

980,399.

L. BAUROTH.  
BARREL MAKING MACHINE.  
APPLICATION FILED DEC. 10, 1908.

Patented Jan. 3, 1911.

6 SHEETS—SHEET 1.

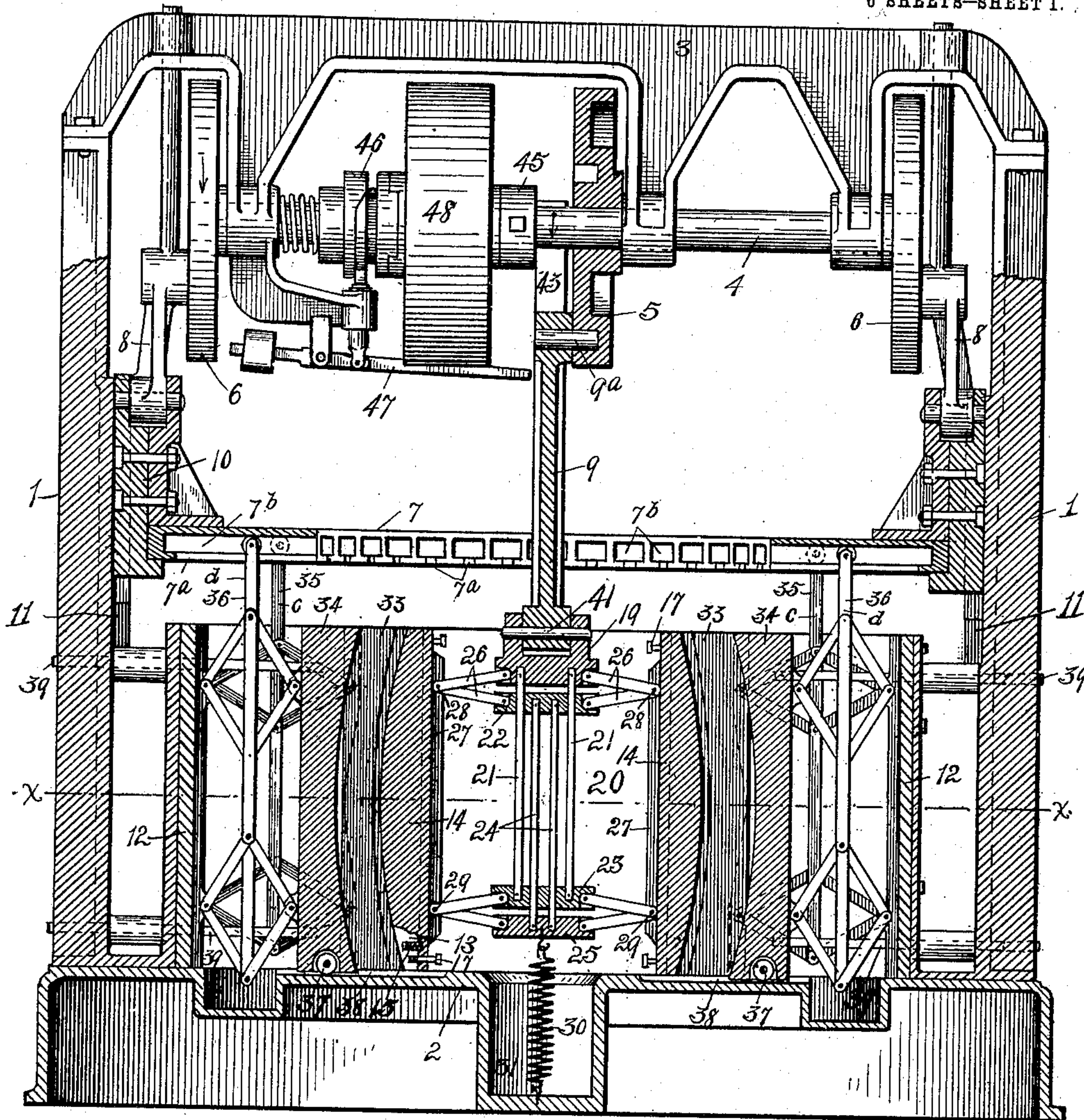


Fig. 1.

WITNESSES:

*D. C. Walter*  
*Hazel B. Hitt*

INVENTOR.

*Leonhard Bauroth,*  
*By Owen & Owen,*  
*His attys.*

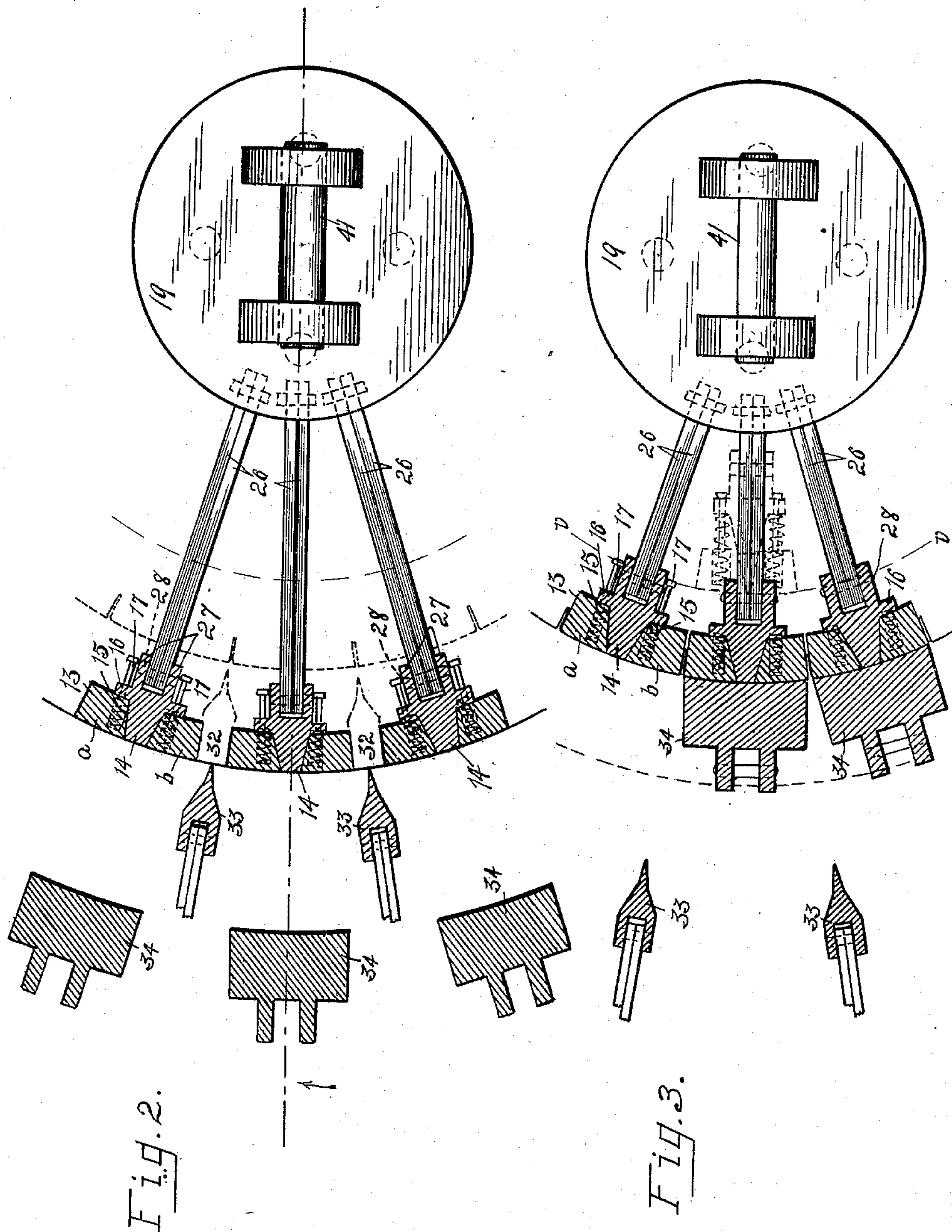


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WITNESSES:

*D. C. Walter*  
*Hazel B. Hiett*

INVENTOR.

