

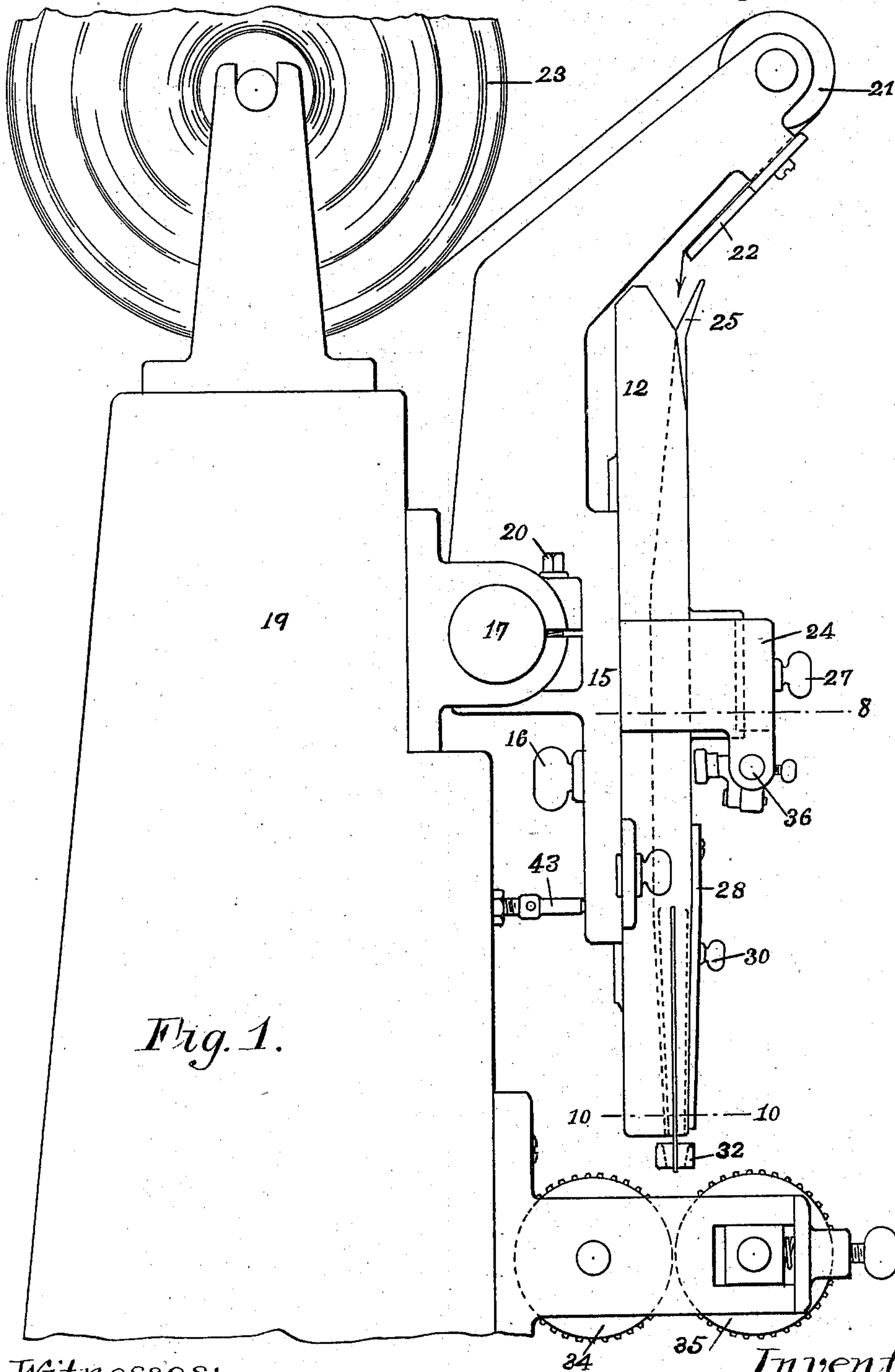
(No Model.)

3 Sheets—Sheet 1.

W. A. LORENZ.  
PLAITING MACHINE.

No. 559,139.

Patented Apr. 28, 1896.



*Fig. 1.*

Witnesses:

*A. Mutter*

*Jamie Bellis*

Inventor:

