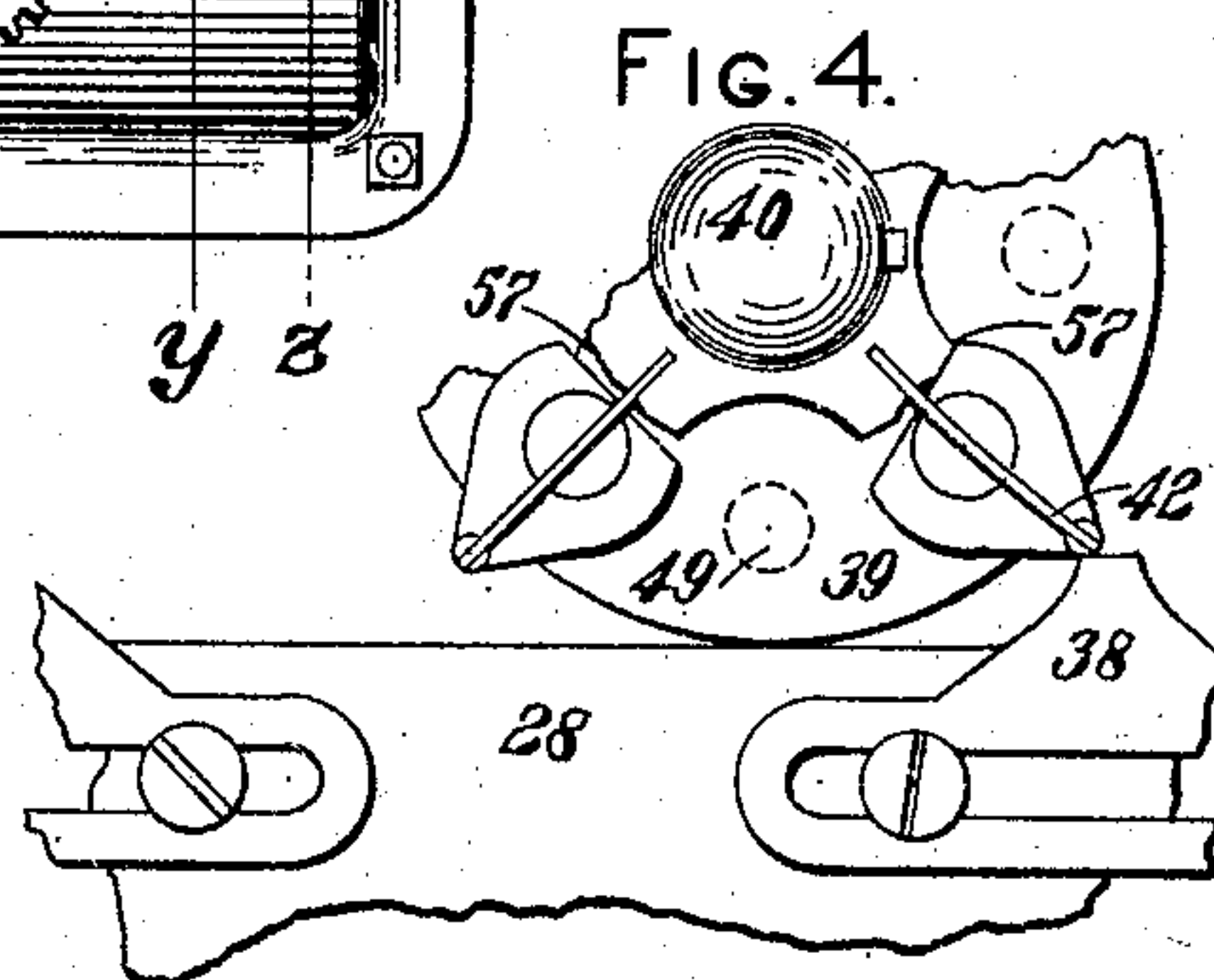