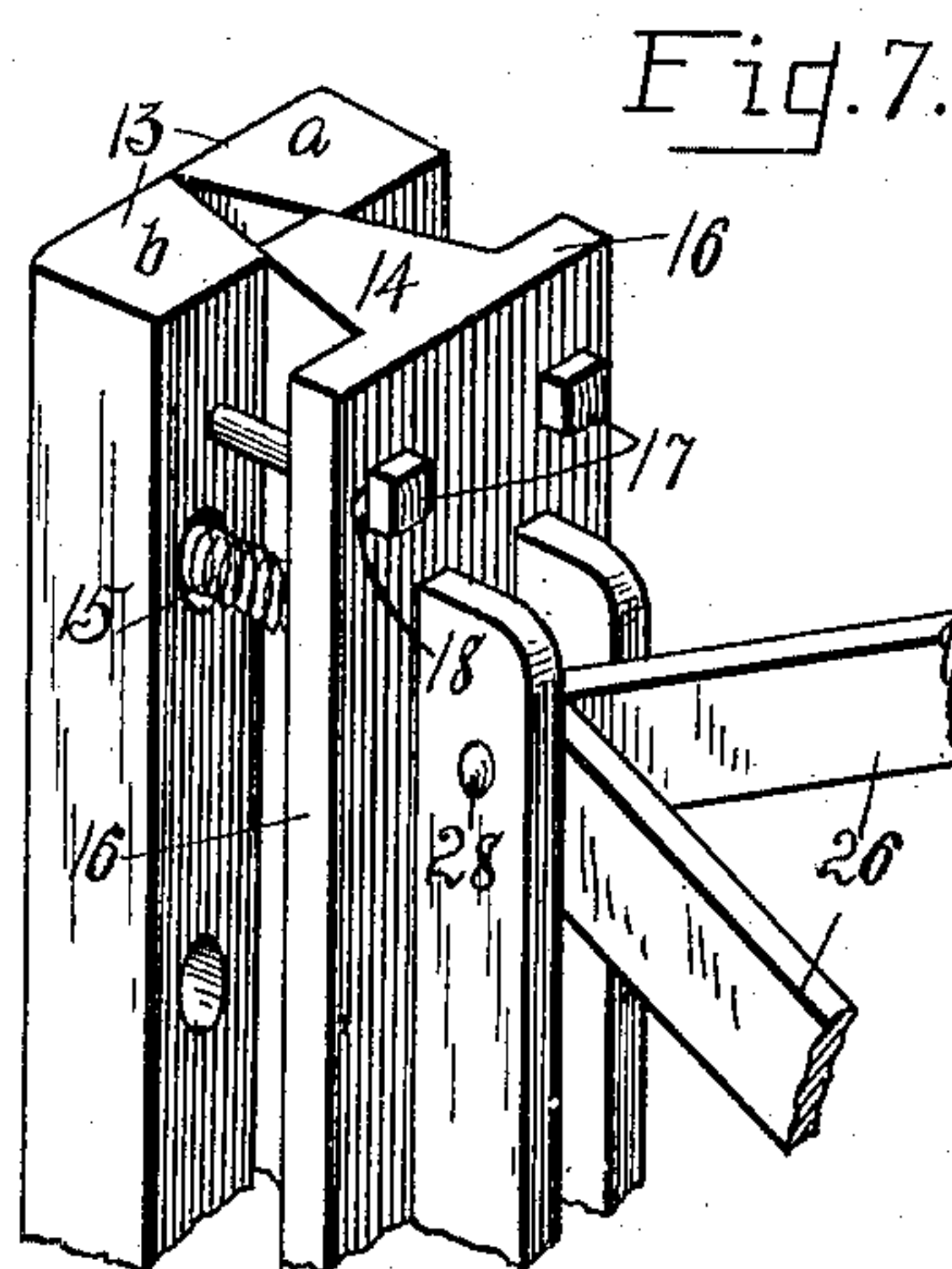
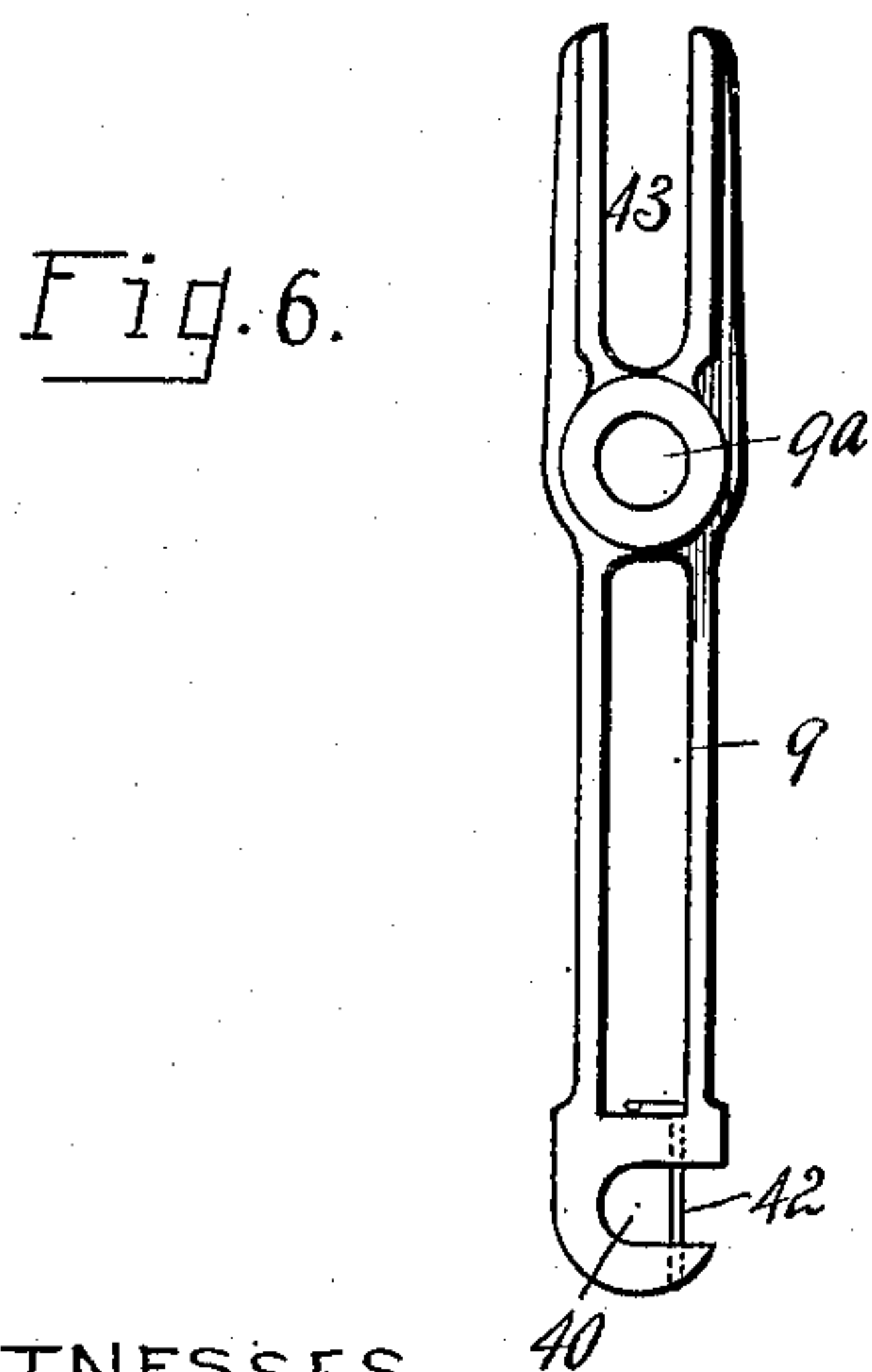
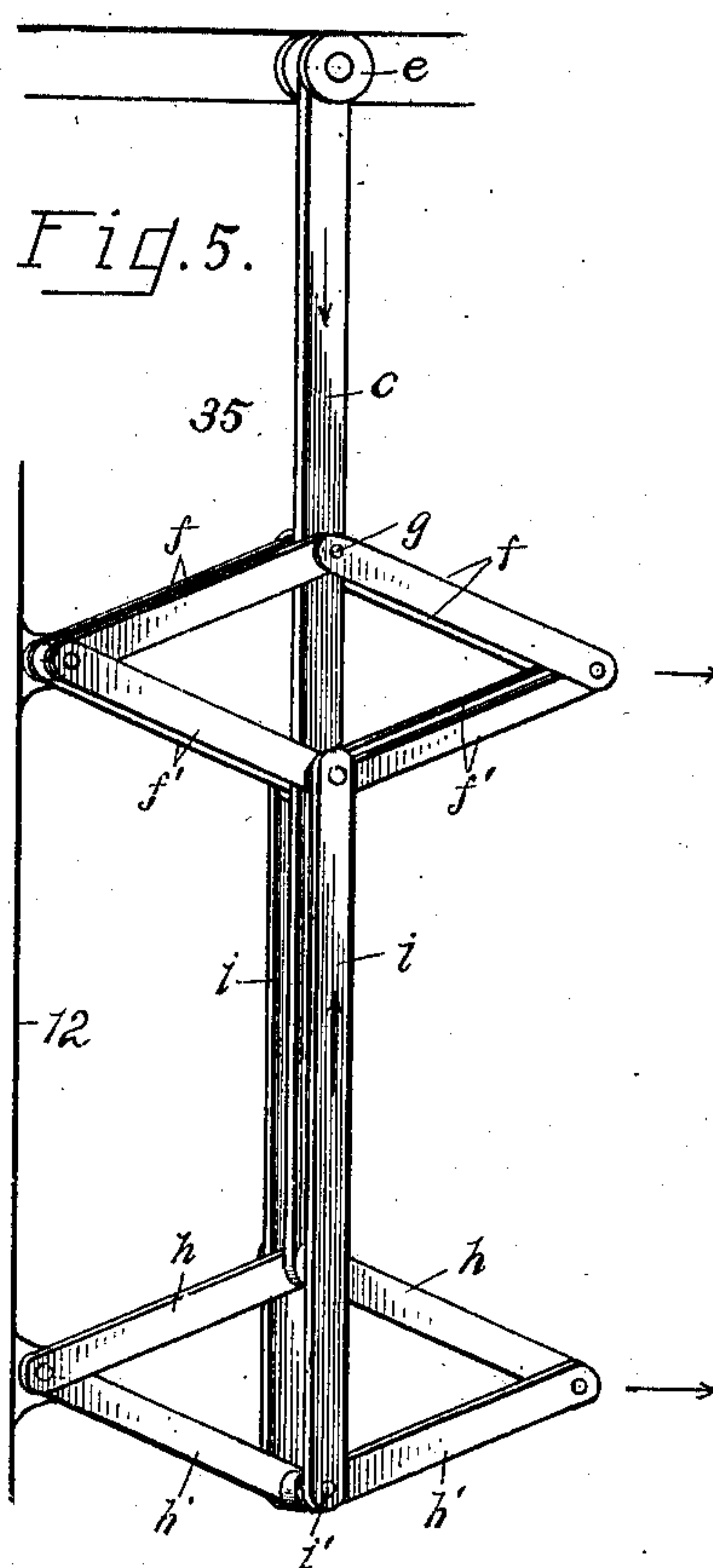
