

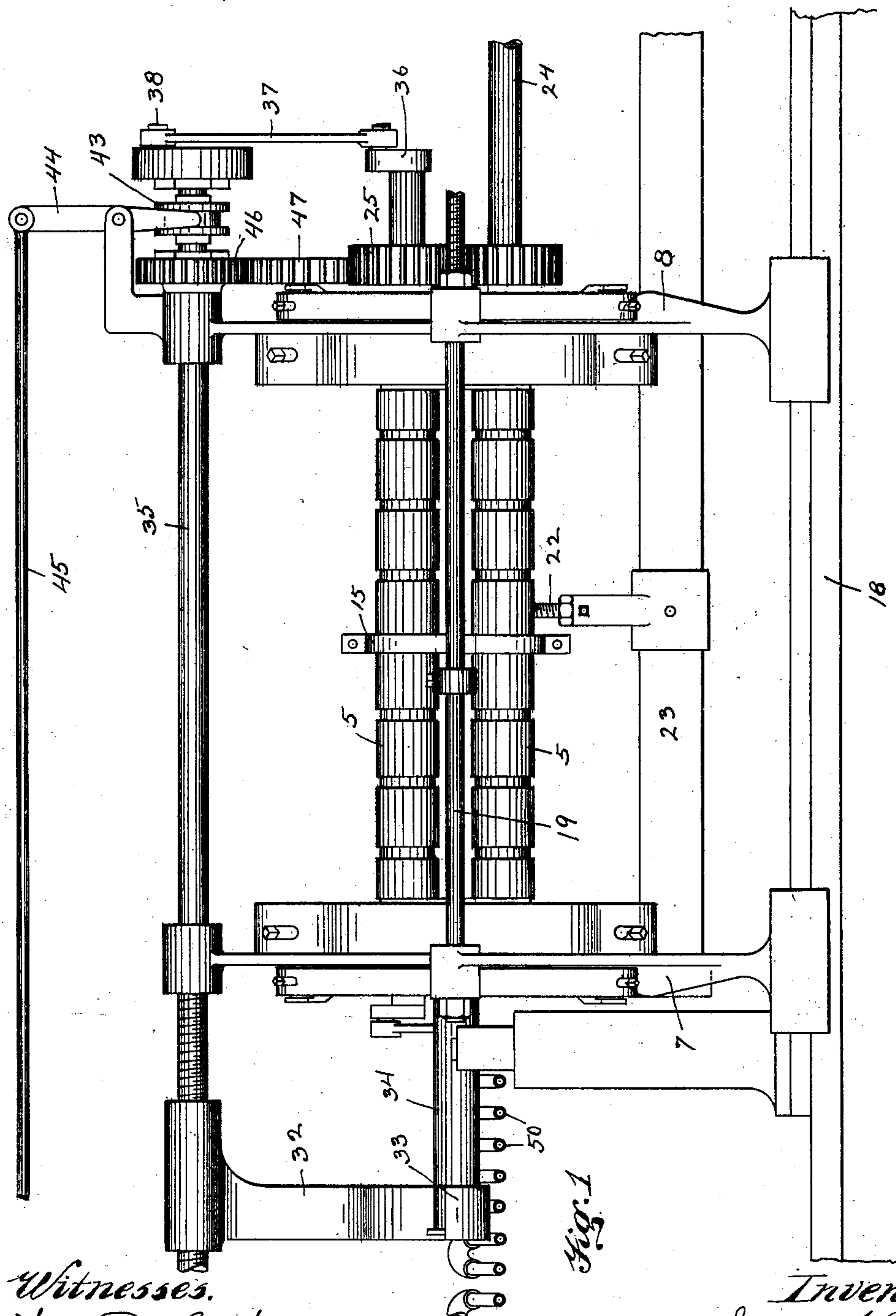
No. 755,698.

PATENTED MAR. 29, 1904.

J. S. REED.
SWAGING APPARATUS.
APPLICATION FILED FEB. 26, 1903.

NO MODEL.

5 SHEETS—SHEET 1.



Witnesses.
Fred D Sweet.
Robert C Zottow

Inventor:
James S Reed
By Kay & Follen
Attorneys.

