and fro about their respective axes 8 and 11 between the end positions shown in Figures 1a and 1b.

There serves for the common drive of the angle levers on each side of the machine stand a double eccentric 15 which is mounted in the middle between the two lever systems and which is set in rotation about a fixed axis 13 and has two diametrically opposite eccentric pins

14 and 14'. Articulated on one eccentric pin 14 is a link 12, the other end of which is connected in an articulated manner to the sliding joint 6 on one side of the stand; articulated on the other eccentric pin 14' is a link 12' which is connected in an articulated manner to the sliding joint 6 on the other side.

Fastened to the ends of the lever arms 5b are counterweights 16 which are dimensioned as compensating masses in such a way that their weight corresponds approximately to the weight of the tool plate 2 and of the elements, particularly the lifting rod 3, serving for its suspension.

When the double eccentric 15 is set in continuous rotation in the direction of the arrow according to Figure 1 by means of a drive, then, starting from the intermediate position according to Figure 1, the sliding joints 6 are moved symmetrically away from one another on both sides, with the result that, on the left-hand according to Figure 1, the angle levers 4 are pivoted counter-clockwise and the angle lever 5 clockwise, whilst, on the right-hand side, in opposition thereto, the angle levers 4 are pivoted clockwise and the angle lever 5 counter-clockwise. As a result of these pivotings, the tool plate 2 is lifted into its upper position, and at the same time the counterweights 16 are lowered; this first end position is shown in Figure 1a.

During the subsequent half revolution of the double eccentric 15, all the angle levers are respectively pivoted in the opposite direction. The tool plate 2 is thereby lowered until it comes to bear on the cutting plate 1, the pins 2a engaging into the holes 1a, and at the same time the counterweights 16 are raised; this other end position of the punching unit is shown in Figure 1b.

Thus, by means of the driven double eccentric 15 and the two lever systems, the tool plate 2 is set in a harmonic lifting motion. As a result of the arrangement and the opposed movement of all the parts, the mass forces occurring during acceleration are compensated both

in the horizontal and in the vertical direction. On the one hand, the two links 12 and 12' as well as the lever arms 4a and 5a of the angle levers execute opposed movements in the horizontal direction on both sides, and, on the other hand, the tool plate 2 together with the lifting rods 3 and the lever arms 4b is always moved vertically in opposition to the counterweights 16 and the lever arms 5b.

Figures 2, 3 and 4 show the example of a practical design of the sliding joint 6 and of the connection of the latter to the link 12. For the sake of clarity, in Figure 3 the lever arm 5b appearing there and the counterweight 16 fastened to its end are shown offset upwards through 90°. The axis 8 according to Figures 1 and 2 is the axis of an angle-lever shaft 18, the ends of which are mounted in bearings 22 of the machine stand 20. Fastened rigidly to this angle-lever shaft 18 are the two angle levers 4 with their lever arms 4a and 4b (Figures 3 and 4) and, laterally next to them and parallel to the lever arms 4a, a further vertical lever arm 4a'. As shown in Figures 2 and 3, the angle levers 4b carrying the lifting rods 3 are fastened to the shaft 8 in a manner offset outwards relative to the lever arms 4a.

The ends of the lever arms 4a carry bearings 24 for receiving the shaft 17, the axis 7 of which is the movable free axis of the sliding joint 6. This sliding joint 6 has a sliding part 6a which is mounted on the shaft 17 and which is mounted on the lever arm 5a of the angle lever 5 so as to be longitudinally displaceable in the direction of the double arrow according to Figure 3. The angle lever 5 together with its lever arm 5a and the lever arm 5b, shown offset through 90° in Figure 3 and carrying the counterweight 16, is fastened rigidly to the shaft 21 which has the axis 11 and which is mounted in bearings 23 of the stand 20.

The lever arm 4a' serves for the articulated fastening of the link 12 which is rotatable at the end of this lever arm about the axis 7' which is in the extension of the axis 7 and which therefore belongs to the

free axis of the sliding joint. The other link 12' is mounted in the same way on the other side.

The lever arm 4a', attached separately from the lever arms 4a, for the articulated fastening of the link 12 or 12' is expedient for reasons of construction. However, it is also possible to connect the link 12 or 12' in another way in an articulated manner to the sliding joint 6 or, which is virtually the same thing, to one of the vertical lever arms 4a or 5a, for example to articulate it directly on the shaft 17 or directly on one of the lever arms 4a or 5a.