*William A. Lorenz*

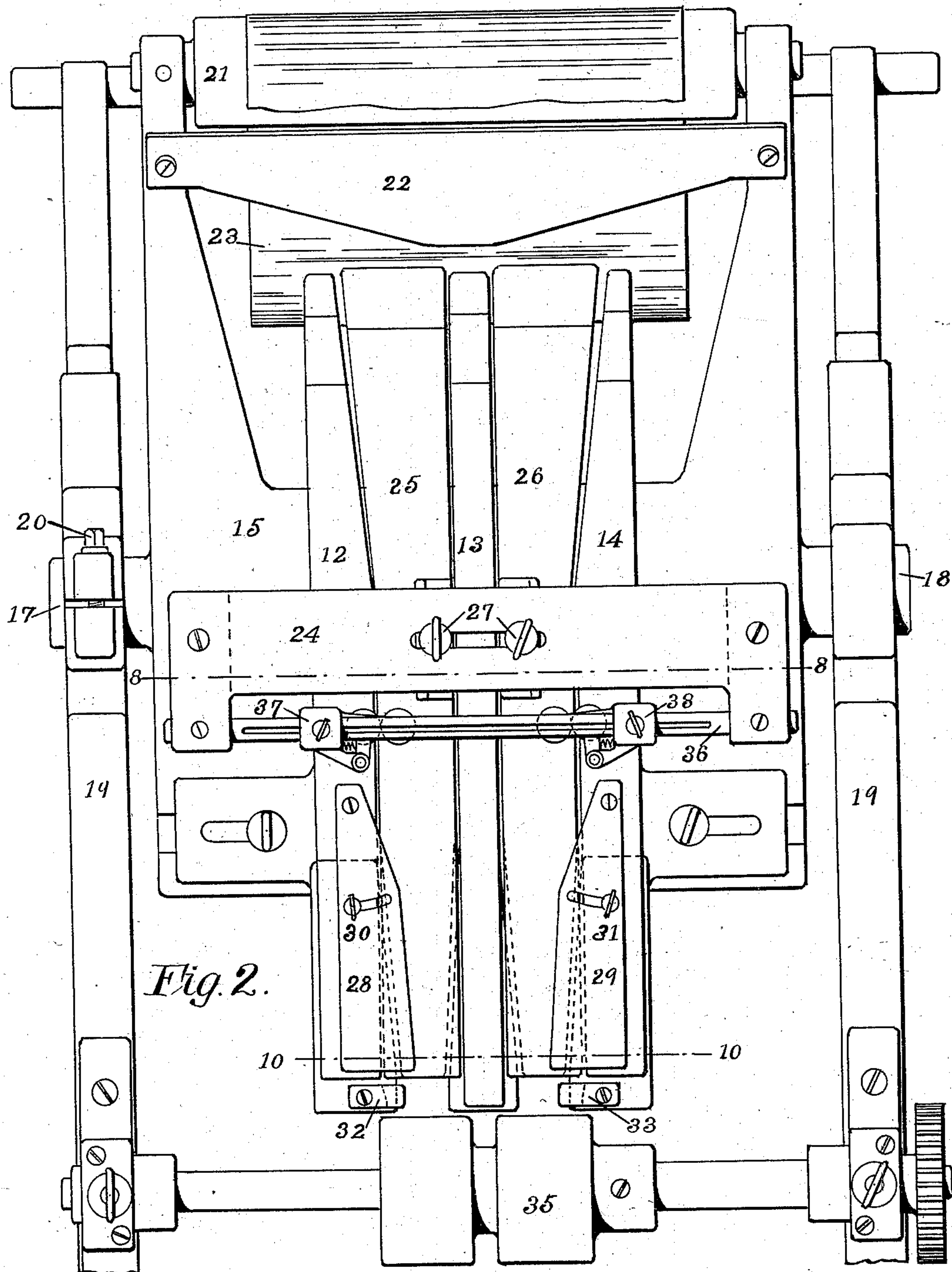
*By his Attorney,*

*W. H. Honiss.*

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*Fig. 2.*

Witnesses:

*A. Mutter.*  
*Jennieellis.*

Inventor:

*William A. Lorenz;*  
*By his Attorney,*  
*W. H. Honiss.*

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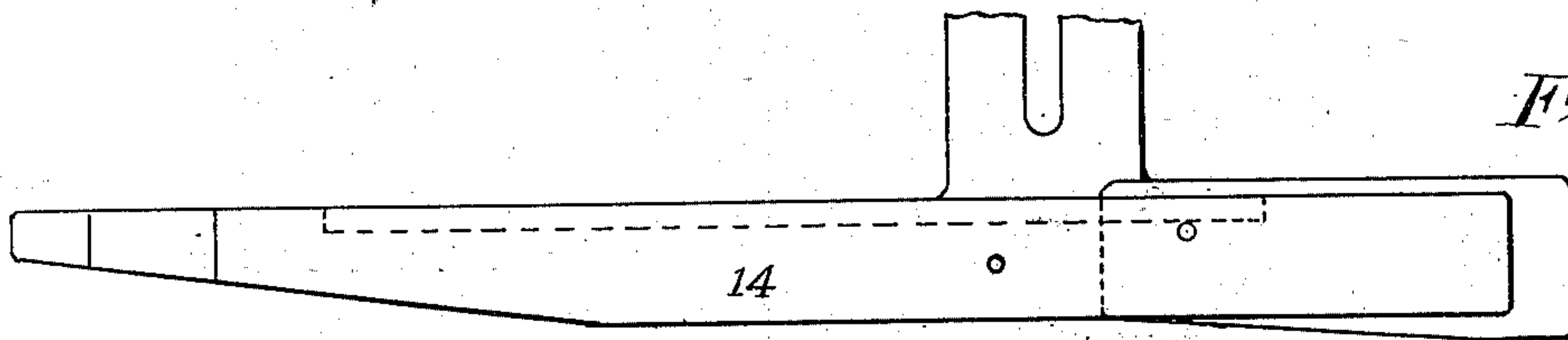


Fig. 3.