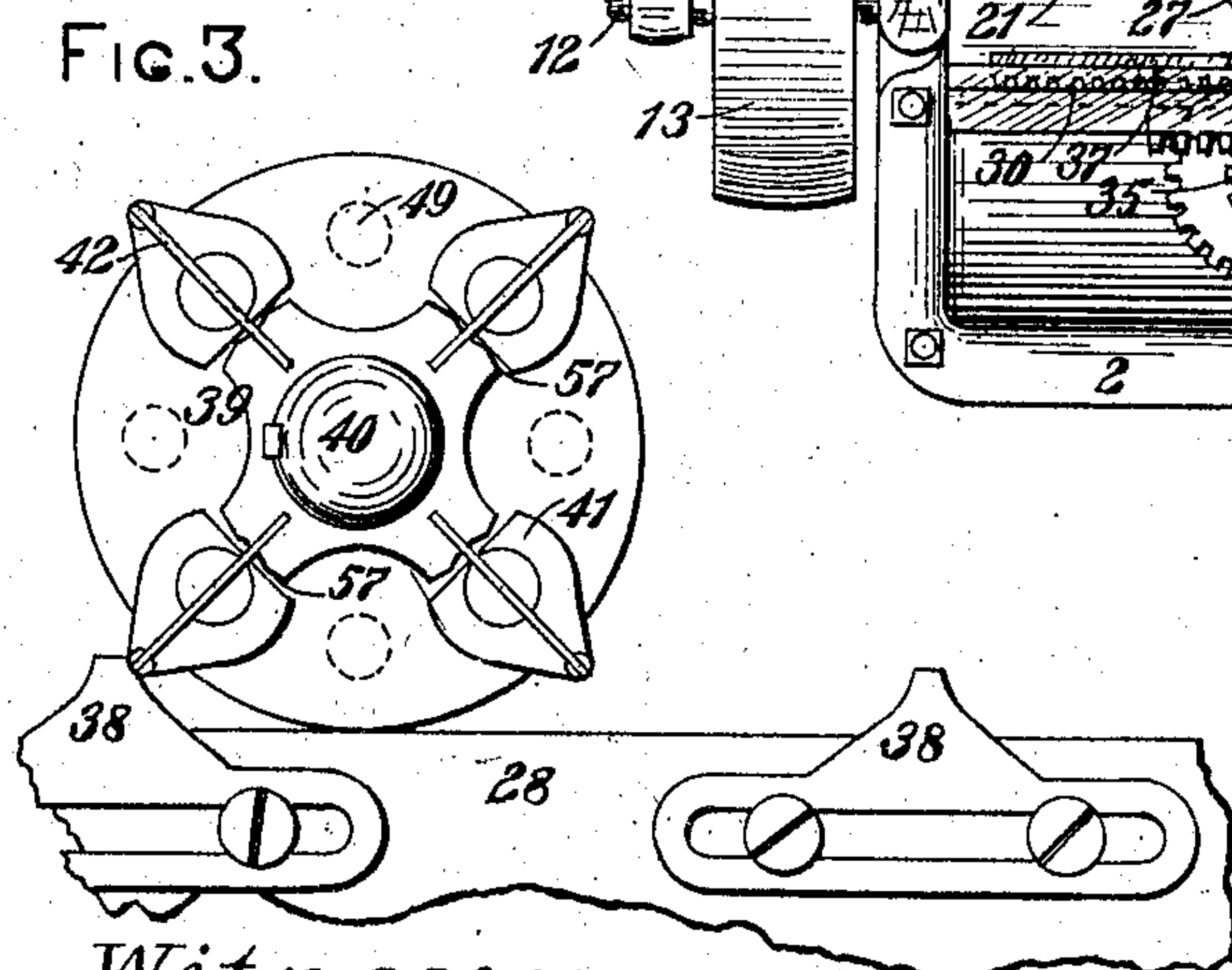