In a modified embodiment, the sliding joint 6 can be omitted if there are attached to each eccentric pin 14 and 14' two links, of which, on each side of the punching unit, one is articulated on the lever arm 5a and the other on one of the lever arms 4a or on a special lever arm similar to the lever arm 4a', the two angle levers 4 and, if present, the special lever arm being connected rigidly to one another, for example by means of an angle-lever shaft similar to the shaft 18. In this embodiment, in each lever system, the articulated connections of the two links to the upper angle lever and to the lower angle levers preferably lie at least approximately in a common vertical plane.

The invention is not restricted to the exemplary embodiments described, but permits many alternative versions in terms of the constructive design of all the parts and the number of angle levers and lifting rods on each side of the punching unit. Thus, in principle, each lever system need have only one lower angle lever, the horizontal lever arm of which carries, for example, a crossmember, on which the pole rods are suspended. Also, more than two lower angle levers and, if appropriate, a plurality of upper angle levers can be provided.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A punching unit for the perforation of sheet-like articles having a horizontal cutting plate, a vertically-movable tool plate parallel thereto and a drive mechanism by means of which the tool plate is displaceable upwards and downwards in oscillation; wherein said tool plate is suspended on each of mutually-opposite sides by means of articulated lifting rods from a lever system which has at least one lower-angle lever, mounted in its angle region so as to be rotatable about a fixed horizontal axis, and at least one upper-angle lever arranged above said lower-angle lever and mounted in its angle region so as to be rotatable about a fixed horizontal axis; wherein each said angle lever has an essentially vertically-directed lever arm and an essentially horizontally-directed lever arm, the vertical lever arm of the lower-angle lever pointing upwards and the vertical lever arm of the upper-angle lever pointing downwards; wherein said lifting rods are articulated on the horizontal lever arms of the lower-angle levers; wherein the horizontal lever arm of the upper-angle lever of each lever system carries a counterweight; and wherein a drive device is provided for pivoting all said angle levers to and fro simultaneously and is designed for moving the angle levers located one above the other respectively in opposite directions of rotation to one another, and the angle levers on one side respectively in

the opposite direction to the corresponding angle levers on the other side, in such a way that the counterweights can be driven in the opposite direction to the vertical movement of said tool plate.

2. The punching unit as claimed in claim 1, wherein the drive device has a double eccentric, which is installed between the two lever systems and which can be set in rotation about a fixed axis and has on diametrically-opposite sides eccentric pins, of which one eccentric pin or the other is connected by means of links to the vertical lever arms of the angle levers arranged one above the other and belonging to one lever system or the other.

3. The punching unit as claimed in claim 2, wherein the ends of the vertical lever arms of the angle levers located one above the other are connected to one another rotatably by means of a sliding joint, and wherein the connection between an eccentric pin and the respective lever system consists of a link which is connected in an articulated manner to the sliding joint, so that, during rotation of the double eccentric, the sliding joints of the two lever systems are moved to and fro in opposition in an at least approximately horizontal direction.

4. The punching unit as claimed in claim 1, 2 or 3, wherein each lever system has a plurality of lower-angle levers and at least one upper-angle lever, and wherein the

lower-angle levers are rigidly fastened at a distance next to one another to a fixedly mounted angle-lever shaft.

5. The punching unit as claimed in claim 4, wherein each lever system has two lower-angle levers and one upper-angle lever.

6. The punching unit as claimed in claim 4 or 5, wherein a shaft forming the shaft of the sliding joint is mounted rotatably between the ends of the vertical lever arms of the lower-angle levers, and wherein the vertical lever arm of the upper-angle lever is connected to this shaft in an articulated manner and is displaceable in the sliding joint.

7. The punching unit as claimed in claim 4, 5 or 6, wherein a further lever arm is rigidly fastened, parallel to the vertical lever arms of the angle lever, to said angle-lever shaft and is articulated at its end on the link.

8. The punching unit as claimed in claim 2, wherein each eccentric pin is connected by means of two links on the one hand to the vertical lever arm of the lower-angle lever, and on the other hand to the vertical lever arm of the upper-angle lever.