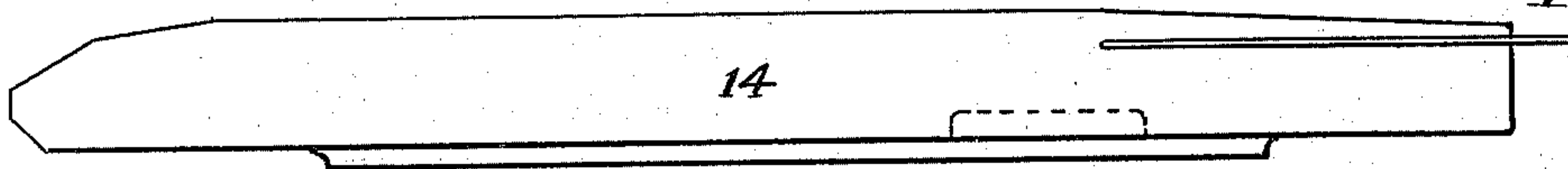


Fig. 4.

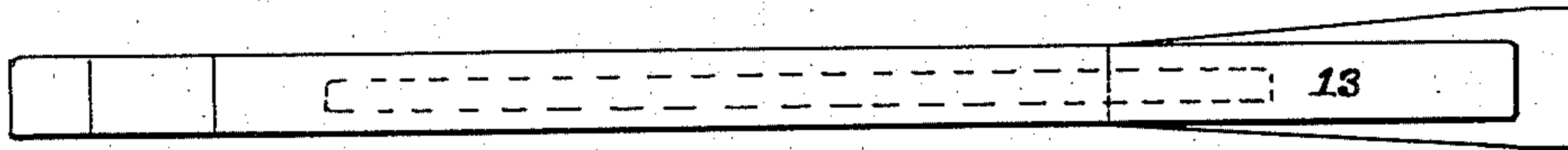


Fig. 5.

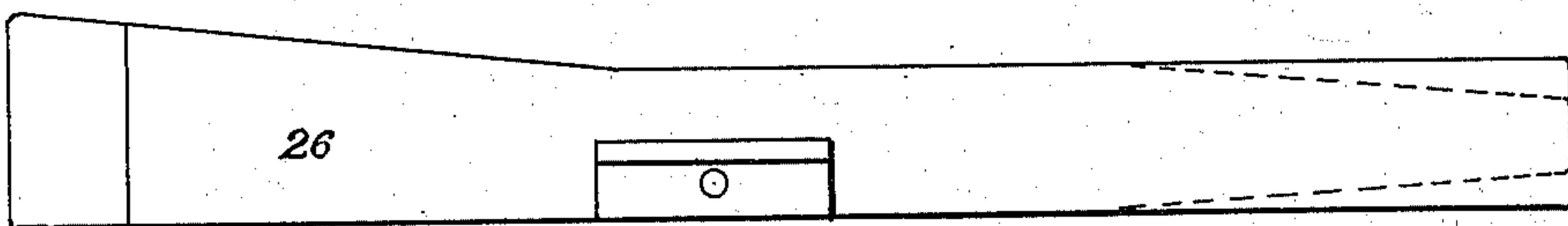


Fig. 6.

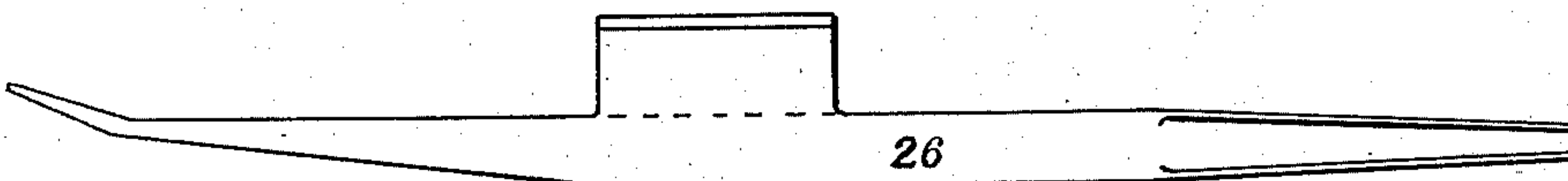


Fig. 7.