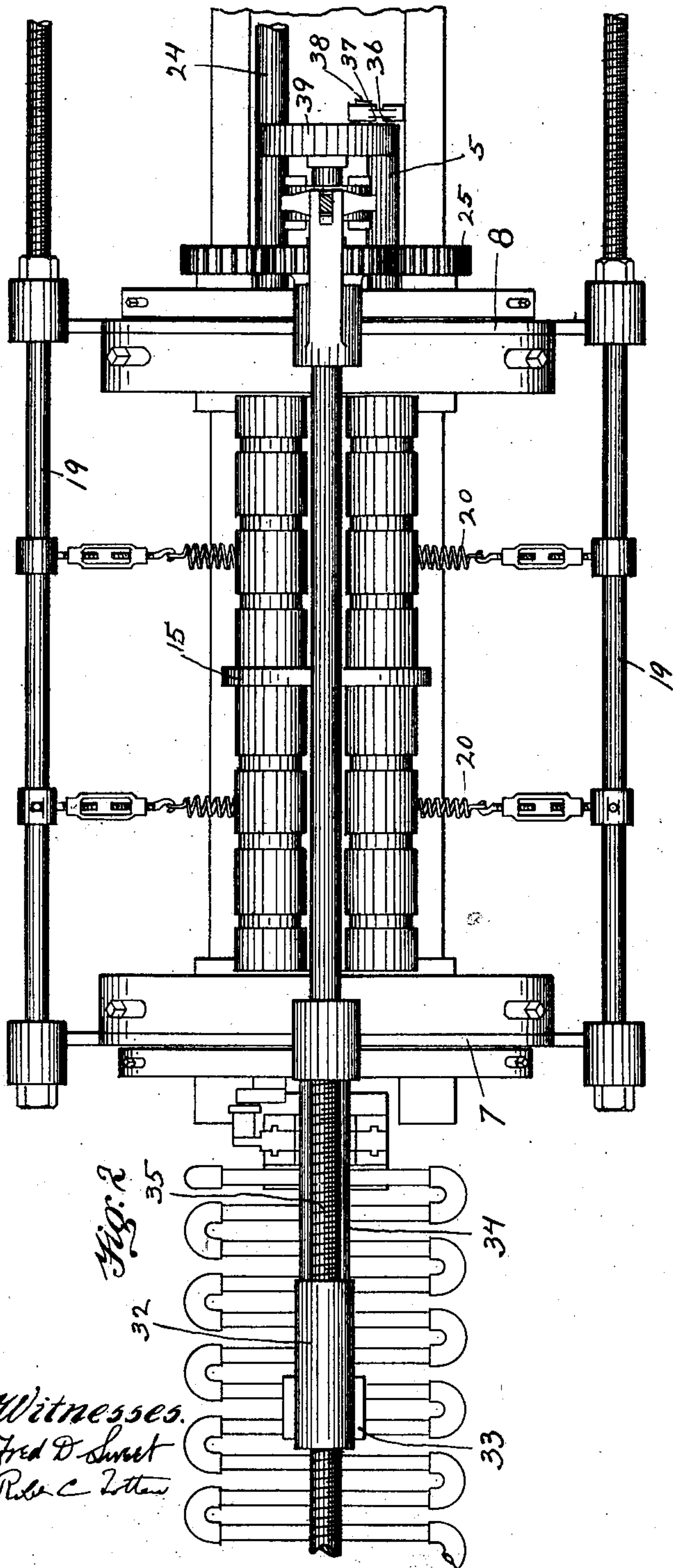
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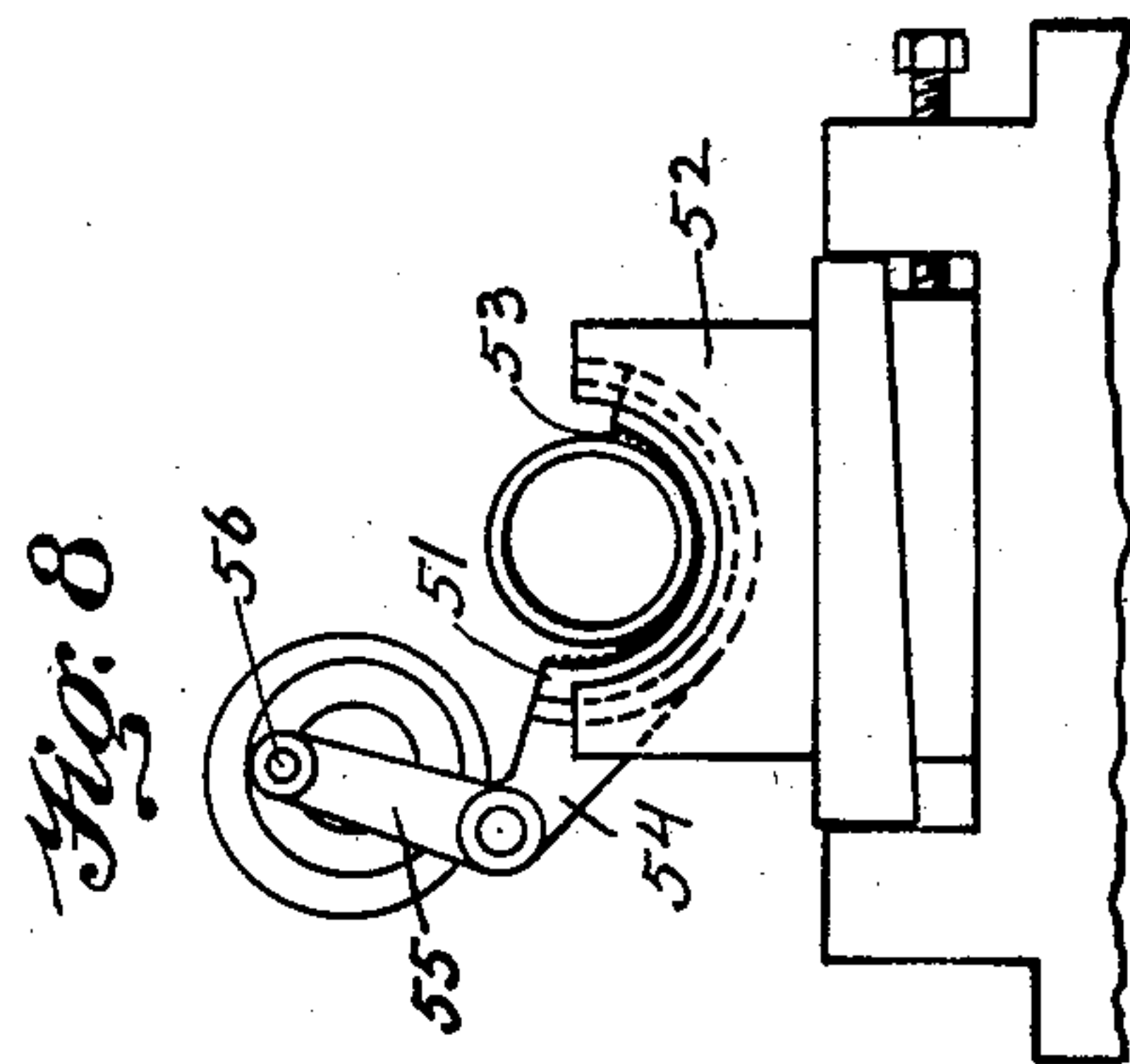
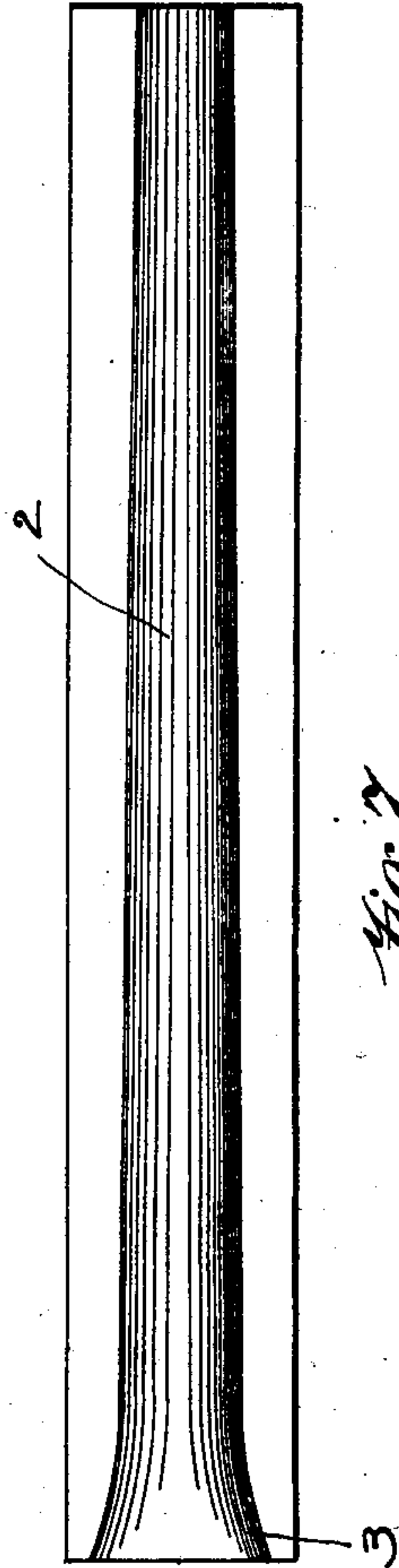
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5 SHEETS—SHEET 2.