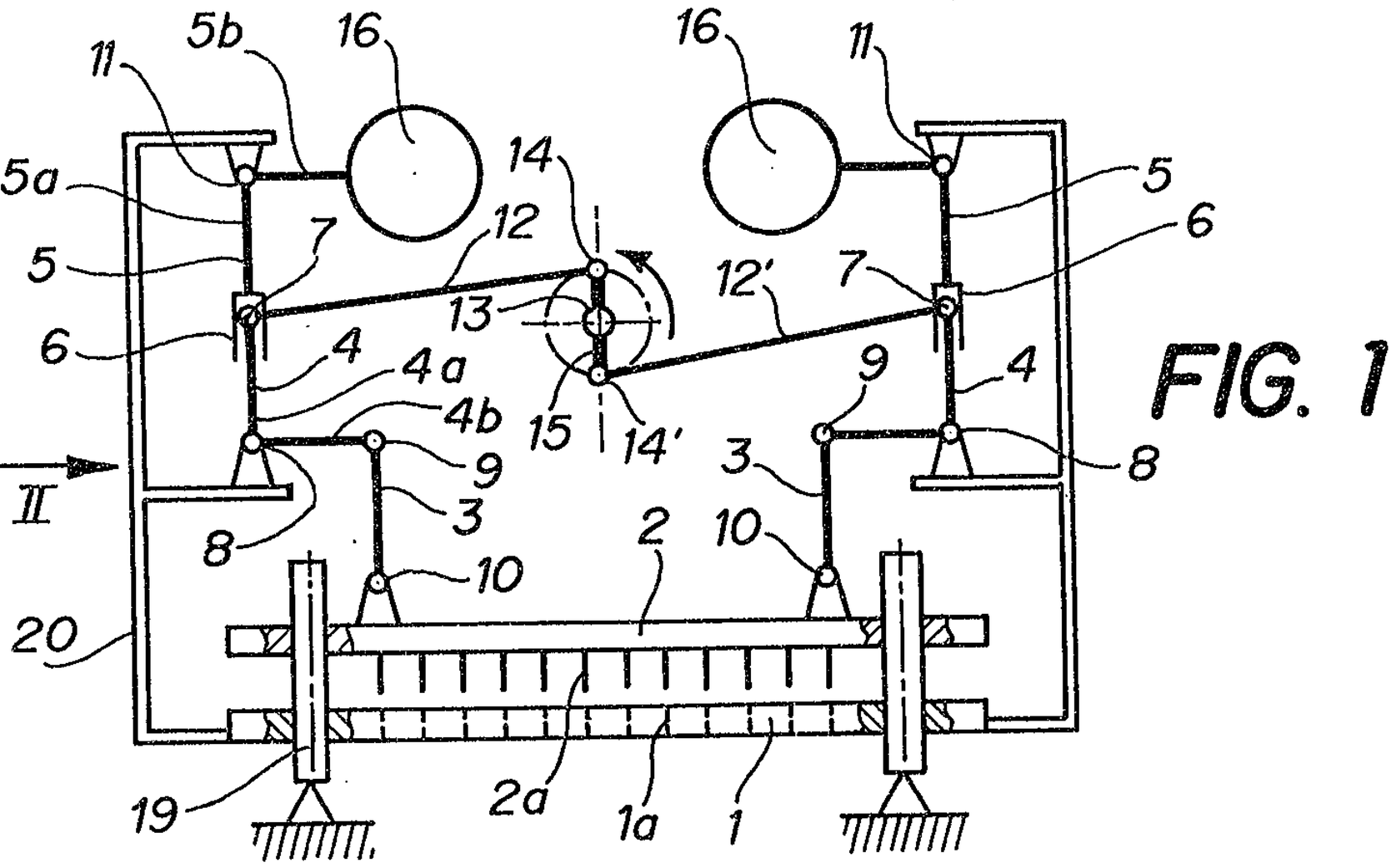


FIG. 1

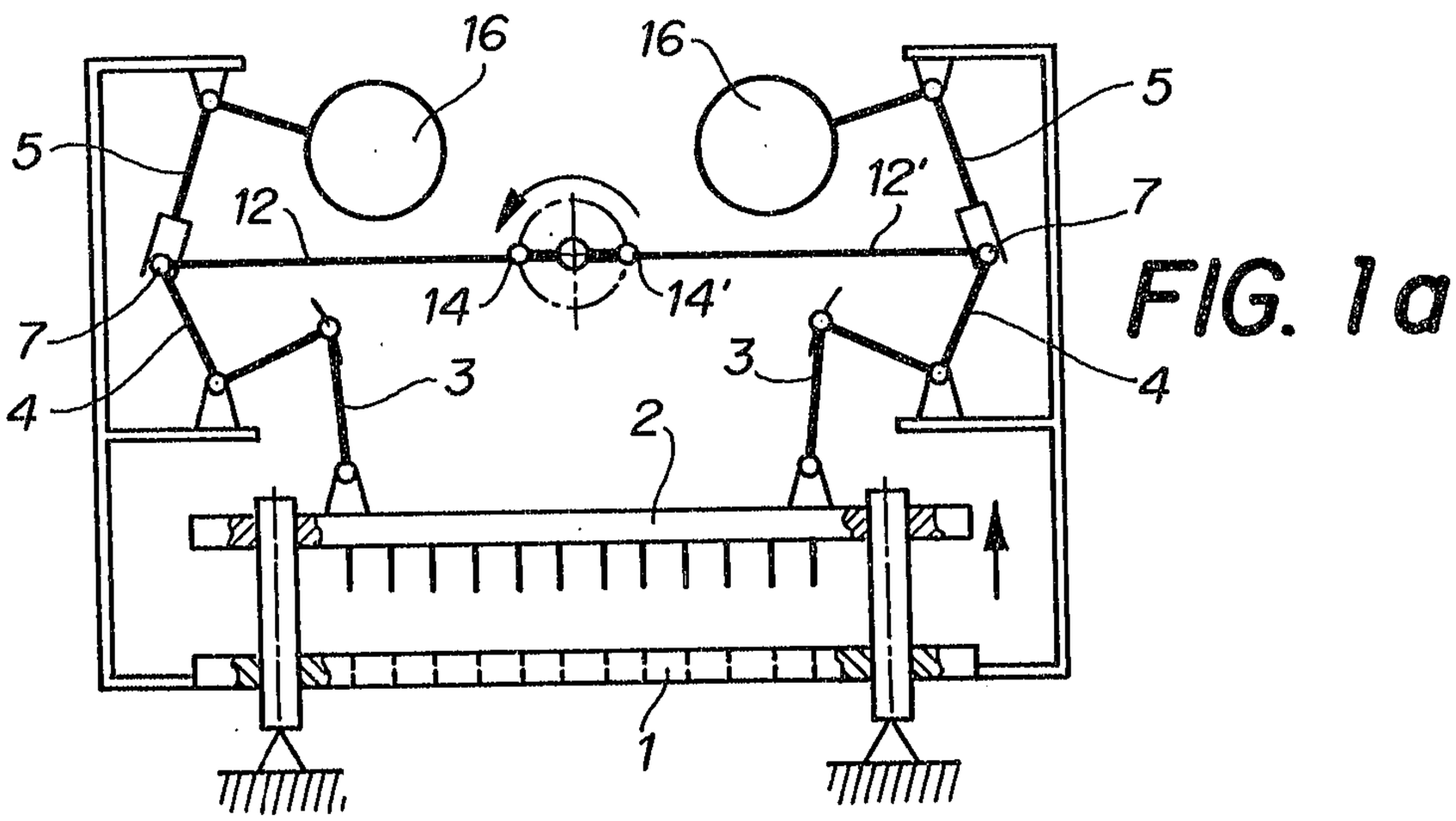