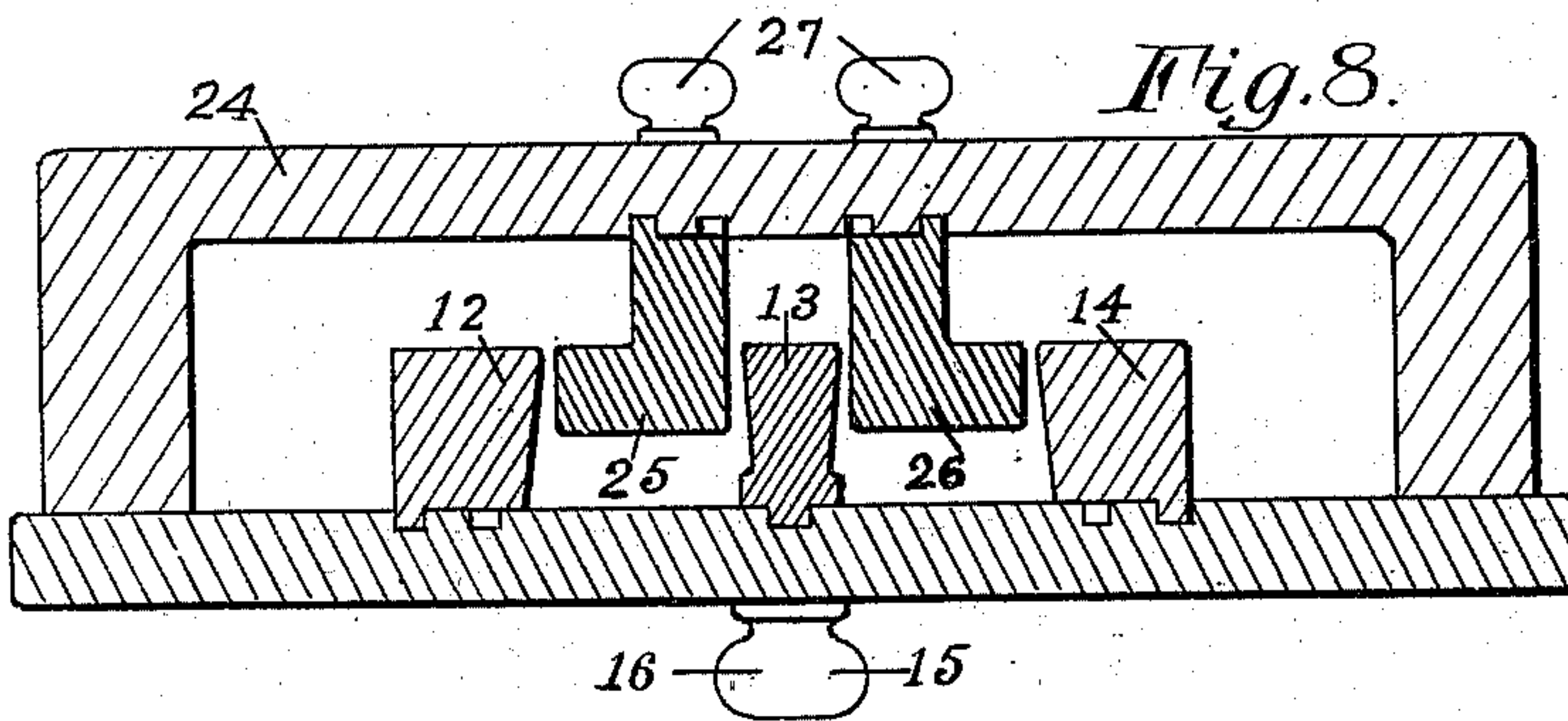


Fig. 8.