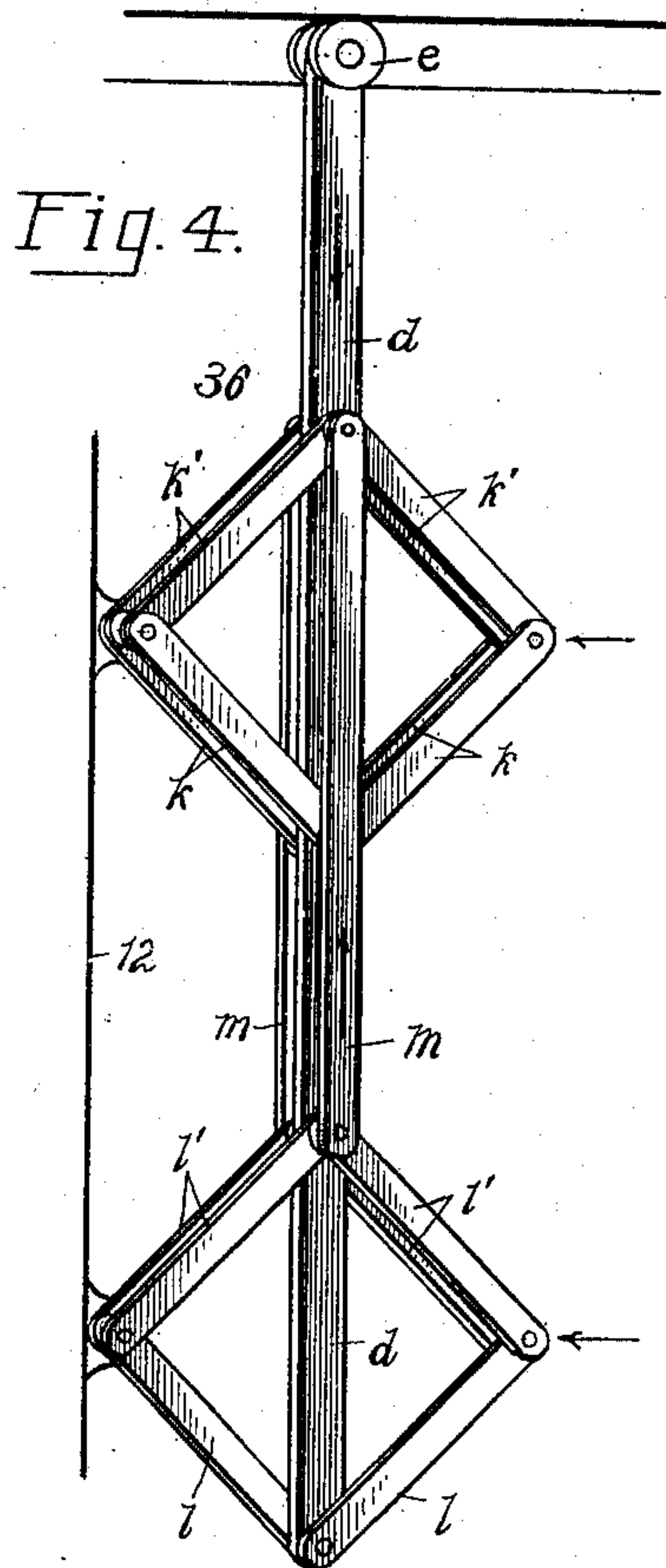
*Leonhard Bauroth,*  
*By Owen & Owen,*  
*His attys.*