FIG. 1a

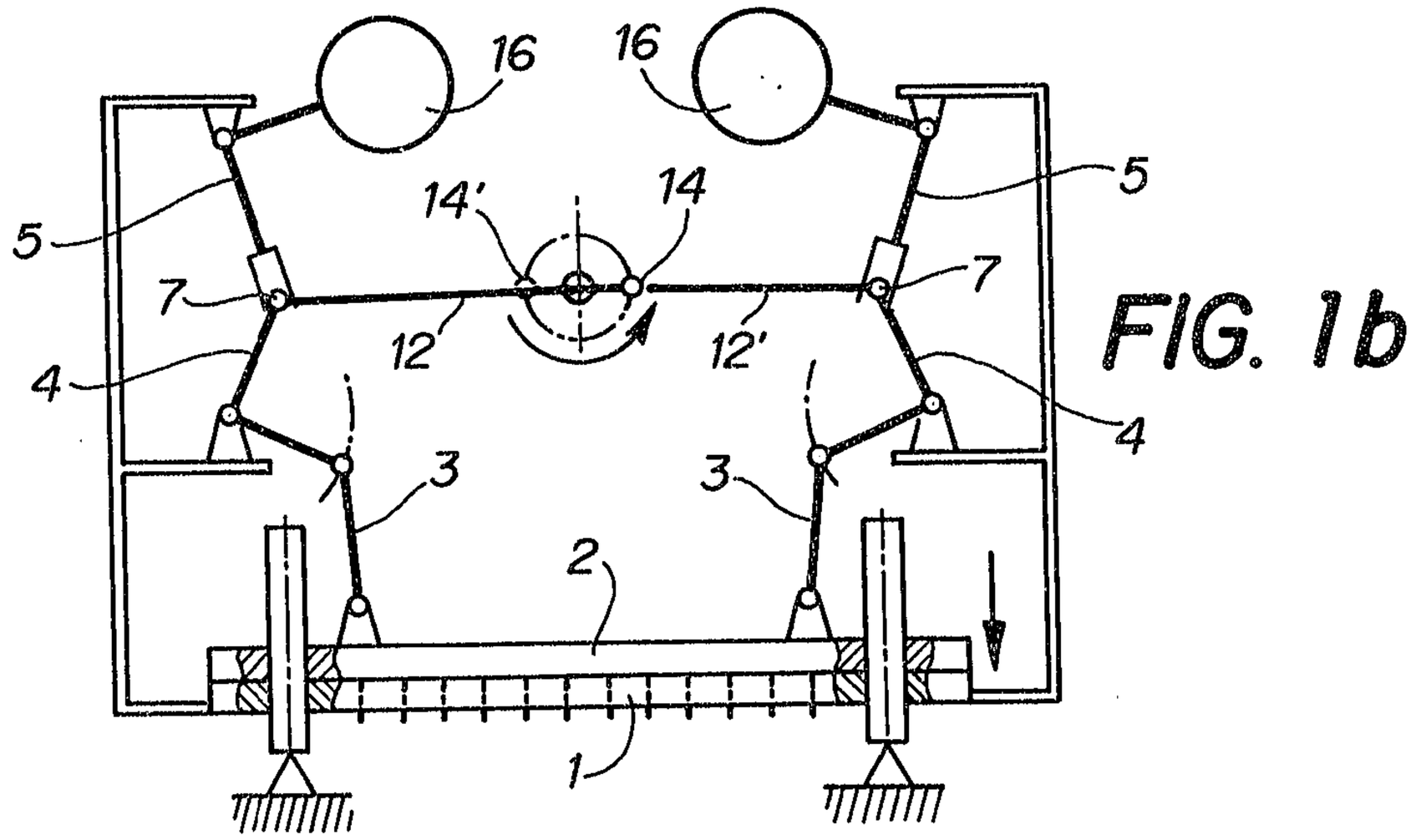


FIG. 1b