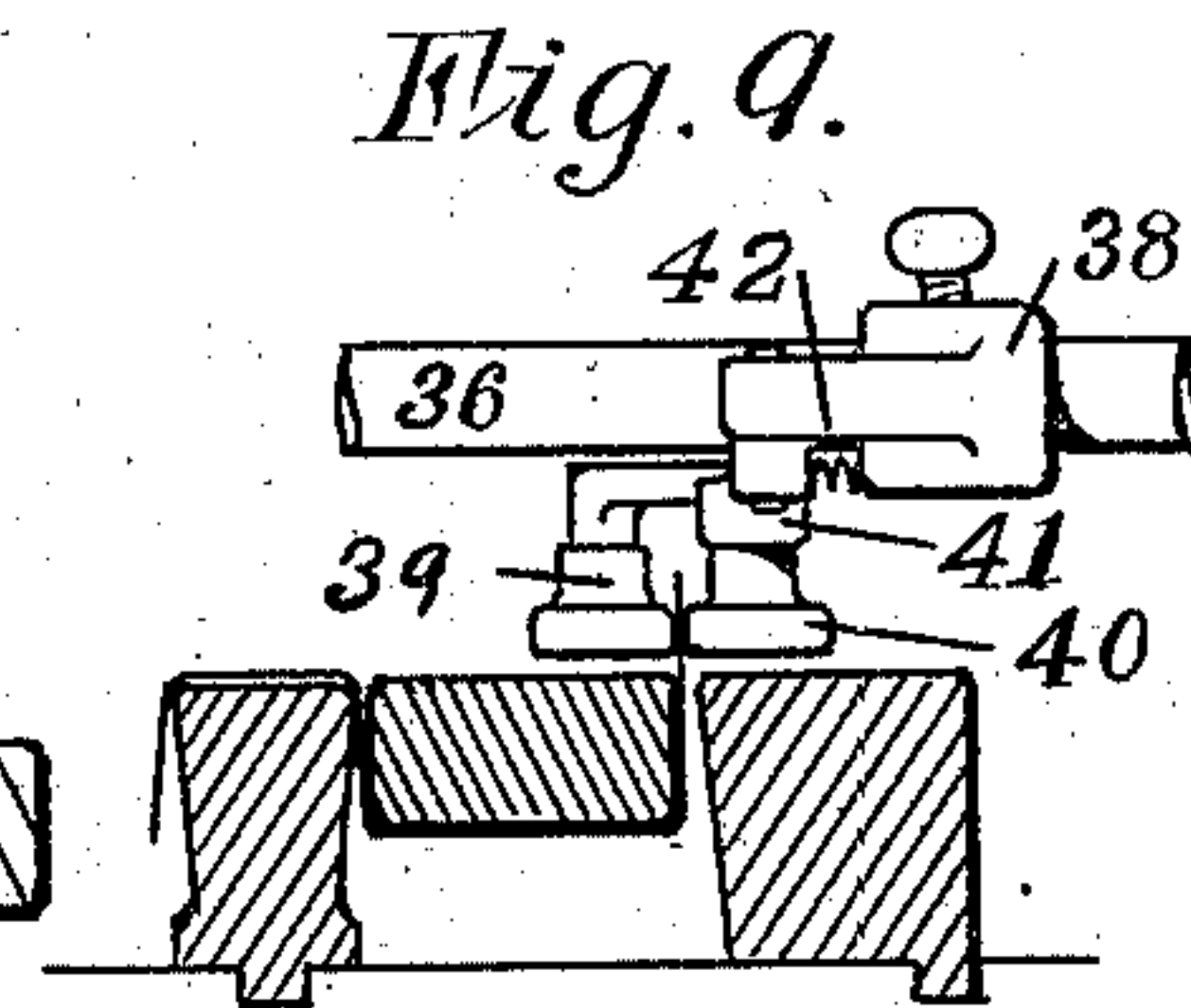


Fig. 9.

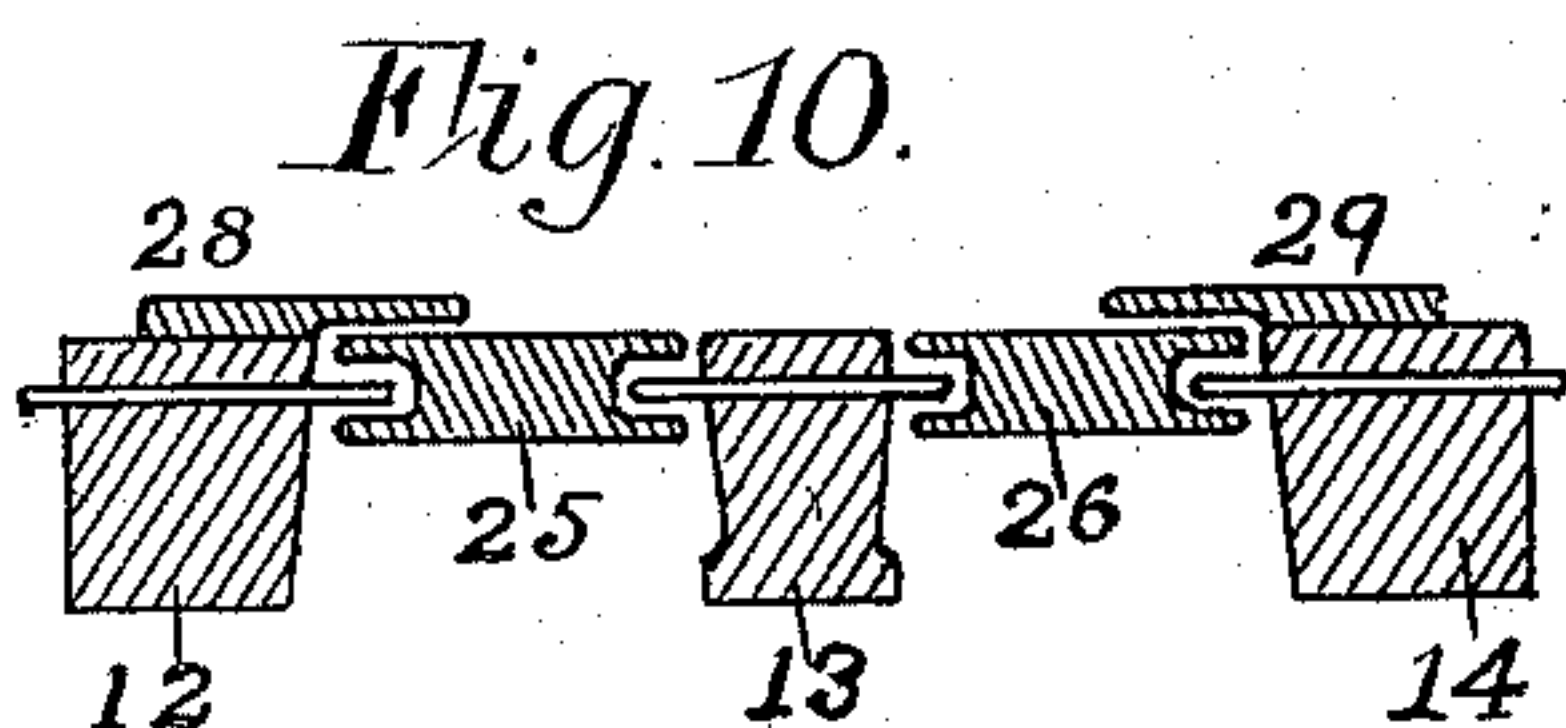


Fig. 10.