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WITNESSES.

D. C. Walter  
Hazel B. Kett

INVENTOR.

Leonhard Bauroth,  
By Owen & Owen,  
His attys.



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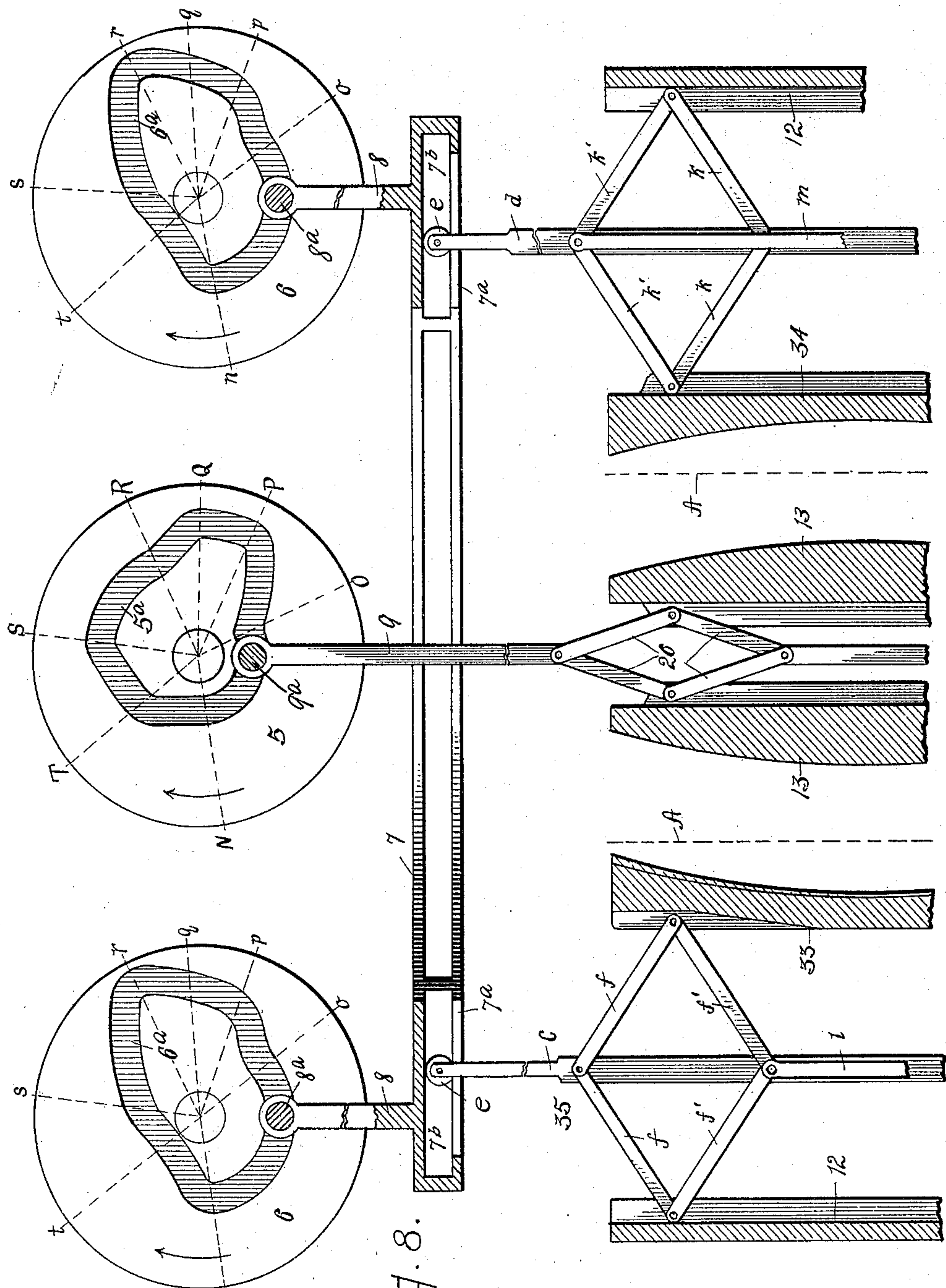


Fig. 8.

WITNESSES:

D. C. Walter  
Hazel B. Hitt

INVENTOR.

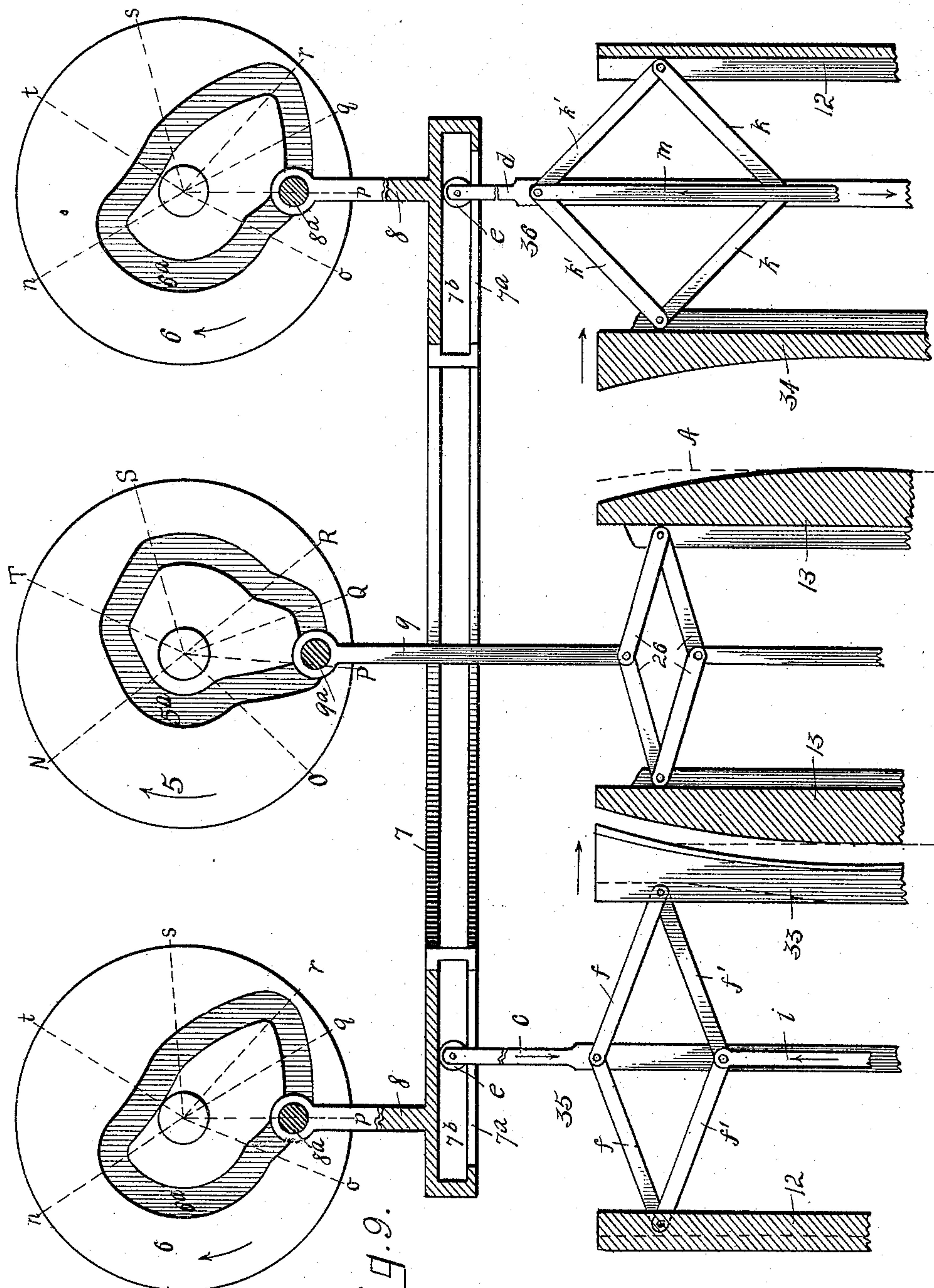
Leonhard Bauroth,  
By Owen T. Owen  
His atty

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6 SHEETS—SHEET 5.

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WITNESSES:

D. C. Walter  
Hazel B. Klett

INVENTOR.