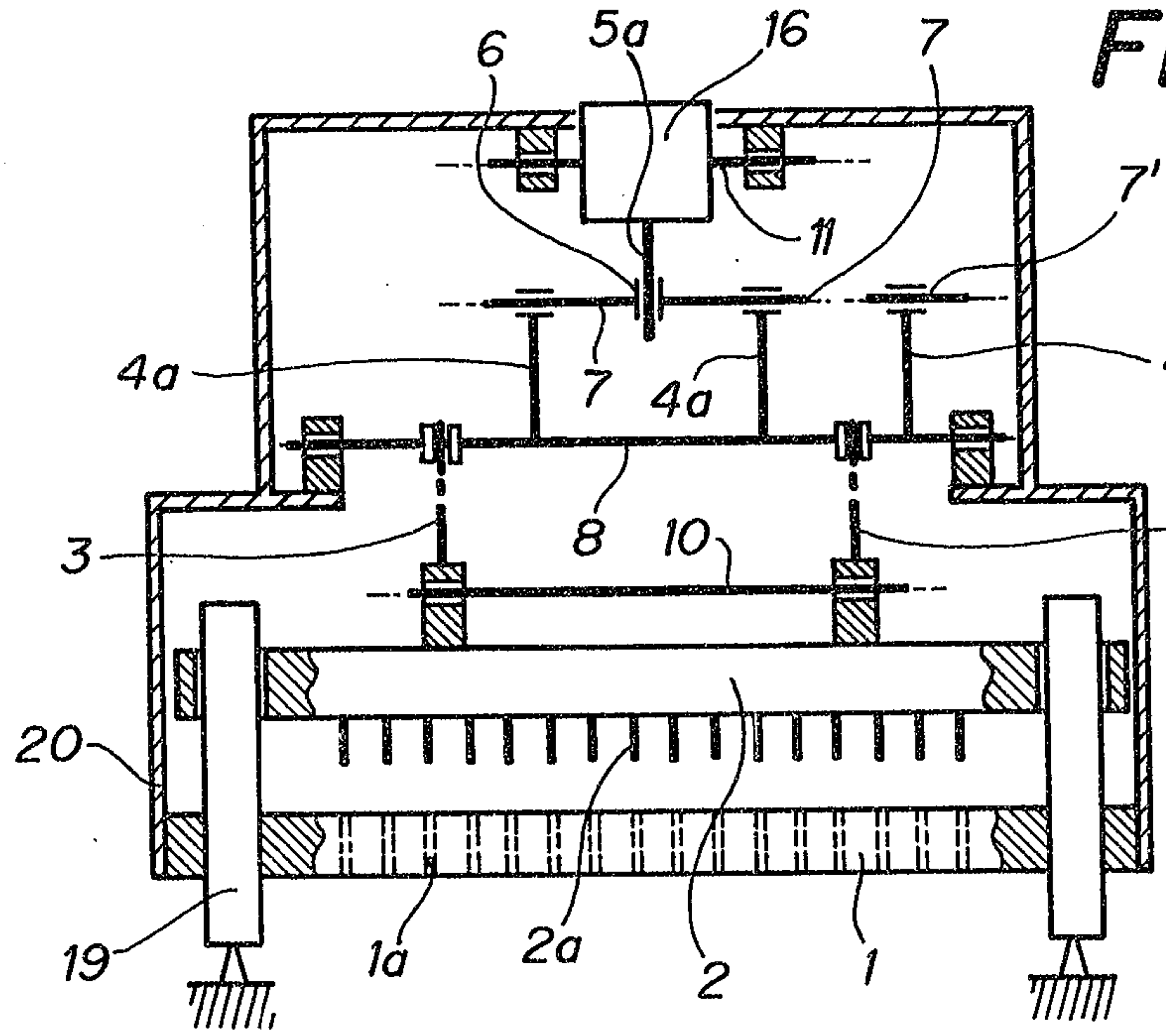


FIG. 2

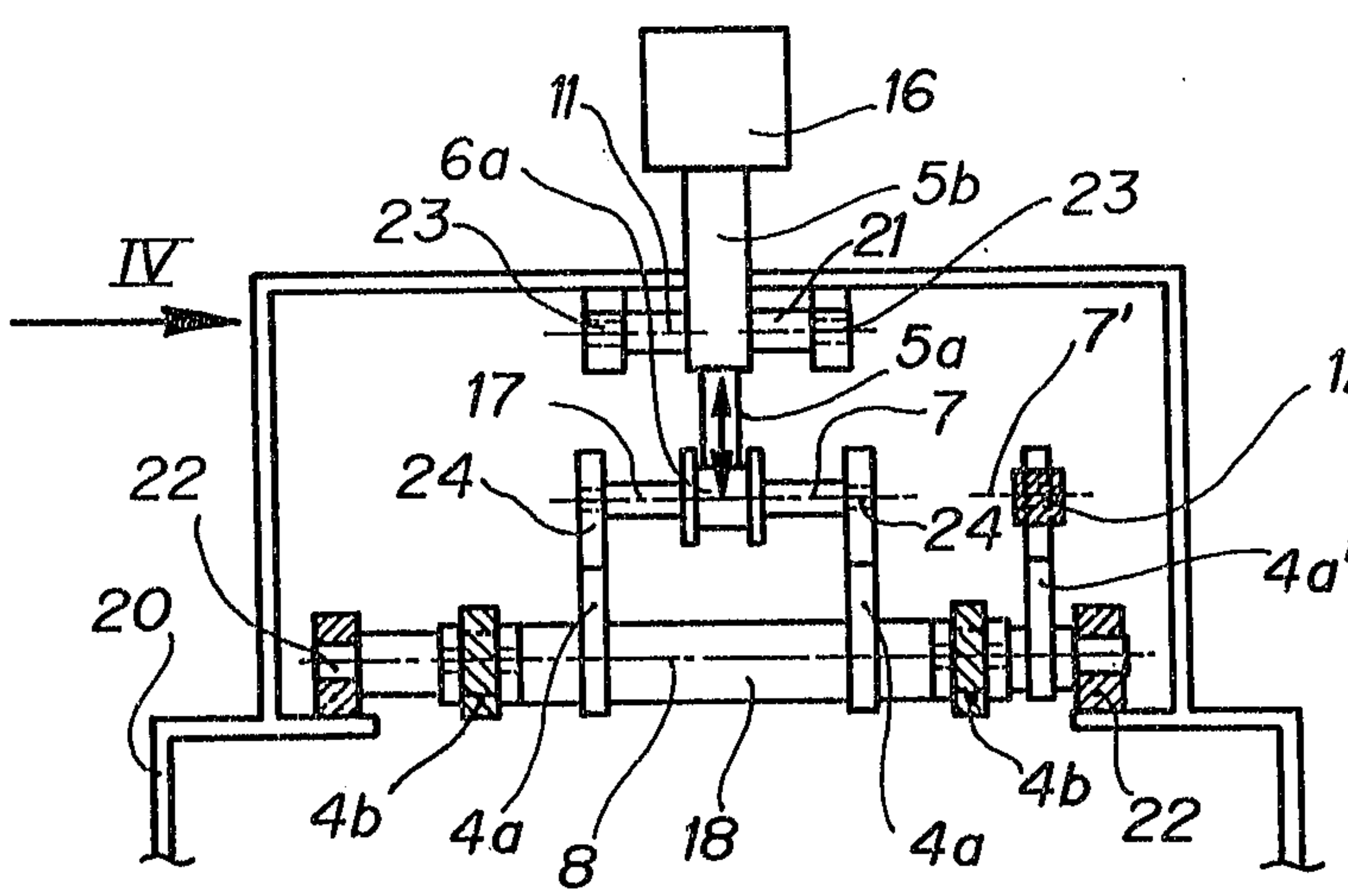