Fig. 11.



Fig. 12.

Witnesses:

*A. Mutter.*  
*Jennie Hall.*

Inventor:

*William A. Lorenz;*  
*By his Attorney,*  
*W. H. Honiss.*



# UNITED STATES PATENT OFFICE.

WILLIAM A. LORENZ, OF HARTFORD, CONNECTICUT, ASSIGNOR OF ONE-HALF TO WILLIAM H. HONISS, OF SAME PLACE.

## PLAITING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 559,139, dated April 28, 1896.

Application filed May 31, 1895. Serial No. 551,118. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM A. LORENZ, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Plaiting-Machines, of which the following is a full, clear, and exact specification.

This invention relates to new and improved means for forming longitudinal plaits or tucks in sheets or webs of paper or other pliable material at a high rate of speed. It is capable of adaptation to many different industries; but it is herein shown and described as particularly adapted to make the "tubes"—viz., the inner fluted or plaited portions—of the compartment paper bags shown and described in my Letters Patent No. 471,257, of March 22, 1892.

This invention may, however, be equally well adapted to the plaiting of many other forms of folds; and it consists, essentially, in a particular construction and arrangement of formers, around and between which the paper or other material to be plaited is drawn longitudinally by means of drawing-rolls or by other effective means.

It consists also in improved means for supporting and adjusting the formers and in improved means of guiding the fabric to and from those formers.

Figure 1 of the drawings represents a side view of a portion of a machine embodying my present invention. Fig. 2 is a view looking from the right-hand side of Fig. 1. Figs. 3 to 7, inclusive, are views showing details of construction of my improved formers. Fig. 8 is a sectional end view, on the line 8 8 of Figs. 1 and 2, looking upward. Fig. 9 is an end view, partly in section, of three of the formers, showing in connection therewith the tension-rolls for engaging the paper. Fig. 10 is a cross-sectional end view taken on the line 10 10 of Figs. 1 and 2. Fig. 11 is an end view representing the paper tube in the form to which it is folded when it reaches that part of the formers at which the section shown in Fig. 10 is taken. Fig. 12 is a similar view of the tube when it is completely folded and drawn from the formers.

The formers 12, 13, and 14 are located upon

the plate 15 by means of tongues which enter corresponding grooves in the plate and are fastened thereto by means of screws 16. The plate 15 is provided with trunnions 17 and 18, which rest in suitable bearings upon the main frame 19 and may be clamped in any desired position by means of screws, as 20. (Best shown in Fig. 1.)

The upper end of the plate 15 is bifurcated and is provided with the idler-roll 21 and apron 22, over which the paper to be folded is drawn from the roll 23, which may be mounted on suitable bearings upon the frame 19 or in any other convenient way. Upon the sides of the plate are fastened the ends of the bridge 24, which is arched over the formers 12, 13, and 14 and serves to support the formers 25 and 26. These formers are suitably located upon the bridge by means of tongues and corresponding grooves and are fastened by means of the screws 27. The relative location of the several formers and the means by which they are located and secured are all best shown in Fig. 8. In the adaptation herein shown the formers 25 and 26 are grooved at their lower ends, and the formers 12, 13, and 14 are provided with tongues which enter the grooves in the formers 25 and 26. This arrangement is best shown in Fig. 10.

The guide-plates 28 and 29 are pivoted upon the outer formers 12 and 14, respectively, and are adjustably clamped in suitable relation thereto by means of the screws 30 and 31, respectively.

A pair of drawing-rolls 34 and 35 are journaled in suitable frames below the formers and are provided with the usual springs and tension-screws.