Witnesses.
Fred D. Sweet
Rube C. Lottan



Inventor.
James S. Reed
By Kay & Lottan
Attorneys.

No. 755,698.

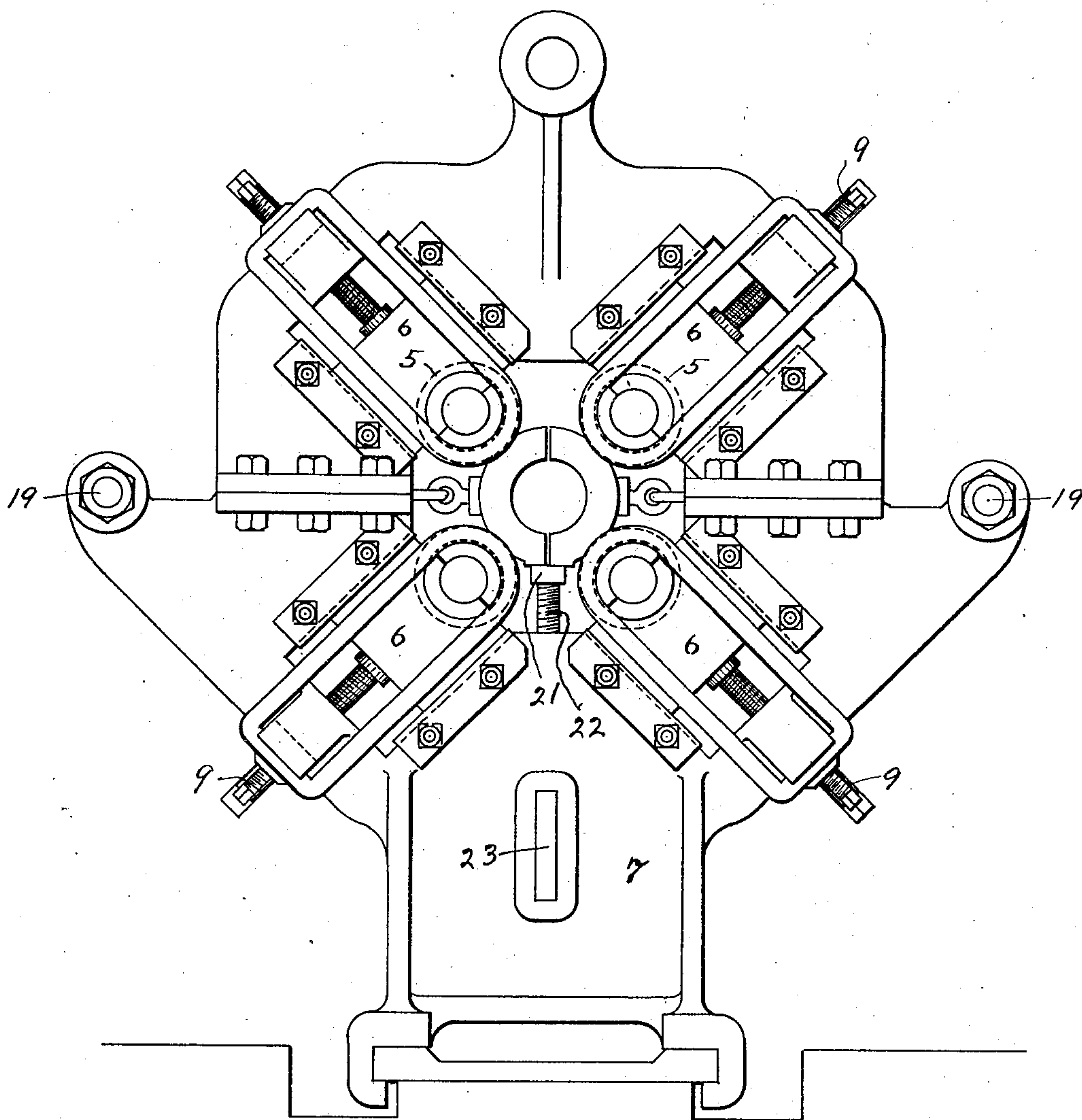
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5 SHEETS—SHEET 3.

Fig. 3



Witnesses.
Fred D. Sweet
Robert C. Litten

Inventor.
James S. Reed
By Kay & Litten
Attorneys.

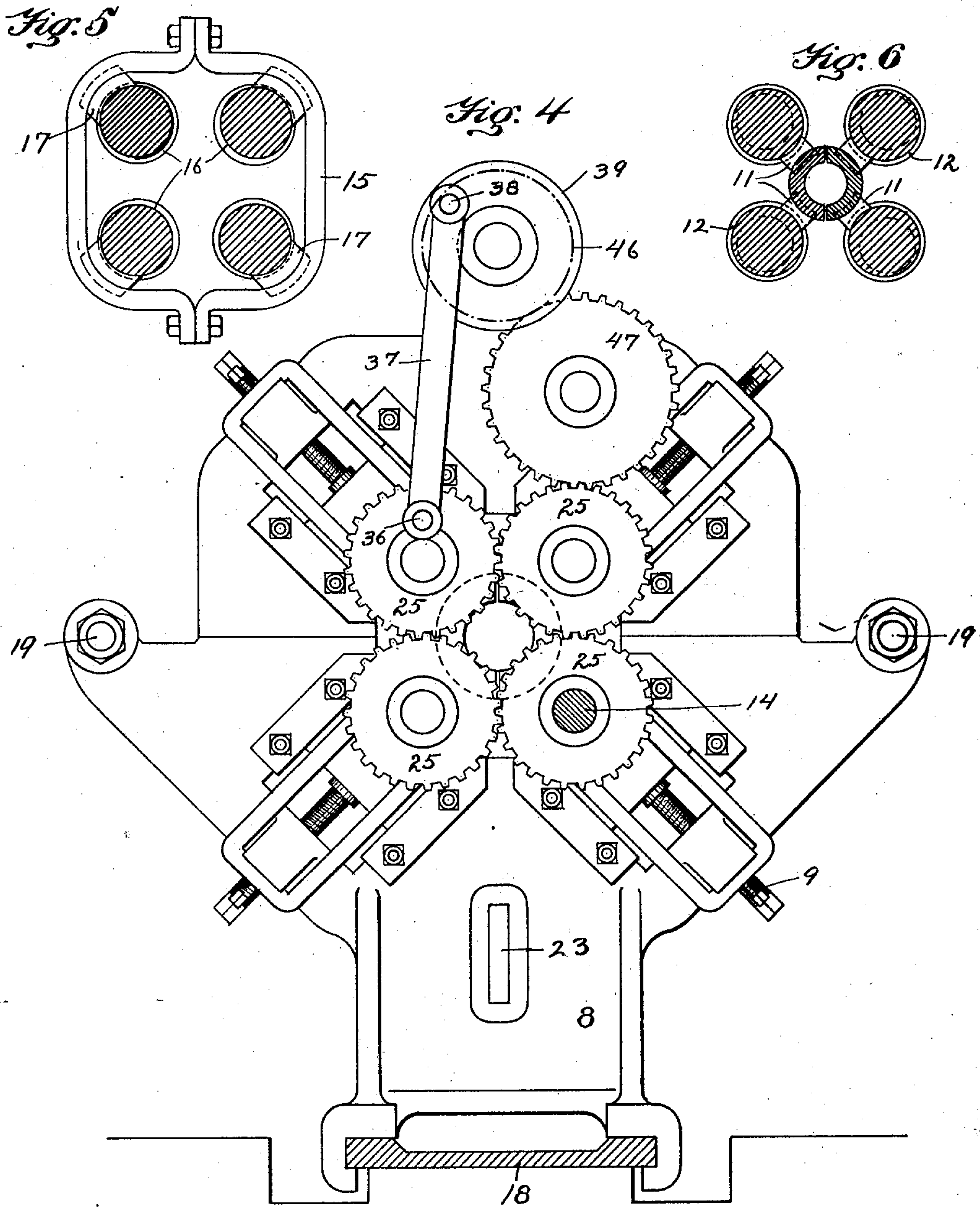
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NO MODEL.