FIG. 3

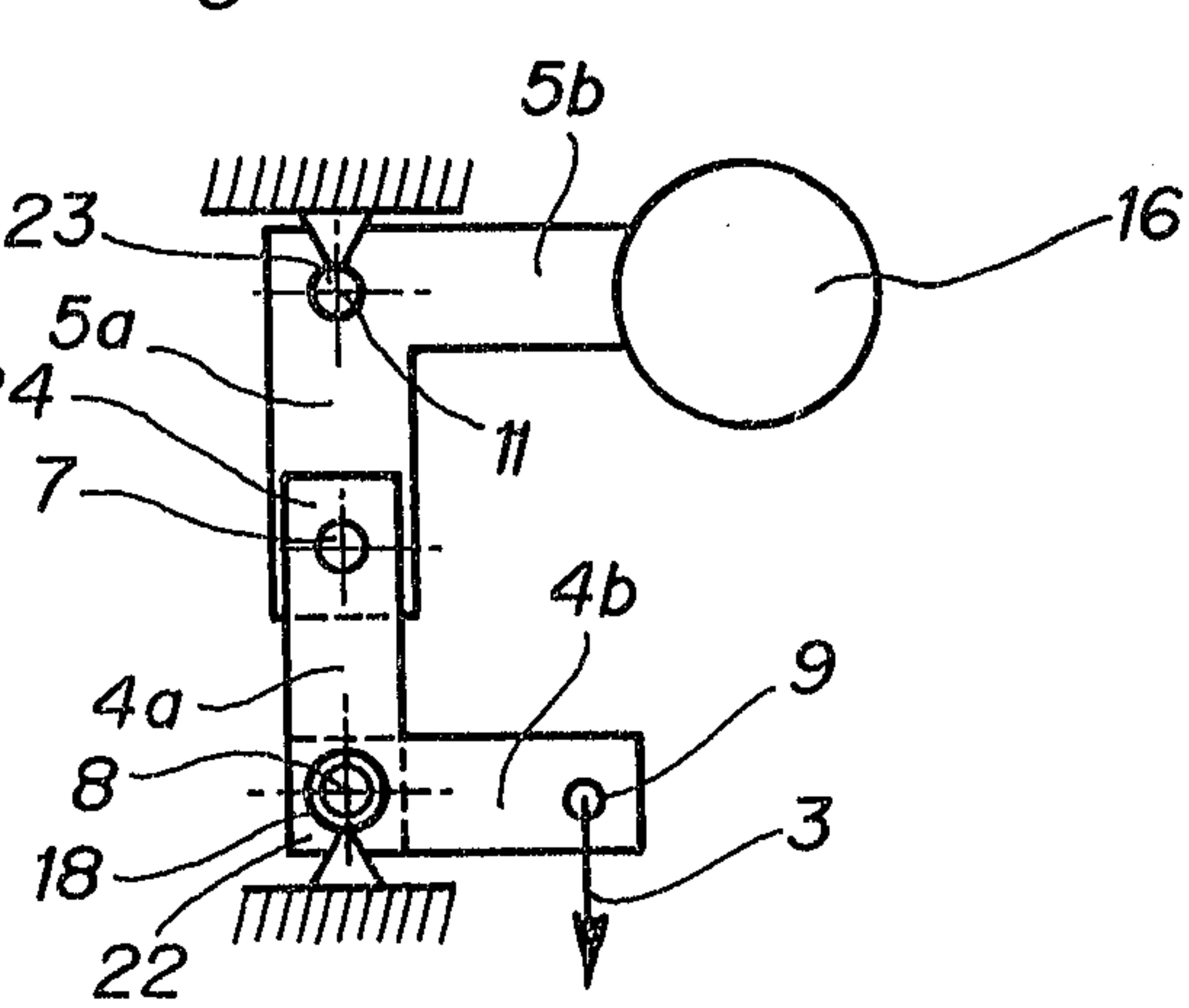