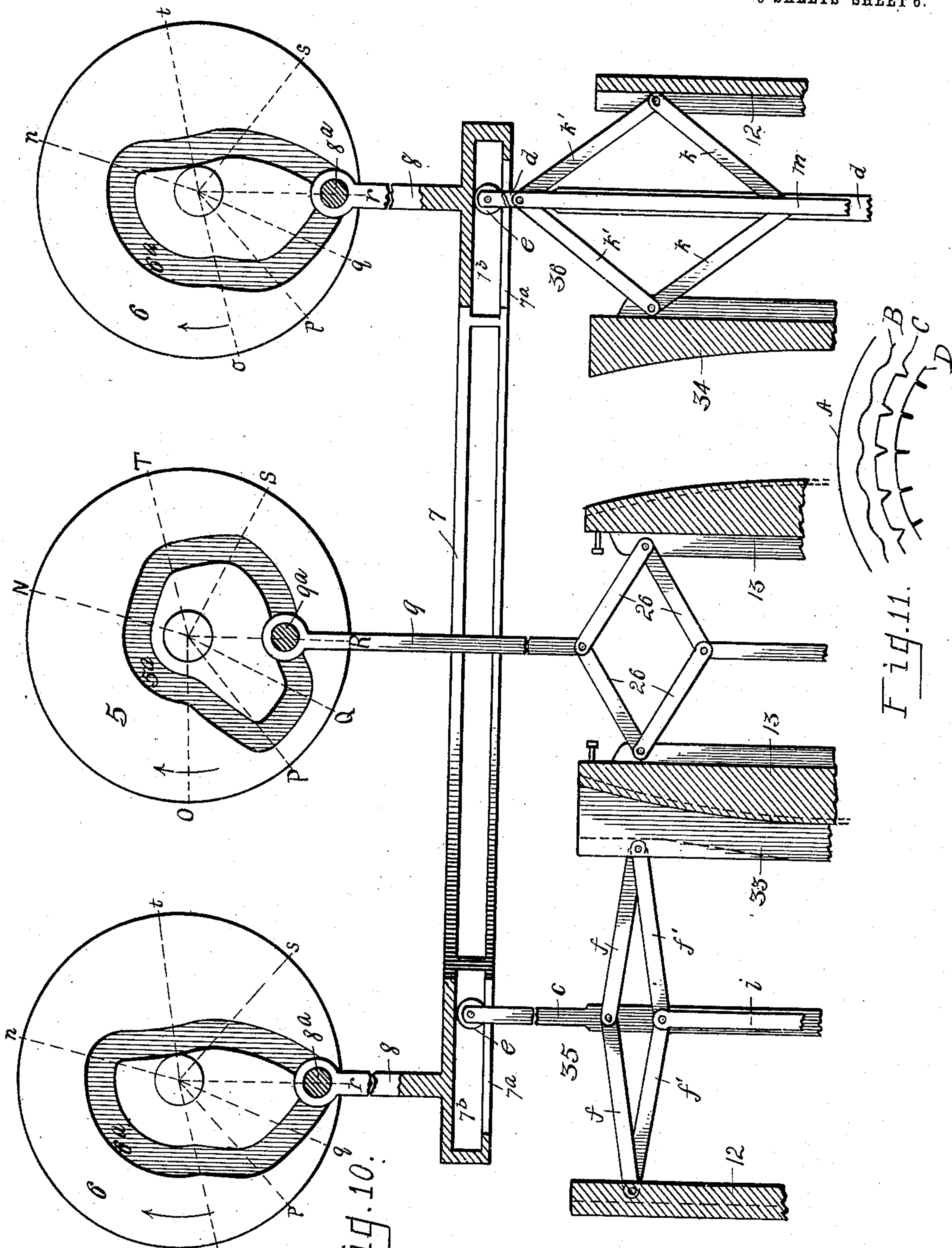
Leonhard Banath.  
By Owen & Owen,  
His attys



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L. BAUROTH.  
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Patented Jan. 3, 1911.  
6 SHEETS—SHEET 6.



WITNESSES:  
D. C. Walter  
Hazel B. Hiett

INVENTOR.  
Leonhard Bauroth,  
By Owen & Owen,  
His attys.



# UNITED STATES PATENT OFFICE.

LEONHARD BAUROTH, OF TOLEDO, OHIO, ASSIGNOR TO THE METALLIC BARREL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF MAINE.

## BARREL-MAKING MACHINE.

980,399.

Specification of Letters Patent.

Patented Jan. 3, 1911.

Application filed December 10, 1908. Serial No. 466,771.

*To all whom it may concern:*

Be it known that I, LEONHARD BAUROTH, a citizen of the United States, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Barrel-Making Machine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures and letters of reference marked thereon, which form a part of this specification.

My invention relates to the manufacture of sheet-metal barrels of the class having spaced crimps or ribs formed longitudinally therein to strengthen them against external compressing stresses, and particularly to the manufacture of barrels of this class which are shaped in bilge form by the crimping operation, but is not restricted to such use.

The object of my invention is to increase the output per operating unit, simplify the manufacture, and reduce the cost of production of barrels of this character to a minimum by the provision of a machine which, at a single action, is adapted to shape and longitudinally crimp a plain sheet-metal blank to form a barrel body, or from which a barrel body may be formed, and to impart bilge formation thereto if it is desired to give such shape to the body.

The invention is fully described in the following specification, and while in its broader aspect it may be embodied in different forms of machines adapted for operating on blanks of cylindrical or other shapes and either include the bilging feature or not, as desired, a preferred form, which is adapted for operating on cylindrical blanks and embodies such bilging feature, is shown in the accompanying drawing, in which,—

Figure 1 is an elevation of a machine embodying the invention with a portion in central vertical section. Fig. 2 is a diagrammatical view with the work-coacting parts in section on the line  $x-x$  in Fig. 1, showing the relative positions of such parts when the punches are beginning to act on the blank and showing in dotted lines the inner dies partially collapsed and the posi-

tions of the punches at the beginning of their receding movements. Fig. 3 is a similar view thereof showing the relative positions of the parts when the pressure-pads have moved to engage the work. Fig. 4 is a perspective view of the connecting mechanism between each pressure-pad and the plunger. Fig. 5 is a similar view of the connecting mechanism between each punch and the plunger. Fig. 6 is a side elevation of the pitman, which operates the inner dies. Fig. 7 is a perspective view of a portion of an inner die and associated parts in completely collapsed state. Fig. 8 is a diagrammatical view of the operating cams, plunger and work coacting parts in neutral or at-rest position, a punch being shown at one side and a pressure-pad at the other side. Fig. 9 is a similar view showing the relative positions of the parts when the punches have begun to act on the work. Fig. 10 is a similar view showing the relative positions of the parts when the punches are at the limit of their crimp-forming stroke, and Fig. 11 illustrates a portion of a blank and the three successive stages of the crimp forming process.

Referring to the drawings, 1 designates the machine or press frame having the base or bed 2 and the top cross-piece 3, in pendent bearing-arms of which cross-piece the shaft 4 is journaled. This shaft at its center carries a cam-grooved disk 5 for controlling the movements of the inner die parts, as herein-after described, and at its opposite ends carries the like cam-grooved disks 6, 6, which connect with and control the movements of the plunger 7 through the medium of the arms or connecting members 8, 8. The arms 8, 8 are shown as having their upper ends projected through vertically registering guide openings in the cross-piece 3 and carry laterally-projecting studs 8<sup>a</sup>, (Figs. 8, 9 and 10) or other suitable means, intermediate their ends for working in the cam-grooves 6<sup>a</sup> of the disks 6. The plunger 7 is of ring-like construction, having its center open for the pitman or connecting-bar 9 of the inner die parts to work through, and is provided at its opposite sides with guide-parts 10 which work in vertical ways 11 in the frame sides.

Rigidly rising from the base 2 concentrically thereof is a wall 12 of substantially



cylindrical shape in cross-section, or preferably so, which opposes the outward thrust of the barrel forming parts as hereinafter described.

5 Mounted concentrically within the wall 12 are a plurality of vertically-disposed barrel-forming dies 13, which form a central die-body, and which, if it is desired to impart bilge formation to the work, may have their  
10 outer faces longitudinally curved for such purpose, as shown in Figs. 1, 8, 9 and 10. Each of these dies is longitudinally separated, preferably centrally thereof, into two parts, *a* and *b*, which have their inner or  
15 contiguous sides oppositely tapered to conform to the sides of and permit the insertion of a wedge-block 14 therebetween, see Figs. 2, 3 and 7. These blocks preferably extend the entire length of the dies and are nor-  
20 mally drawn within the spaces between the parts of the dies by the action thereon of contraction-springs 15, a plurality of which connect each die part with a laterally projecting flange 16 on the contiguous side of  
25 the wedge-block.

The wedge-blocks 14 are movable between the die parts *a b* to force the same apart and their outer edges or faces are flattened, as shown, to adapt them, when forced home be-  
30 tween the die parts *a b*, to stand flush with the outer faces of such dies and to cooperate with the dies and pressure pads as hereinafter described to hold the work. The outward movements of the wedge-blocks within  
35 the dies are limited by the flanges 16 engaging the inner edges of the die parts, while the inward movements of such blocks relative to the die parts are limited by headed pins 17, which project from the die-parts  
40 and work through transverse slots 18 (Fig. 7) in the flanges 16 of the associated block.