To the bridge 24 are secured the ends of the rod 36, upon which are mounted the slides 37 and 38, each of which carries a pair of tension-rolls adapted to engage with the opposite edges of the sheet or web and serve to draw it tightly against the formers. The construction and arrangement of one of these slides are best shown in Fig. 9. The roll 39 is mounted to turn loosely upon a stud fixed in the slide 38, while the roll 40 is mounted loosely upon a stud fixed in the arm 41, which is pivoted upon the slide 38. A spring 42 be-



tween the slide 38 and the arm 41 serves to keep the roll 40 pressed against the roll 39 with a suitable tension. The function of the rolls is to engage between them the edges of the sheet or web of paper and to hold that web tightly drawn into contact with the formers in order that the paper shall be made to fold sharply around the edges thereof. The axes of the rolls are preferably so arranged that the plane in which they revolve is somewhat inclined to the general direction of the formers, as shown in Fig. 1. They thus operate to draw the edges of the paper away from the formers as it passes along between the rolls. The slides which carry the rolls are secured to the rod 36 by means of screws which enter a longitudinal groove in the rod, and the angle of inclination of the rolls above referred to may be varied by turning that rod in its seats in the bridge 24. Some of these formers which are used by me in plaiting the inner tube shown in Fig. 3 of the above-mentioned patent, No. 471,257, are herein separately shown in Figs. 3 to 7, inclusive. The former 14, of which a plan and a side view are shown in Figs. 3 and 4, respectively, is a mated counterpart of the former 12, which, therefore, need not be separately shown. A plan view of the former 13 is shown in Fig. 5. The former 26 (shown in plan and side views in Figs. 6 and 7, respectively) is a mated counterpart of the former 25, and those formers are provided at their right-hand ends, as is seen in Figs. 6 and 7, with inclined recesses, into which the reëntrant folds of the material are pushed by the fins. (Shown on the corresponding ends of the formers 12, 13, and 14.)

Suitable space is left between these formers for the free passage of the material, as shown in Figs. 8 and 10.

Many different forms may be folded upon the same machine by providing suitable sets of formers adapted in cross-section to the number, width, depth, and other particular characteristics of the desired plications. These formers should be attached to the former-plate or to the bridge according as the respective folds to be made by them may be entrant from one side or the other of the web. These sets of formers may all be located in their suitable relative positions by means of dowels or by tongues and grooves, as herein shown, to enable them to be quickly removed from the machine and as quickly replaced with extreme accuracy.

By providing the former-plate 15 with trunnions, as shown, I am enabled to adjust the entire set of formers into proper relation to the drawing-rolls without disturbing the relative position of those formers to each other, and by carrying the idler-roll 21 and the apron 22, also mounted upon this swinging former-plate, they are at all times maintained in operative relation to each other and to the formers. An adjusting-screw 43 is employed to facilitate the exact adjustment of the former-

plate, as shown in Fig. 1. The preponderance of weight of the former-plate being on the right-hand side of the center of the trunnions serves to keep the former against the end of the screw 43. Thus sustained the former-plate, with its idler-roll, apron, bridge, tension-rolls, and formers, may be turned pivotally upon its trunnions or slid upon them laterally to any desired extent without getting the formers out of their necessarily exact parallel relation to the web of paper and to the plane of the drawing-rolls.

The guide-plates 28 and 29 serve to turn the outer edges of the web of paper down upon the formers after those edges pass out of engagement with the tension-rolls 39 and 40, and those plates are pivoted, as shown, in order that they may be swung out of the way to enable the front end of the paper to be carried through in the operation of "threading" the former.

The gaging-blocks 32 and 33 are employed to engage with the folded edges of the completed tube as it is passing from the formers to the drawing-rolls and serve to keep those edges uniform in width and free from the distortion due to a slight tendency of the plaited fabric to open and widen laterally after leaving the formers. These blocks exert a very considerable influence upon the width of the plaited fabric independently of the effect of the formers, and that width may be regulated to a considerable degree and with great precision by suitable adjustment of the gaging-blocks. This feature is one of great utility and convenience, inasmuch as the operator is thereby enabled to vary the width of the production to a considerable extent without adjusting the formers themselves, and therefore without the attendant liability of disturbing their necessarily exact interrelation.

When this device is employed in connection with another machine, the drawing-rolls may be driven at a suitable relative speed therewith by means of proper connecting-gearing. Suitable knives may be adapted to sever the plaited tube in any desired lengths in accordance with any of the several well-known methods, or the tube, uncut, may be wound upon a drum in passing upon the drawing-rolls, to be subsequently manipulated in any desired manner.

It will be observed that the only power-driven elements of this machine are those of the rolls employed for drawing the material along the formers, and that these rolls may be and are preferably driven by continuously-rotary motion, which permits of attaining a high rate of speed as compared with those machines for this purpose which make the folds by means of reciprocating motions.

By the present organization and arrangement of the different elements of this invention I am enabled to produce at a high rate of speed tubing of any desired length and having all of its folds or plaits exact as to



width with perfect uniformity throughout, so that when one portion is compared with another the most exact and critical eye cannot discern the slightest variation. This extreme accuracy results from the adaptation of the formers to their work, particularly in respect of that feature by the operation of which all of the external corners of the folds are first defined upon the rectangular portions of the formers, as shown in Figs. 8 and 9, and are thereafter maintained in their perfect integrity while the reëntrant folds are formed in the material between those external corners by the gradual interlapping of the formers toward their lower ends, as shown in Fig. 10. In this connection the function of the two pairs of tension-rolls 39 and 40 is a very important one, serving to hold the opposite edges of the material apart in order that it may be drawn with a suitable and uniform tension against the formers.