5 SHEETS—SHEET 4.



Witnesses.
Fred D. Smith
O. R. C. Lottan

Inventor.
James S. Reed
By Kay & Lottan
Attorneys.

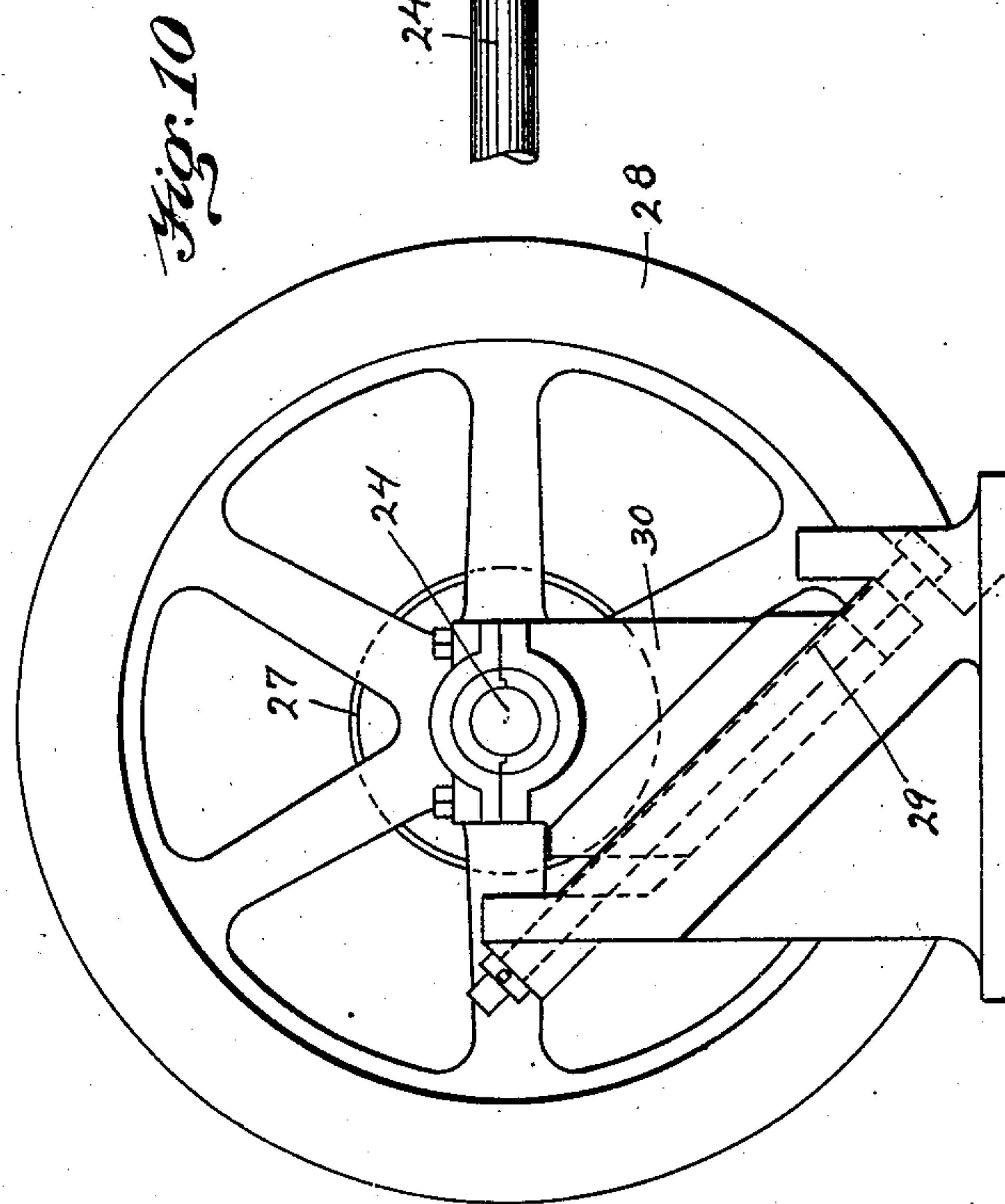
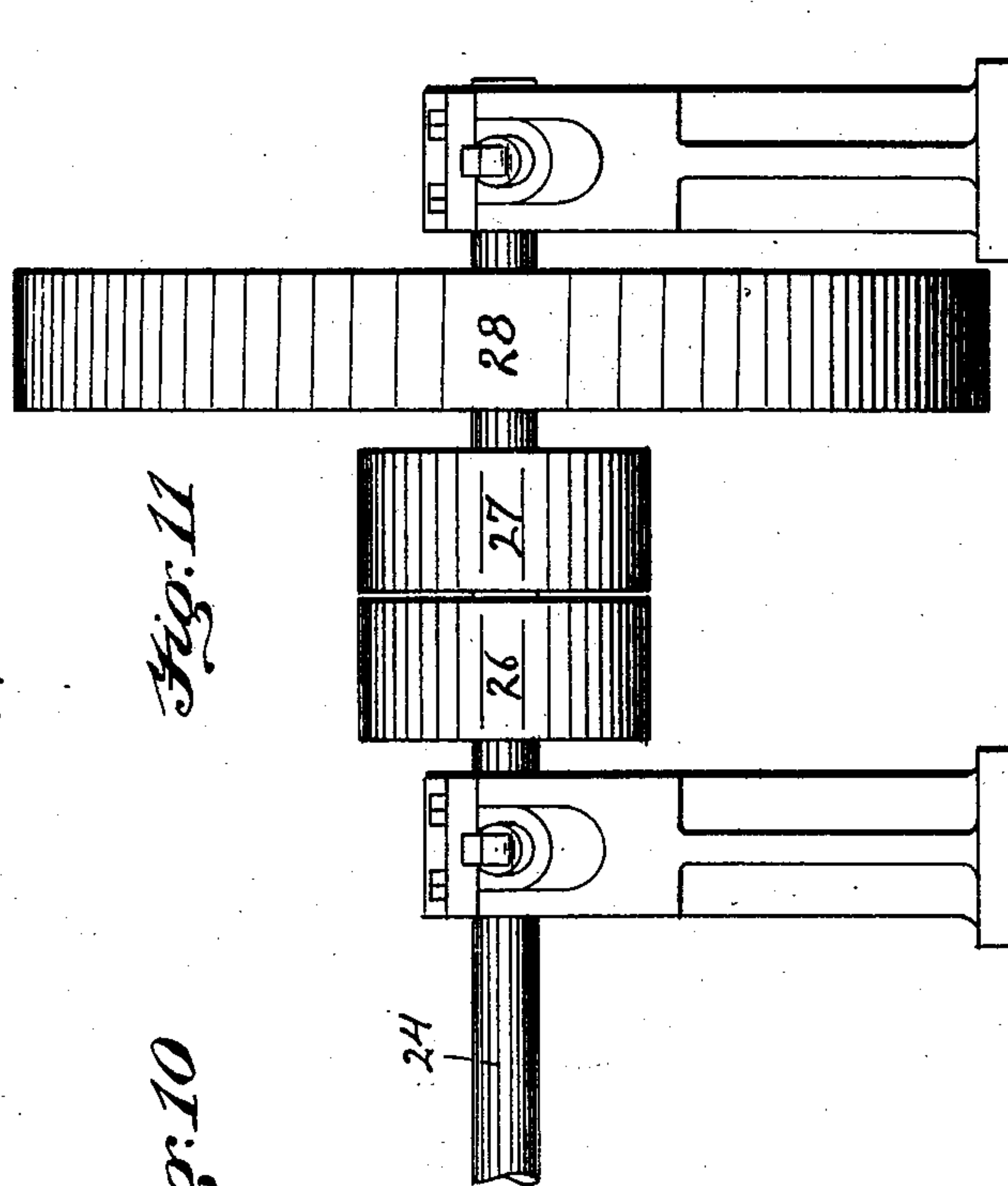