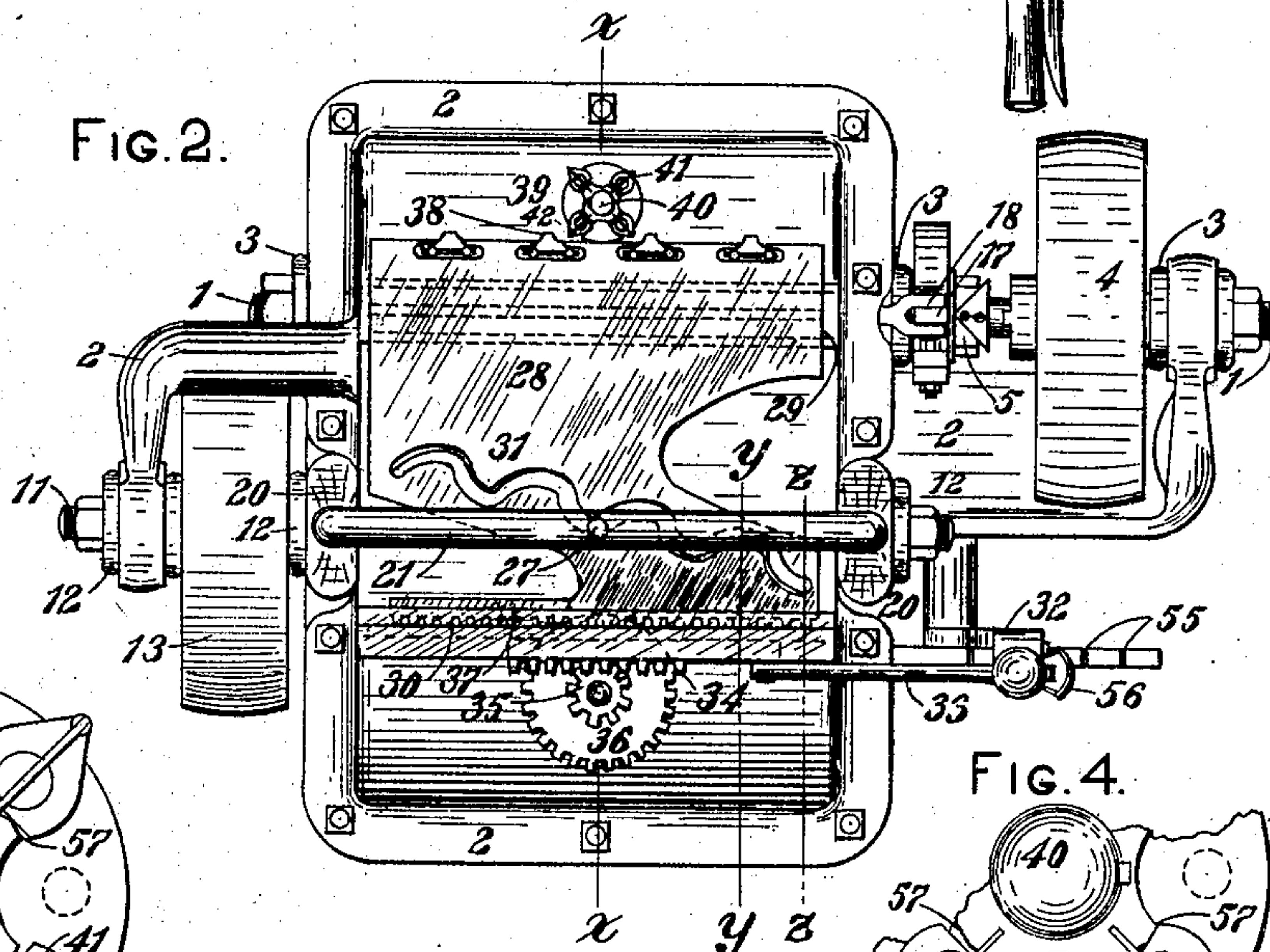