19 designates a head-block, which is attached to the lower end of the pitman 9 and suspended thereby within the upper end of  
45 the opening 20 formed by the dies 13 and associated parts. A set of rods 21 project downwardly from the block 19 loosely through a contiguous subjacent block or disk-like member 22, and attach at their lower ends  
50 to a block or disk-like member 23, which is disposed in the lower portion of the opening 20. The block 22 also has a set of rods 24 projecting downwardly therefrom, the lower ends of which pass loosely through the block  
55 23 and attach to a contiguous subjacent block or disk-like member 25. These several blocks are each connected by toggle-links 26 to each of the wedge-blocks 14, the links which connect the two blocks 19, 22 to the wedge-  
60 blocks being pivoted at their outer ends to flanges 27 on the inner sides of the wedge-blocks, as at 28, (Figs. 1 and 7), while the links which connect the two blocks 23, 25 to the wedge-blocks are pivoted at their outer  
65 ends to the flanges 27, as at 29. The lower

block 25 is connected by a contraction-spring 30 to the bottom of a pocket 31 provided centrally in the bed-plate 2.

Bearing in mind the arrangement and manner of connecting the several blocks 19, 70 22, 23 and 25, it will be evident that on an upward movement of the pitman 9 the wedge-blocks 14 and attached die parts will be drawn inwardly to contract the size of the opening 20, due to the rigidly connected 75 blocks 19 and 23 moving upwardly in unison with the pitman and the rigidly connected blocks 22 and 25 moving downwardly in unison under the influence of the spring 30 and the consequent expanding action of the 80 inner ends of the sets of links 26 as their outer ends approach the vertical planes of their inner ends. The several dies 13 when in a relatively expanded state or at their limits of outward movements are laterally 85 separated to form the crimp-forming spaces 32 therebetween, as shown in Fig. 2, which spaces close or contract on an inward movement of the die parts whereby to closely compress the walls of the interposed crimps 90 when the dies have reached a predetermined point in their inward movements, as shown in Fig. 3.

Arranged in alternating order around the dies 13 within the wall 12 are a plurality 95 of punches 33 and pressure-pads 34, the former of which radially aline with the spaces 32 between the dies 13 and are adapted to cooperate with such dies to initially crimp or corrugate a blank, while the latter 100 radially aline with the dies 13, as shown in Figs. 2 and 3. The pressure-pads 34 have their inner or work-coacting faces conforming to the shape of the outer faces of the dies 13, while the punches 33, if to be used in 105 conjunction with bilge forming dies, have their inner or work coacting edges struck from radii which are shorter than the radii from which the longitudinal arcs of the working faces of the dies 13 are struck, thus 110 causing the depths of the crimps to be gradually increased from their centers outwardly to effect a correspondingly increasing contraction of the diameter of the blank from the center to the ends thereof to impart the 115 desired bilge formation thereto.

The punches and pressure-pads 33, 34 have opposed radial reciprocatory movements imparted thereto relative to the inner set of dies 13 during the reciprocatory movements 120 of the plunger 7, due to the action thereon of the separate toggle-mechanisms 35 and 36, respectively. These mechanisms are provided with the main operating bars *c* and *d*, respectively, which have their upper ends 125 projected through registering radial slots 7<sup>a</sup> in the under side of the plunger 7 and into radial openings 7<sup>b</sup> therein and carry rollers *e* for working on the bottoms of such openings at the sides of the slots 7<sup>a</sup>, as 130



shown, thus adapting the several operating bars to have radial movements relative to the dies 13.

Referring now to the mechanism 35 (Fig. 5) it will be noted that the bar *c* has the inner ends of the two sets of oppositely extending toggle-links *f f* pivoted thereto, as at *g*, while at its lower end are pivoted the inner ends of the oppositely extending toggle-links *h, h*. The sets of links *f f* are pivoted at their outer ends to the outer ends of a companion set of links *f' f'*, which latter links have their inner ends passing on opposite sides of the bar *c* and pivoted to the upper ends of bars *i i* disposed on the same side of the bar *c* therewith, as shown. The bars *i i* stand in parallelism with the bar *c* and are connected at their lower ends by a pivot-pin *i'* to which the inner ends of oppositely projecting toggle-links *h' h'* are attached, said links *h' h'* being pivoted at their outer ends to the outer ends of the links *h h*. It is thus apparent that the sets of links *f f* and *f' f'* and the individual links *h h* and *h' h'* form sets of double toggles, which are connected at their inner ends to the outer side of an associated punch 33 and at their outer ends to the inner side of the encircling wall 12, see Figs. 5, 8, 9, 10, and also that a downstroke of the bar *c* will effect a horizontal lengthening of the sets of toggles and a consequent inward movement of the attached punch, while an upstroke of the bar *c* will effect a vertical lengthening of the sets of toggles and a consequent outward movement of the attached punch.

The action of the several mechanisms 36 which control the movements of the pressure-pads is intended to be the reverse to that of the mechanisms 35 to cause the pressure-pads to recede from the work on each downstroke of the plunger and move toward it on each upstroke of the plunger. To accomplish this I connect each operating bar *d* to the inner ends of the lower toggle-links *k k* and *l l* of the upper and lower sets of toggles, respectively, and the inner ends of the companion sets of upper links *k' k'* and *l' l'* of both sets by the bars *m m*, one of which is disposed on either side of the bar *d* in parallelism therewith, as shown in Fig. 4. The sets of toggles *k k* and *k' k'* and *l l* and *l' l'* have their outer ends attached to the wall 12 and their inner ends attached to the outer side of an associated pressure-pad 34, as shown. Inasmuch as the punches and pressure-pads are alternately arranged around the inner dies 13 it will be apparent that the mechanisms 35 and 36 are also arranged in alternating order within the wall 12.

In order to facilitate the radial movements of the several punches and pressure-pads, each carries an antifriction roller 37 (Fig.

1) at its lower end which travels in a registering radial groove 38 in the surface of the bed-plate 2. Projecting outwardly from each punch 33 and pressure-pad 34 in the direction of its radial movements are the upper and lower guide-rods 39, 39, which work through registering guide openings in the wall 12, thus tending to hold the punches and pressure-pads erect so that their respective operating mechanisms 35, 36 are relieved of lateral strain.

The pitman 9 has its lower end provided with a lateral notch 40 (Fig. 6) for receiving the pivot pin 41 carried by the head-block 19 of the inner die controlling mechanism, which pin is held in engagement therewith by a pin 42, thus adapting the pitman to be readily disengaged from the head-block 19 and swung laterally to permit a work-blank to be placed around the inner dies 13 or a formed barrel body removed therefrom. The pitman has its upper end forked as shown at 43, Fig. 6, to adapt it to straddle the shaft 4 to guide its vertical movements and carries a laterally projecting stud 9<sup>a</sup> or other suitable means below such part for working in the cam-groove 5<sup>a</sup> of the disk 5. A collar 45 is carried by the shaft 4 and coacts with the upper end of the pitman to retain the stud 44 within its groove.

46 designates a clutch of the single-revolution type, which is carried by the shaft 4, and, when released in the usual manner by the movement of a trip-lever or other suitable means 47, is influenced by a spring or the like to move into clutch engagement with the hub of a loose drive-pulley 48 on said shaft whereby to impart a single revolution to the shaft.

When the operative parts of the construction shown are in normal or at rest position, see Fig. 8, the guide-studs 8<sup>a</sup> of the plunger-arms 8, 8 stand near the forward ends of the neutral zones *n—o* of their respective cam grooves 6<sup>a</sup>, at which position the plunger 7 and attached punches 33 and 34 each stand at half stroke, while the guide-stud 9<sup>a</sup> of the pitman 9 stands near the forward end of the neutral zone *N—O* of its cam-groove 5<sup>a</sup> at which position the pitman stands at the limit of its upstroke with the attached inner dies 13 in completely collapsed state. On starting the press the inner dies 13 are quickly expanded to full open position due to the stud 9<sup>a</sup> working in the outwardly diverging portion *O—P* of its groove which effects a complete transverse or horizontal lengthening of the toggles controlling the movements of the inner die parts, as shown in Figs. 1 and 9. During this movement of the inner dies the studs 8<sup>a</sup> have traveled to the positions *p* in their grooves, which effects a partial lowering of the plunger 7 and a consequent inward



movement of the punches 33 and outward movement of the pressure-pads 34 due to the action thereon of their respective operating mechanisms 35 and 36. At this stage of the operation the punches have begun to act on the ends of the blank A and have imparted a corrugated formation thereto, as shown at B, Fig. 11. The inner dies now stand stationary while the associated stud 9<sup>a</sup> travels in the neutral zone P—Q of its groove during which period of movement the punches have moved into engagement with the entire length of the blank or stand in approximately the positions shown in Fig. 2, and the studs 8<sup>a</sup> have traversed approximately the distance  $p—q$  of their grooves. During the travel of the studs 8<sup>a</sup> in the portions of their courses  $q—r$ , which completes the downstroke of the plunger, the punches act on the blank to draw portions thereof within the spaces 32 between the dies 13 to form longitudinal crimps therein, as represented by stage C, Fig. 11.