FIG. 4

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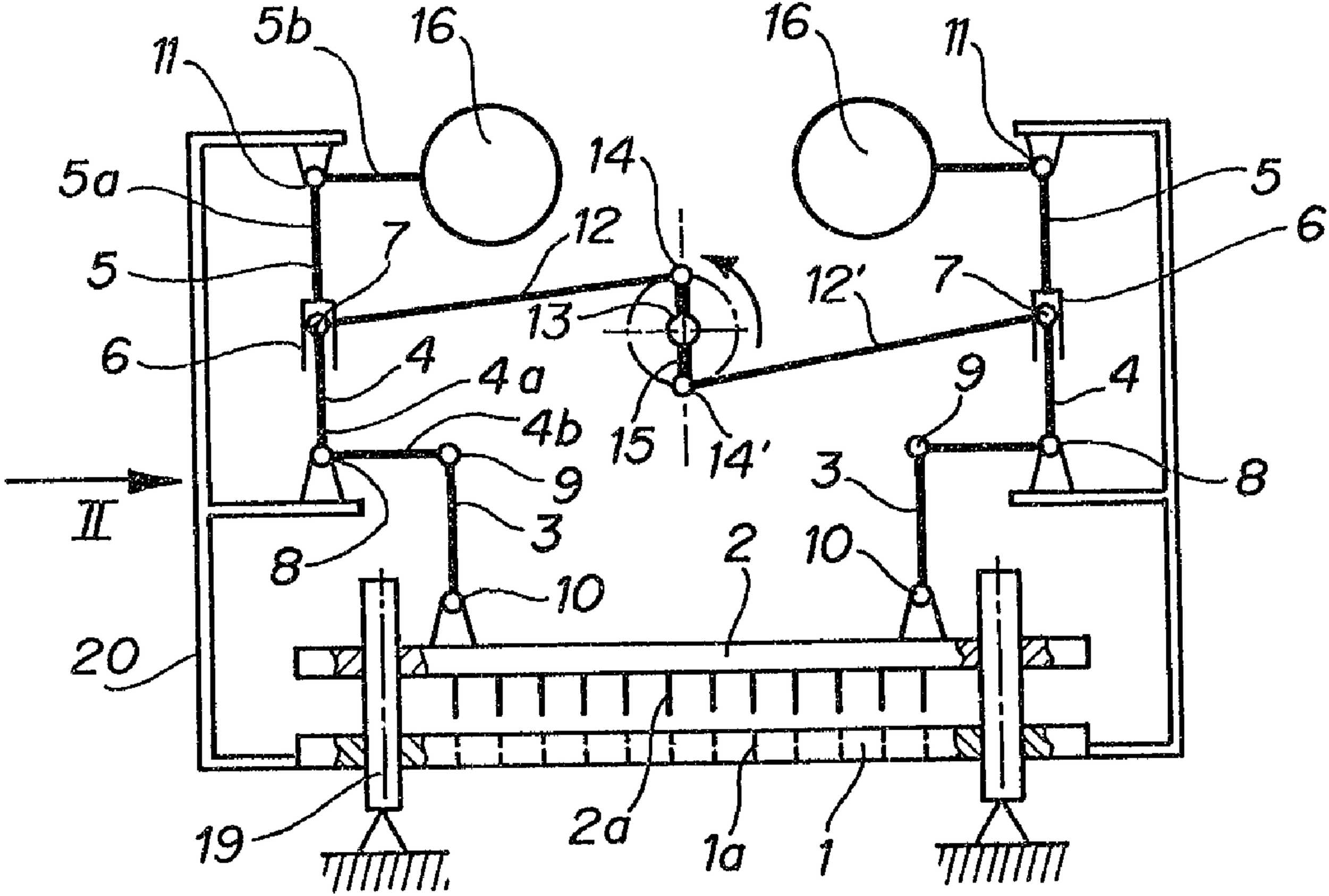
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