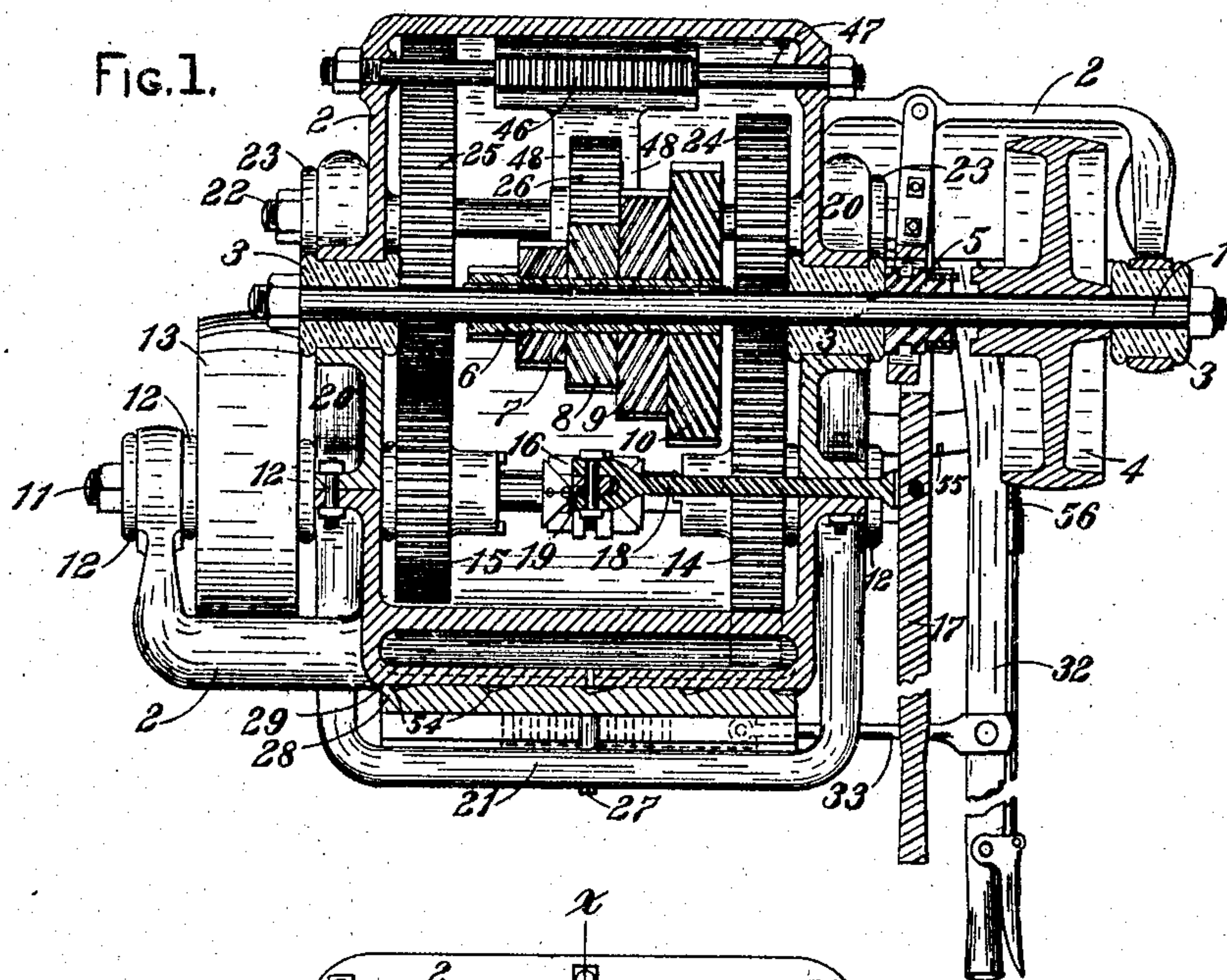