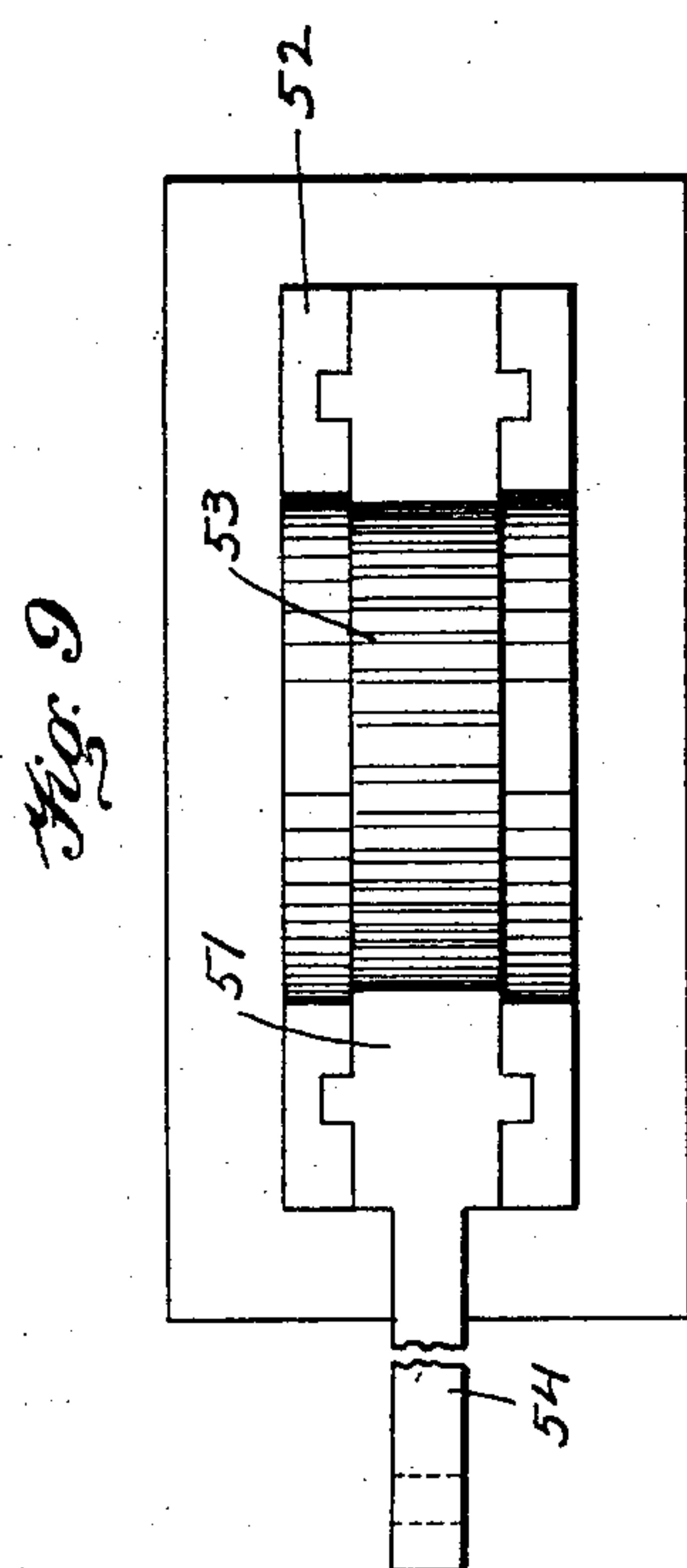
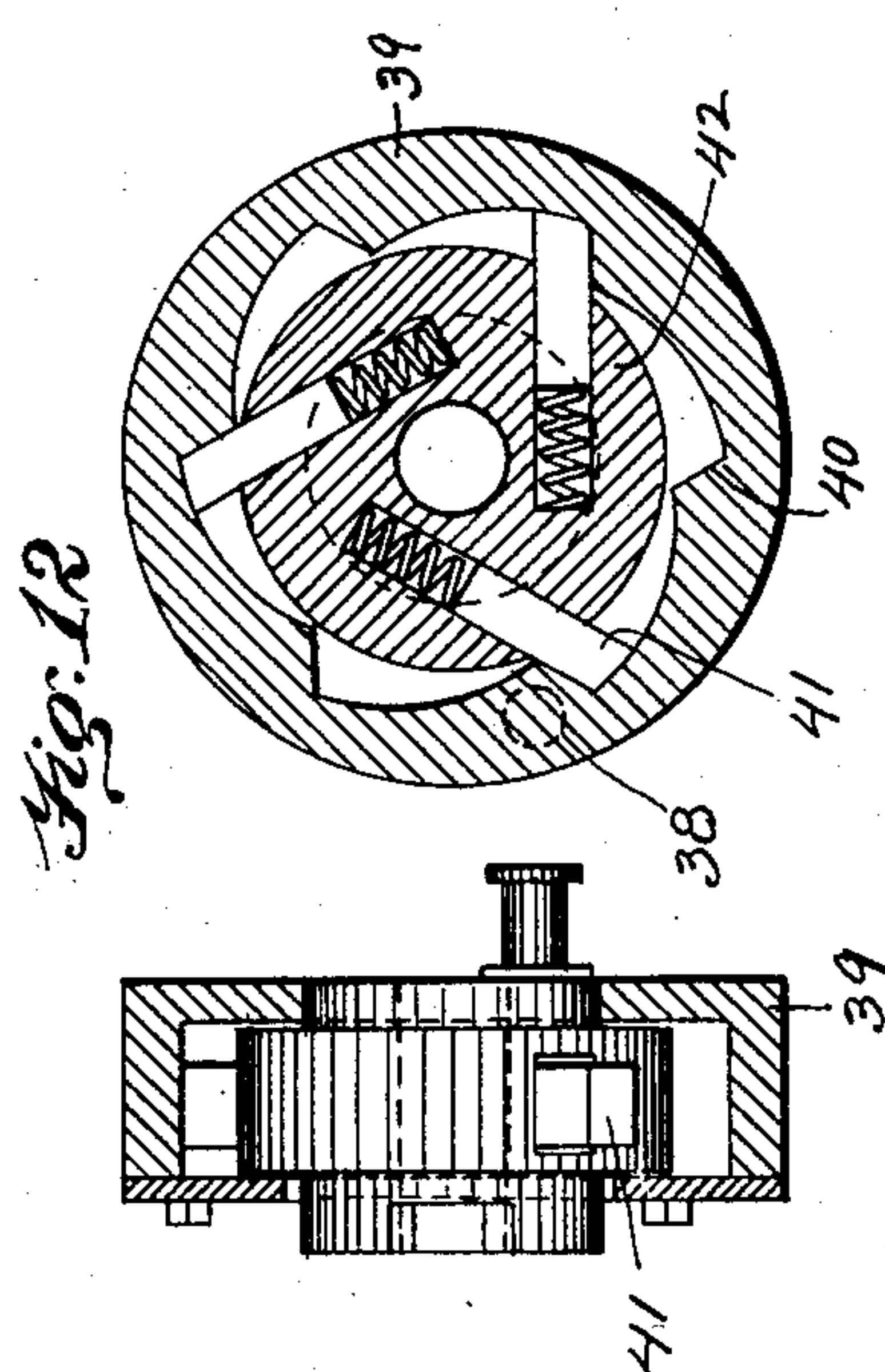
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APPLICATION FILED FEB. 26, 1903.