As the drawing of the metal within the spaces 32 to form the crimps causes a contraction of the diameter of the blank, it will be apparent that the dies 13 must have a retracting movement during such action, which is effected by the stud 9<sup>a</sup> traversing the inwardly extending portion Q—R of its groove, thus effecting a partial upstroke of the pitman 9, see Fig. 10. The pitman stud 9<sup>a</sup>, on leaving the portion Q—R of its groove, enters the neutral portion R—S thereof which maintains the inner die-parts stationary while the studs 8<sup>a</sup> are traversing the inwardly extending portions  $r—s$  of their grooves, which quickly elevates the plunger 7 to near the limit of its upstroke and effects a quick outward movement of the punches 33 and an inward movement of the pressure-pads 34 to a point where they engage the work and press it closely to the inner dies 13 to give it the desired bilge formation. The pressure-pads having now engaged the work, the stud 9<sup>a</sup> traverses the inwardly extending portion S—T of its groove which effects an inward movement of the dies 13 to the position shown in full lines in Fig. 3, whereby to closely compress the walls of the crimps formed in the blank, thus leaving the blank in the form shown at D in Fig. 11. During this contracting movement of the dies the pressure-pads are caused to follow up at the same rate of speed so as to hold the work to the dies during the closing of the crimps, due to the studs 8<sup>a</sup> working in the inwardly extending portions  $s—t$  of their grooves, which movement completes the upstroke of the plunger 7. The studs 8<sup>a</sup> now traverse the outwardly extending portions  $t—u$  of their grooves and enter the neutral zones  $n—o$  thereof in which latter the cycle of operations is completed, thus imparting a half

downstroke to the plunger and effecting an outward movement of the pressure-pads and an inward movement of the punches to their starting point. During this movement of the studs 8<sup>a</sup> the stud 9<sup>a</sup> traverses the inwardly extending portion T—N of its groove and enters the neutral starting-zone N—O thereof, thus moving the toggle mechanism associated with the inner dies to completely collapse said dies to permit a withdrawal of the formed barrel. In this collapsing action of the dies, the wedge-blocks 14 are drawn inwardly relative to the dies against the tension of the springs 15 to permit a sufficient relative contraction of the parts  $a—b$  of each die to enable the dies to be drawn inwardly to approximately the line  $v—v$  in Fig. 3, as shown by dotted lines in said figure. When the cycle of operations is completed the clutch 46 is automatically released from the drive-pulley 47.

It is apparent that as the punches and pressure-pads contract and recede relative to the work the rollers  $e$  of the controlling mechanisms 35 and 36 thereof will be caused to have corresponding movements in their respective runways 7<sup>b</sup> in the plunger 7.

I desire it to be understood that my invention is not limited to any specific form or arrangement of parts or form or shape of blank operated on except in so far as such limitations are specified in the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is,—

1. In a machine of the class described, co-operating die mechanisms arranged on opposite sides of a blank for forming a plurality of crimps therein at a single operation, the dies of one mechanism being arranged in different radiating planes around the other mechanism, and means for operating said mechanisms.

2. In a machine of the class described, concentrically disposed inner and outer co-operating die mechanisms arranged to simultaneously act upon a plain cylindrical blank to form a plurality of longitudinal crimps therein at a single operation, and means for operating said mechanisms.

3. In a machine of the class described, the combination of inner and outer circularly arranged die mechanisms for acting on a cylindrical blank to close crimps formed therein, means without the blank co-operating with the inner die mechanism to initially form the crimps in the blank, and means for operating said mechanisms and means.

4. In a machine of the class described, the combination of a plurality of inner and outer dies, means for moving such dies, and mechanism for co-operating with said dies to form a plurality of crimps in a blank.

5. In a machine of the class described, a plurality of combined bilge and crimp-form-



ing dies capable of relative movements, parts movable to act in conjunction with said dies to form crimps, close the same and bilge an entire blank at a single operation, and mechanism for operating said parts.

6. In a machine of the class described, the combination of mechanism for acting on an entire cylindrical blank to form longitudinal crimps therein and close the same in a single operation, and means for operating such mechanism.

7. In a machine of the class described, the combination of a central die-body, and means arranged around the body and operative to cooperate therewith to initially crimp a blank at a single operation.

8. In a machine of the class described, the combination of a central collapsible die-body, and mechanism for cooperating with such body to crimp a blank and close such crimps at a single operation and to collapse said body during such operation.

9. In a machine of the class described, the combination of a central collapsible die-body, means for cooperating with the body to crimp and bilge a blank, and means for collapsing the body to complete the crimps and permit the removal of a formed article.

10. In a machine of the class described, the combination of a central collapsible die-body, a set of punches associated with such body, means for moving the punches to cooperate with the die-body to initially crimp a blank, and means for collapsing the die-body.

11. In a machine of the class described, the combination of a central collapsible die-body, a set of punches arranged around such body, means for moving the punches in unison to cooperate with the die-body to crimp a blank, and means for imparting intermittent collapsing movements to the die-body to assist in the crimp-forming operation and to collapse the body to permit a removal of the work.

12. In a machine of the class described, the combination of a central collapsible die-body, radially movable parts arranged around such body, means for moving said parts to cooperate with the body to bilge and initially crimp a blank, and means for collapsing the die-body.

13. In a machine of the class described, the combination of a collapsible die-body, a set of punches and a set of pressure-pads associated with the die-body, means for relatively moving the punches and pressure-pads to cooperate with the die-body to initially crimp and shape a blank, and means for collapsing the die-body to effect a closing of the crimps and permit a removal of the work.

14. In a machine of the class described, the combination of a plurality of circularly-arranged dies, means for moving said dies

to vary the diameter of the circle described thereby, and mechanism cooperating with said dies to longitudinally crimp an encircling blank and close such crimps.

15. In a machine of the class described, the combination of a plurality of inner and outer dies arranged in substantially the form of a circle and of a shape to impart a bilge to a blank, means for radially moving said dies, and mechanism for cooperating with such dies to form a plurality of crimps in the blank.

16. In a machine of the class described, the combination of a plurality of dies arranged in substantially the form of a circle and radially movable, punches cooperating with the dies to crimp a blank and mechanism for operating the punches to crimp the blank and to radially move the dies during the crimping operation.

17. In a machine of the class described, the combination of a set of dies arranged in substantially the form of a circle, said dies being shaped to impart a bilge to a blank and radially movable, punches cooperating with the dies to crimp a blank and draw it in bilge shape, and mechanism for operating the punches to crimp the blank and to radially move the dies.

18. In a machine of the class described, the combination of a set of dies, said dies being shaped to impart a bilge to a blank, punches for cooperating with the dies to crimp a blank and draw it in bilge shape, and mechanism for operating the punches to crimp the blank and to move the dies.

19. In a machine of the class described, the combination of a set of radially movable circularly arranged dies, means for cooperating with such dies to crimp a blank, and means for moving the dies to permit a crimping of a blank and then to closely compress the crimps.

20. In a machine of the class described, the combination of a set of radially movable circularly arranged dies, means for cooperating with such dies to bilge and crimp a blank, and means for effecting a relative contraction of the dies to permit a crimping of a blank, to closely compress the crimps and to collapse the dies to permit a removal of a formed blank.

21. In a machine of the class described, the combination of an inner set of movable circularly arranged dies, means for cooperating with the dies to initially crimp an entire blank in a single operation, and pressure means for cooperating with the dies and said means to shape a blank.