I. M. FOSTER.
VARIABLE SPEED MECHANISM.
APPLICATION FILED NOV. 8, 1904.

2 SHEETS—SHEET 1.



Witnesses:
Clarence L. Pordaw.
A. S. Ludlow

Inventor:
Isaac M. Foster
By James H. Causey
Attorney.

I. M. FOSTER,
VARIABLE SPEED MECHANISM.

APPLICATION FILED NOV. 8, 1904.

2 SHEETS—SHEET 2.

FIG. 5.

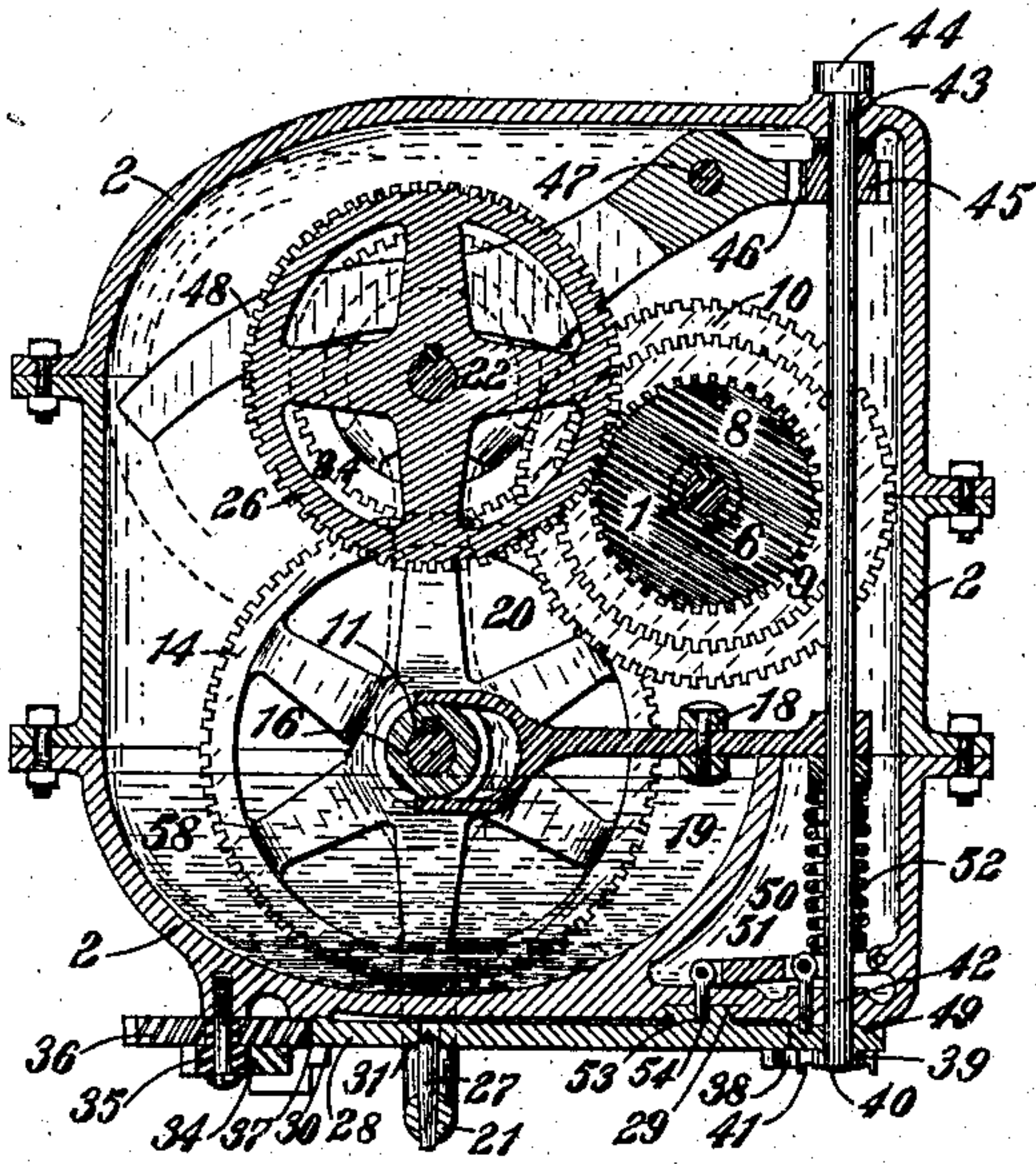


FIG. 8.