I claim as my invention—

1. The combination of two sets of formers arranged side by side, their leading portions being rectangular in cross-section, and adapted to first form the material into a connected series of corresponding rectangular flutes, opening alternately in opposite directions, the adjacent walls of the formers merging thence into grooves and corresponding tongues adapted to form reëntrant plies in the corresponding walls of the series of flutes, the upper and lower walls of the formers converging toward their latter ends to allow of the formation of the reëntrant sides of the series of flutes and to permit the simultaneous collapsing of that entire series, substantially as described.

2. The combination of two sets of formers arranged side by side, their leading portions being rectangular in cross-section, and adapted to first form the material into a connected series of corresponding rectangular flutes, opening alternately in opposite directions, the adjacent walls of the formers merging thence into grooves and corresponding tongues adapted to form reëntrant plies in the corresponding walls of the series of flutes, the upper and lower walls of the formers converging toward their latter ends to allow of the formation of the reëntrant sides of the series of flutes and to permit the simultaneous collapsing of that entire series, with an apron 22 adapted to guide the material to and between the two sets of formers, substantially as described.

3. The combination of two sets of formers arranged side by side, their leading portions being rectangular in cross-section, and adapted to first form the material into a connected series of corresponding rectangular flutes, opening alternately in opposite directions, the adjacent walls of the formers merging thence into grooves and corresponding tongues adapted to form reëntrant plies in the corresponding walls of the series of flutes, the upper and lower walls of the formers conver-

ging toward their latter ends to allow of the formation of the reëntrant sides of the series of flutes and to permit the simultaneous collapsing of that entire series, with means for drawing the material longitudinally of the formers and for flattening down the series of flutes, substantially as described.

4. In a plaiting-machine, the combination of a series of formers arranged side by side, having their leading ends adapted to form the external angles of each of a series of flutes, provided with grooves and corresponding tongues adapted to form reëntrant folds between those external angles, and a plate adapted to support the formers in their relative positions, the plate being supported on bearings which permit of lateral sliding and oscillatory adjustment thereon, while maintaining the parallel relation of the formers to the direction of travel of the material, substantially as described.

5. In a plaiting-machine, the combination of a series of formers arranged side by side, having their leading ends adapted to first form the external angles of each of a series of flutes, provided with grooves and corresponding tongues adapted to form reëntrant folds between those external angles, and a plate adapted to support the formers in their relative positions, having a guiding-roll journaled thereon in suitable relation to the formers, the plate being supported on bearings which permit of lateral sliding and oscillatory adjustment thereon, while maintaining the relation of the formers to the guiding-rolls, substantially as described.

6. In a plaiting-machine, the combination of a series of formers arranged side by side, having their leading ends adapted to first form the external angles of each of a series of flutes, provided with grooves and corresponding tongues adapted to form reëntrant folds between those external angles, a plate adapted to support the formers in their relative positions, and a guiding-roll and apron carried thereon adapted to guide the web into suitable relation to the formers, the plate being supported on bearings which permit of lateral sliding and oscillatory movement thereon, whereby, while maintaining the operative relation of the formers to the guiding-roll and apron they may be adjusted in proper lateral relation to the rest of the machine.

7. In a plaiting-machine, in combination with a series of formers adapted to form longitudinal plications in a web of material, a former-plate adapted to support the formers for those plications which are entrant from one side of the web, and a bridge supported by the plate and adapted to sustain the formers for those plications which are entrant from the opposite side of the web and an apron adapted to guide the material to and between the two sets of formers.

8. In a plaiting-machine, in combination with a series of formers adapted to form longitudinal plications in a web of material, a



former-plate adapted to support the formers  
for those plications which are entrant from  
one side of the web, a bridge supported by  
the plate and adapted to sustain the formers  
5 for those plications which are entrant from  
the opposite side of the web, an apron 22  
adapted to guide the web to the formers and  
means substantially as described for drawing  
the web longitudinally between the formers.  
10 9. In a plaiting-machine, in combination  
with a series of formers adapted to form lon-  
gitudinal plications in a web of material, a  
former-plate adapted to support the formers  
for those plications which are entrant from  
15 one side of the web, a bridge supported by  
the plate and adapted to sustain the formers  
for those plications which are entrant from  
the opposite side of the web, and means sub-  
stantially as described for drawing the web  
20 longitudinally along the formers, the plate

being supported on bearings which permit of  
lateral sliding and oscillatory adjustment  
thereon of the plate and its appurtenances  
while maintaining their parallel relation to a  
constant plane, substantially as described. 25

10. In a plaiting-machine, the combination  
of a series of formers arranged side by side,  
having their leading ends adapted to first  
form the external angles of each fold in the  
series, provided with grooves and correspond- 30  
ing tongues adapted to form reëntrant folds  
between those external angles, with adjust-  
able gaging-blocks arranged and adapted to  
engage with the edges of the plicated tube  
after it leaves the formers, substantially as 35  
described.

WILLIAM A. LORENZ.

Witnesses:

THOMAS DURANT,  
ALEX. S. STEUART.