22. In a machine of the class described, a plurality of circularly arranged inner and outer combined bilge and crimp forming dies capable of relative movements, parts movable to act in conjunction with said dies to crimp and bilge an entire blank at a sin-



gle operation, and mechanism for operating said parts.

23. In a machine of the class described, the combination of a set of dies arranged about a common axis, a set of punches and a set of pressure-pads arranged around the dies and mechanism for operating the punches and pressure-pads to coöperate with the dies to crimp and shape a blank.

24. In a machine of the class described, the combination with a set of dies arranged around a common axis, a set of punches and a set of pressure-pads arranged around the dies, and mechanism for operating the punches and pressure-pads to successively act on a blank to bilge and crimp the same.

25. In a machine of the class described, the combination of a set of circularly arranged dies, a set of punches and a set of pressure-pads alternately arranged around such dies, and mechanism for moving the punches and blank holders to act in conjunction with the dies to crimp and bilge a blank.

26. In a machine of the class described, the combination of a set of dies, a set of punches and a set of pressure-pads associated with said dies and alternately arranged, and mechanism for moving the punches and pressure-pads to act in conjunction with the dies to crimp a blank.

27. In a machine of the class described, the combination of a set of circularly arranged dies, a set of punches and a set of pressure-pads arranged around such dies, and mechanism for moving the punches and pressure-pads to successively act in conjunction with the dies to shape a blank.

28. In a machine of the class described, the combination of a set of movable circularly arranged dies, a set of punches and a set of pressure-pads arranged around such dies, and mechanism for moving the dies, punches and pressure-pads to coöperate to shape a blank.

29. In a machine of the class described, the combination of a set of circularly arranged dies, a set of punches and a set of pressure-pads arranged around the dies, and mechanism for imparting opposed radial movements to said punches and pressure-pads to cause them to successively act in conjunction with the dies to shape a blank.

30. In a machine of the class described, the combination of a set of circularly arranged radially movable dies, parts arranged around the dies and movable to coöperate therewith to crimp and shape a blank, and mechanism for moving said parts to crimp and shape a blank and for moving said dies inwardly to relatively contract them during the crimping operation.

31. In a machine of the class described, the combination of a set of circularly arranged radially movable dies, parts arranged

around the dies and movable to coöperate therewith to crimp and shape a blank, means for moving said parts to act on a blank, and means for radially contracting the dies during the crimping operation and then collapsing them to permit a removal of a formed article.

32. In a machine of the class described, the combination of a set of circularly arranged radially movable dies, a set of punches arranged around the dies, means for moving the punches to coöperate with the dies to crimp a blank, and means for retracting the dies during the crimp forming operation to complete the crimps.

33. In a machine of the class described, the combination of a set of circularly arranged retractable dies, a set of punches arranged around the dies, means for radially moving the punches to coöperate with the dies to crimp a blank, and means for retracting the dies during the crimping operation to complete the crimps and then to collapse them to permit a removal of a formed article.

34. In a machine of the class described, the combination of a set of circularly arranged retractable dies, a set of punches and a set of pressure-pads arranged around the dies, means for moving the punches and pressure-pads to coöperate with the dies to bilge and crimp a blank, and means for retracting the dies to close the crimps in a blank.

35. In a machine of the class described, the combination of a collapsible die-body, a set of punches and a set of pressure-pads arranged entirely around said body, means for imparting opposed radial movements to the punches and pressure-pads to successively coöperate with the die-body to bilge and crimp a blank, and means for imparting intermittent collapsing movements to the die-body to change its diameter during the forming of the crimps.

36. In a machine of the class described, the combination of a collapsible die-body having radially and laterally movable die-parts, means for coöperating with such body to crimp a blank, means for radially moving said parts to collapse the die-body, and means normally maintaining the die parts laterally expanded and movable at a predetermined point in the collapsing movement of the die-body to permit a complete collapse thereof.

37. In a machine of the class described, the combination of a set of relatively collapsible dies forming a central die-body, said dies each comprising laterally movable parts, means for coöperating with said dies to crimp a blank, and means for collapsing the dies to restrict the size of the die-body and close the crimps and at a predetermined point in such collapsing movement to effect a relative lateral movement of the parts of



the dies to permit a further collapsing of the dies.

38. In a machine of the class described, the combination of a collapsible die-body comprising a plurality of individual dies which, when in expanded state, have their edges spaced to provide crimp forming recesses, means for cooperating with the die-body to initially crimp a blank, and means for collapsing the die-body to complete the crimps.

39. In a machine of the class described, the combination of a collapsible die-body comprising a plurality of individual dies, which, when in expanded state, have their edges spaced to provide crimp forming recesses, each of said dies being composed of relatively movable parts and a wedge-part normally acting to retain said parts relatively expanded, means for cooperating with the die-body to crimp a blank, and means for moving the dies to reduce the size of the body and effect a closing of the crimp-forming spaces and to move said wedge-parts to permit a complete collapse of the die-body.

40. In a machine of the class described, the combination of a die-body, punches arranged around such body, a plunger, means for moving the punches in unison to cooperate with the die-body to initially crimp a blank when the plunger is reciprocated, and means for reciprocating the plunger.

41. In a machine of the class described, the combination of a die-body, a set of punches and a set of pressure-pads arranged around such body, a plunger, means for reciprocating the plunger, means connecting the plunger and punches, and means connecting the plunger and pressure-pads, said punch and pressure-pad connecting means being capable of imparting opposed movements to said punches and pressure-pads to cause them to successively cooperate with the die-body to crimp and shape a blank when the plunger is operated.

42. In a machine of the class described, the combination of a collapsible die-body, a set of punches and a set of pressure-pads arranged around such body, a plunger, cam means for operating the plunger, means connecting the plunger and punches, means connecting the plunger and pressure-pad, said connecting means being capable of imparting opposed movements to the punches and pressure-pads to successively cooperate with the die-body to crimp and bilge a blank when the plunger is operated, and cam-controlled means for imparting collapsing movements to the die-body during and after the crimping and bilging operations.

43. In a machine of the class described, the combination of inner and outer cooperating crimp forming mechanisms, both said mechanisms having inward radial

movements during the crimp forming operation, and means for operating such mechanisms.

44. In a machine of the class described, the combination of cooperating outer pressure pads and inner crimp closing dies both radially movable in the same general direction during the crimp closing operation, and means for operating such pads and dies.

45. In a machine of the class described, the combination of an inner radially contractible body, means arranged around such body and capable of cooperating therewith to close crimps in an interposed blank, and mechanism for moving said means and contracting the body to effect such crimp closing operation.

46. In a machine of the class described, the combination of an inner radially contractible body having a plurality of relatively movable parts, means external of such body and capable of having contracting movements therewith, and mechanism for imparting contracting movements to said body, and means to crimp an interposed article.

47. In a machine of the class described, the combination of dies which are capable of both radial and relative contractible movements, means for holding a blank to such dies, and mechanism for imparting such movements to the dies to close the crimps in a blank and for moving said means to cooperate in such operation.

48. In a machine of the class described, the combination of a plurality of movable dies, means for cooperating with such dies to close crimps in an interposed article, and mechanism for radially moving such dies and means toward a common point to perform such operation.

49. In a machine of the class described, the combination of cooperating crimp closing mechanisms arranged on opposite sides of a blank, and means for radially moving the cooperating parts of such mechanisms in unison in the same general direction to close the crimps of a blank.

50. In a machine of the class described, the combination of dies, punches for cooperating with the dies to crimp an interposed blank, means cooperating with the dies and movable therewith to close the crimps, and mechanism for operating such dies, punches and means.

51. In a machine of the class described, the combination of a radially contractible body, punches for cooperating with such body during a portion, at least, of its contracting movement to form crimps in an interposed blank, and mechanism for operating the body and punches.

52. In a machine of the class described, the combination of a contractible body, a



plurality of punches associated with such body, and mechanism operative to contract the body and move the punches therewith to form crimps in an interposed blank and at  
5 a predetermined stage in the crimp forming operation, retract the punches to permit a closing of the crimps by the body.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

LEONHARD BAUROTH.

Witnesses:

C. W. OWEN,  
CORNELL SCHREIBER.