NO MODEL.

5 SHEETS—SHEET 5.



Witnesses.
Fred D. Sweet.
Robert C. Zotten

Inventor:
James S. Reed
By Kay & Zotten
Attorneys.

UNITED STATES PATENT OFFICE.

JAMES S. REED, OF PITTSBURG, PENNSYLVANIA.

SWAGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 755,698, dated March 29, 1904.

Application filed February 26, 1903. Serial No. 145,218. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. REED, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Swaging Apparatus; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to swaging-machines, and more especially to machines for swaging tapers on tubes, rods, or other articles.

The object of my invention is to improve machines for this purpose which have comparatively long dies with longitudinal working faces by providing improved means for actuating said dies, so that a more efficient action of the dies is secured and a wide adjustment thereof provided.

A further object of my invention is to provide means for feeding the blank into the dies and for rotating the blank while being acted on by the dies.

To these ends my invention consists, generally stated, in a machine having comparatively long dies provided with longitudinal working faces and arranged to reciprocate toward and from each other, together with a cam shaft or shafts extending parallel to each die and contacting directly therewith in order to actuate the same.

The invention also consists in providing means for preventing the cam-shafts from bending or springing outwardly at their central portions and also in making said cam-shafts adjustable so as to adapt the machine for swaging different sizes of tubes or other articles.

The invention also consists in a mechanism which is intermittently actuated from a moving part of the machine and pushes the blank into the dies at the time they are open.

The invention also consists in a device which engages the tube and is intermittently rocked to rotate the blank in the dies.

The invention also consists in certain details of construction, such as providing grooves on the cam-shafts which engage lugs or projections on the dies, so as to reduce the friction between the cam-shaft and the dies, an adjustable support on which the dies move, and

in other details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation of my improved machine. Fig. 2 is a plan view of the same. Fig. 3 is an elevation of the front end thereof. Fig. 4 is an elevation of the rear end thereof, the driving mechanism being removed. Fig. 5 shows the means for preventing the cam-shafts from springing outwardly at their central portions. Fig. 6 is a detail cross-section through the cam-shafts and dies. Fig. 7 is a face view of one of the dies. Fig. 8 is a detail end view of the means for rotating the blank. Fig. 9 is a plan view of the same. Fig. 10 is an end view of the driving mechanism. Fig. 11 is a side view of the same, and Fig. 12 shows longitudinal and transverse sections of the clutch for giving an intermittent feed to the blank.

The dies of the machine are comparatively long, as shown in Fig. 7, and are each provided with a longitudinal working face 2, which may be of any suitable contour in cross-section, that shown in the drawings being semicylindrical; but obviously it may be semi-hexagonal, semi-octagonal, or the like or may be semicylindrical on one die and semi-hexagonal or other shape on the other. This working face will be enlarged at the entrance end, as at 3, in order to provide a bell-mouth to permit the entrance of the tube or any other blank being swaged. As shown in Fig. 7, the working face tapers from the entrance to the exit end, and this form will be followed when a tapered tube or rod is to be made; but obviously the working faces can be straight, so as to form perfectly straight articles, or they may be of varying outline. In the drawings two dies are shown, each forming a half of the pass; but obviously any other number of dies may be employed—as, for instance, four, each of which is provided with a working face forming a quadrant of the pass. Hence I do not wish my invention limited to a pair of dies such as shown, although this is preferable. The dies are mounted so as to have a movement toward and from each other, and preferably each of the dies of the

set will be movable, although this is not absolutely essential, as one thereof may be stationary and the other alone made movable. In the drawings both dies are shown so mounted as to reciprocate in a horizontal plane toward and from each other. They are moved toward each other by means of suitable cam-shafts or rolls 5, four such shafts being shown, two contacting with each die; but obviously a single shaft for each die would also serve my purpose. I prefer to use two shafts for each die, as that gives a more positive and true movement to the dies. These shafts are mounted in bearings 6 in suitable housings or frames 7 and 8, and in order to adjust the machine to form articles of different sizes the bearings 6 are adjustable in any suitable way, such as by the screws 9, so that the cam-shafts can be moved inward and outward, as desired. This adjusting means also permits the shafts being separated more at one end than at the other in order to give various tapers to the tube or other article. These cam-shafts may be of various shapes in cross-section, those shown in the drawings being practically eccentric shafts—that is, the body thereof is eccentric to the journals, as indicated in Fig. 3, so that for each rotation of the shafts a single reciprocation is given to the dies. It is obvious, however, that these shafts may be formed with more than a single cam-face—such, for instance, as by making the rolls elliptical—in which event they would give two reciprocations to the dies for each rotation of the shafts. In the same manner the cam-shafts may be made of such cross-sectional shape as to give three or even more reciprocations to the dies for each rotation of said shafts.

In order to facilitate the finishing of the contact-faces between the cam-shafts and the dies and to enable said contact-faces to be made of accurate form, I so construct the same that the shafts contact with the dies only at intervals along their lengths. Various arrangements for this purpose may be employed, and, as shown in Fig. 6, the dies are provided with radially-projecting blocks or bushes 11, preferably made of bronze or other metal having little friction and which project into grooves 12, formed in the cam-shafts.

In swaging long tapered tubes and the like it is necessary to have the dies practically the length of the tapered portion to be formed, and consequently they will be of considerable length. As the cam-shafts 5 must be of a corresponding length, there is liability that they will bend or spring apart at points intermediate their ends. In order to stiffen the same, I connect them by means of one or more bands 15, Fig. 5, which preferably are made in sections, as shown, for ease of application and which contact with surfaces 16, formed on the shafts concentric with their journals. Prefer-

ably these surfaces will be formed by turning grooves in the bodies of the shafts and securing bronze or similar blocks 17 to the band 15, which blocks project into the grooves and into contact with the concentric faces 16. In the drawings I have shown only a single band at the middle of the length of the shafts 5; but obviously any necessary number of such bands may be employed.

In order to adapt the machine to form tapers of various lengths, it is necessary to have dies of various lengths and cam-shafts corresponding thereto. Consequently the machine is so constructed that the dies and cam-shafts may be removed and replaced by dies and cam-shafts of different lengths. To permit this, one of the housings, such as the rear housing 8, is secured to the base 18, so that it can be moved along the same. Suitable tie-rods 19 connect the two housings, and these, as shown, are provided with a long threaded extension at their rear ends, so as to permit the application of cam-shafts and dies of different lengths.

The cam-shafts 5 act to move the dies toward each other to swage down the tube or other article. Suitable means are provided for opening up the dies, and in the drawings I have shown springs 20, connected to the dies and to a stationary part of the frame, such as the tie-rods 19. Obviously, however, various other means might be employed for opening the dies. These springs will hold the dies constantly in contact with the cam-shafts; but to further assist in supporting the dies I provide a plate or plates 21 underneath the dies and upon which they rest while being reciprocated. Preferably this supporting-plate will be adjustable vertically in order to accommodate dies of different sizes, and therefore they are supported on adjusting-screws 22, as shown, these screws being in turn supported on a bar 23 in the housings 7 and 8 and extending longitudinally through the base of the machine.

The cam-shafts 5 are rotated by any suitable mechanism, which must be so arranged that all of the cam-shafts are rotated in exact unison. As shown in the drawings, the rear ends of the shafts are provided with intermeshing spur-gears 25, and one of said shafts projects beyond the others, as at 24, and has connected thereto fast and loose pulleys 26 and 27, upon which runs a suitable belt for driving the same. A fly-wheel 28 is also provided on the driving-shaft 24. This shaft must be provided with adjustable bearings, so that it can be moved in unison with the inward and outward adjustment of the cam-shafts 5. An adjustable bearing suitable for this purpose is shown in Fig. 10, the same having an inclined face 29, upon which moves the bearing 30, so that when said bearing is moved in one direction the driving-shaft will be moved downwardly and outwardly, and

when moved in the opposite direction said shaft will be moved inwardly and upwardly, corresponding to the movement of one of the lower cam-shafts 5 when the latter is adjusted.

Means are provided for feeding the blank into the dies. I have shown for this purpose a pushing-arm 32, which has at its lower end a suitable seat 33 for engaging the rear end of the tube or other blank 34. This arm is moved toward the machine intermittently, so as to push the blank forward only during the time that it is free from the grip of the dies. Various mechanisms for this purpose may be used, that shown in the drawings comprising a screw-shaft 35, tapped through the arm 32 and provided with suitable clutch mechanism for driving the same intermittently. The clutch mechanism shown in the drawings is actuated from a crank 36 on one of the cam-shafts 5, which is connected by a rod 37 to a crank 38 on the oscillating clutch member 39, loosely mounted on the shaft 35. This oscillating member 39 is provided on its inner face with ratchet-faces 40, which cooperate with detents 41, mounted in the clutch member 42, also loosely mounted on the shaft 35. The rotation of the crank 36 imparts a step-by-step movement to the clutch member 42. The latter is adapted to be engaged by a clutch 43, which is splined to the shaft 35 and is provided with a shifting lever 44, to which is connected an operating-rod 45. On the side of the clutch 43 opposite the clutch member 42 is a spur-gear 46, provided with a clutch-face to be engaged by the clutch 43, said gear being loosely mounted on the shaft 35 and connected by an idler 47 with one of the gears 25. When the clutch 43 is in the neutral position, as shown in Fig. 1, the screw-shaft 35 is idle. When said clutch 43 is moved into contact with the clutch member 42, a step-by-step rotary movement will be given to the screw-shaft 35, and this movement is so timed that it moves the arm 32 inwardly or toward the machine during the intervals that the blank is not gripped by the dies, thus feeding the blank into the dies. When the clutch member 43 is moved into engagement with the gear 46, the screw-shaft 35 will be rotated in the opposite direction, thus moving the pushing-arm 32 outwardly. Suitable means may be provided for connecting the tube to the arm 32, so that in the outward movement of the latter the swaged article will be pulled out of the dies. A support for the blank is provided at the front of the machine in line with the dies, and inasmuch as the blank is at a good forging-heat this support is preferably formed of water-tubes 50, as shown, so that a circulation of water can be maintained therethrough to keep them from being destroyed by the hot blank. After each pressure of the swaging-dies it is necessary to rotate the blank in or-

der to prevent the formation of fins or other defects thereon. For this purpose I have shown a gripping member 51, which is practically a semicircle and mounted in an arc-shaped bearing-block 52, so that said member can be rocked in the bearing. This member is provided with a suitable gripping-face for engaging the blank, this gripping-face being shown as formed with teeth 53, which preferably slope in one direction. The rocking member 51 is provided with an arm 54, which is connected by a rod 55 to a crank 56 on the forward end of one of the cam-shafts 5, so that in the rotation of said shafts the member 51 will be rocked alternately in opposite directions. This movement will be so timed with reference to the dies that the teeth 53 engage the blank during the time that it is not held by the swaging-dies, thus turning said blank. During the movement of the rocking member in the opposite direction the teeth slip more easily over the blank, thus not gripping very firmly, and, besides, the blank is held by the swaging-dies, so that it will not be again rotated in the opposite direction. Suitable means, such as the wedges 57, are provided for adjusting the bearing-block 52 vertically in order to adapt the rotating means to the blanks of different sizes.

The operation of my machine is as follows: The arm 32 having been moved to the desired distance outwardly, a hot blank is thrown upon the water-tubes 50, and its rear end is placed in the seat 33 in the pushing-arm 32, and its forward end is entered into the bell-mouth 3 of the dies. The machine is then started and the cam-shafts 5 move the dies 2 toward each other, thus compressing the end of the blank between the same. As soon as the projecting portions of the cam-shafts 5 leave the dies the springs 20 open the dies. During this interval the rocking member 51 gives a partial rotation to the blank. At the same time the ratchet-clutch 39 gives a partial rotation to the screw 35, thus moving the arm 32 toward the dies and pushing the blank still farther into the dies. On the next inward movement of the dies the blank is further compressed and at the next opening of the dies the blank is again given a partial rotation and pushed still farther into the dies, and this will continue until the entire length of the blank has been shoved into the dies. The clutch 43 is then moved to engage the gear 46, thus rotating the screw 35 in the opposite direction and moving the pushing-arm 32 outwardly, and by suitably connecting the swaged article to said arm it can be withdrawn from the dies.

My machine is adapted for swaging rods, tubes, or other articles, and for providing said articles with straight faces as well as with the tapers shown in the drawings. The cam-shafts move the dies toward each other positively and in a true position, and as said shafts

contact with the dies at intervals only the friction is very largely reduced. The machine is practically automatic in its operation and is adjustable, so as to operate on various diameters and lengths of articles.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft bearing for substantially the entire distance between its bearings against one of said dies to actuate the same, and mechanism for rotating said cam-shaft.

2. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft bearing for substantially the entire distance between its bearings against each of said dies to actuate the same, and connecting-gearing for rotating said cam-shafts.

3. In a swaging-machine, the combination of a pair of dies provided with longitudinal working faces and arranged to coöperate with each other, a pair of cam-shafts bearing against one of said dies to reciprocate the same, and mechanism for rotating said cam-shafts.

4. In a swaging-machine, the combination of a pair of dies provided with longitudinal working faces and arranged to coöperate with each other, a pair of cam-shafts bearing against each die, and connecting-gearing for rotating said cam-shafts.

5. In a swaging-machine, the combination of a pair of dies provided with longitudinal working faces and arranged to move in a horizontal plane, a pair of cam-shafts bearing against each die to reciprocate the same, and springs arranged to hold said dies against said cam-shafts.

6. In a swaging-machine, the combination of a plurality of long dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft bearing against each die for actuating the same, independent adjustable bearings for each end of said cam-shafts, and mechanism for rotating said cam-shafts.

7. In a swaging-machine, the combination of a pair of long dies provided with longitudinal working faces, a pair of cam-shafts bearing against each die, bearings for said cam-shafts adjustable radially with reference to the axis of the dies, and mechanism for rotating said cam-shafts.

8. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft bearing against one of said dies, said shaft and die being so constructed as to contact with each other only at intervals along their lengths, and mechanism for rotating said cam-shaft.

9. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft bearing against one of said dies, projections on the die contacting with the cam-shaft, and means for rotating said cam-shaft.

10. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces, a cam-shaft bearing against each die, mechanism for rotating said cam-shafts, and a band surrounding said shafts intermediate their ends to prevent them from springing outwardly.

11. In a swaging-machine, the combination of a pair of dies provided with longitudinal working faces, a pair of cam-shafts for each die, connecting-gearing for rotating said cam-shafts in unison, concentric faces formed on said cam-shafts, and a band or yoke surrounding said shafts and engaging said concentric faces.

12. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft for each of said dies, mechanism for rotating said cam-shafts, said cam-shafts being each provided with a series of cam-faces and a concentric face, projections on the dies engaging said cam-faces, and a band or yoke surrounding said shafts and engaging said concentric faces.

13. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, a cam-shaft bearing against each of said dies for actuating the same, and housings in which said shafts are mounted, said housings being so mounted as to be movable toward and from each other in order to accommodate dies and cam-shafts of various lengths.

14. In a swaging-machine, the combination of a plurality of long dies provided with longitudinal working faces arranged to coöperate with each other, a cam-shaft for actuating each of said dies, a pusher for feeding a blank into the die, a screw connected to said pusher, a ratchet-clutch for intermittently rotating said screw in one direction, mechanism for rotating said screw in the opposite direction, and means for connecting either said mechanism or said ratchet-clutch to said screw.

15. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, actuating mechanism therefor, a pusher for feeding the blank into the dies, a screw-shaft engaging said pusher, a gear loose on said screw-shaft geared to the die-actuating mechanism, an intermittently-acting clutch member also loose on said screw-shaft and also connected to the die-actuating mechanism, and a clutch splined to said screw-shaft and arranged to engage either said gear

or said intermittently-acting clutch on the screw-shaft.

16. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, mechanism for actuating the same, intermittently-operating mechanism for pushing the blank into the dies, a device for gripping the blank, a rocking bearing therefor, and connections between the die-actuating mechanism and said gripping device for rocking the latter.

17. In a swaging-machine, the combination of a plurality of dies provided with longitudinal working faces, a cam-shaft for each of said dies to actuate the same, intermittently-operating mechanism for pushing the blank into the dies, rocking gripping means for engaging the blank to rotate the same, a crank on one of the cam-shafts, and connections from the crank to said rocking means for actuating the latter.

18. In a swaging-machine, the combination

of a plurality of dies provided with longitudinal working faces and arranged to coöperate with each other, mechanism for actuating the same, mechanism operated from the die-actuating mechanism for rotating the blank, and intermittently-operating mechanism for pushing the blank into the dies.

19. In a swaging-machine, the combination of a plurality of dies arranged to coöperate, a cam-shaft bearing against each of said dies, pushing mechanism for the blank, an intermittently-acting clutch operated from the cam-shafts for actuating said pushing mechanism, a rocking member for engaging the blank to rotate the same, and connections between one of the cam-shafts and said rocking member to actuate the latter.

In testimony whereof I, the said JAMES S. REED, have hereunto set my hand.

JAMES S. REED.

Witnesses:

F. W. WINTER,
ROBERT C. TOTTEN.