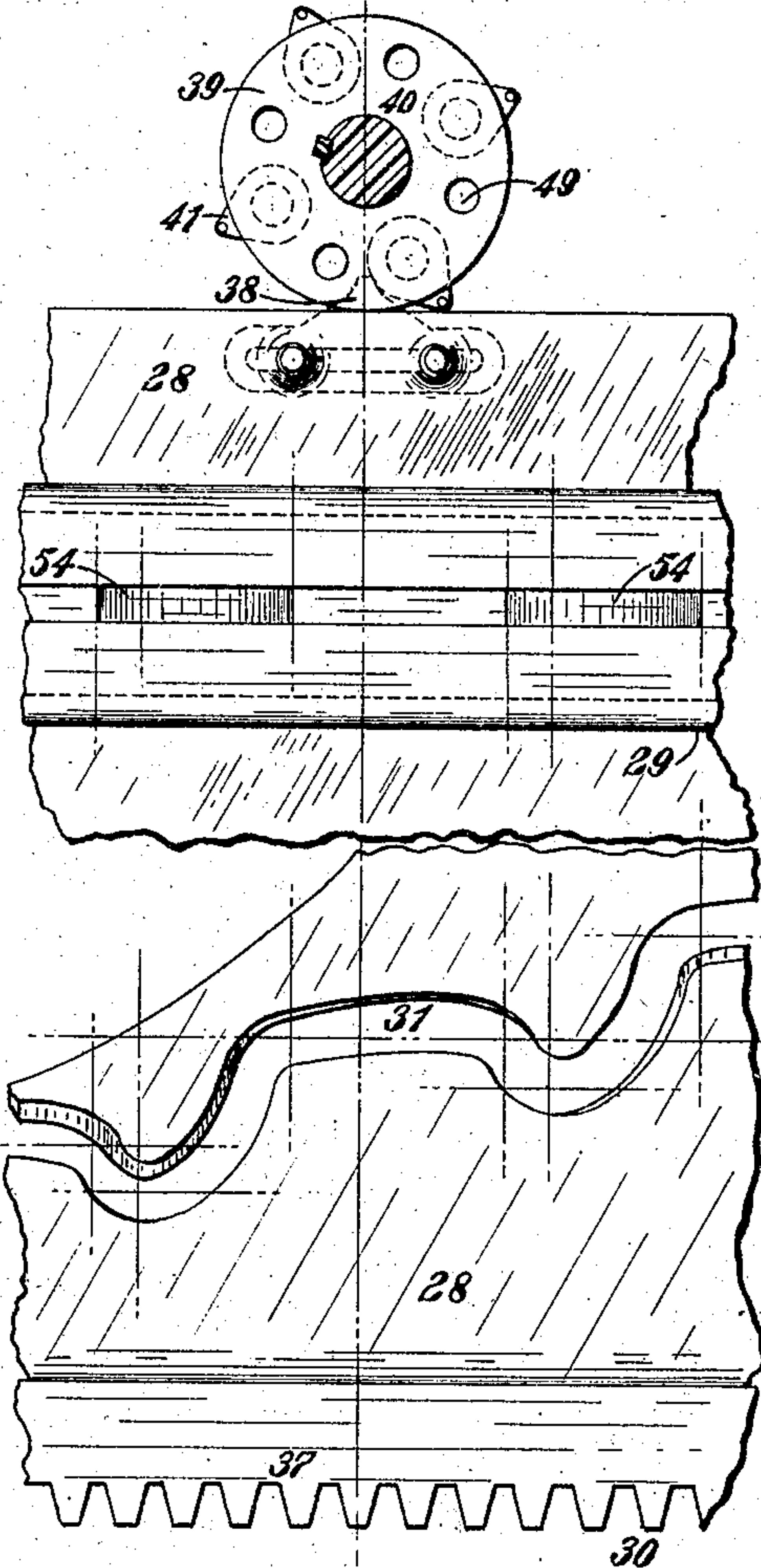


FIG. 6.

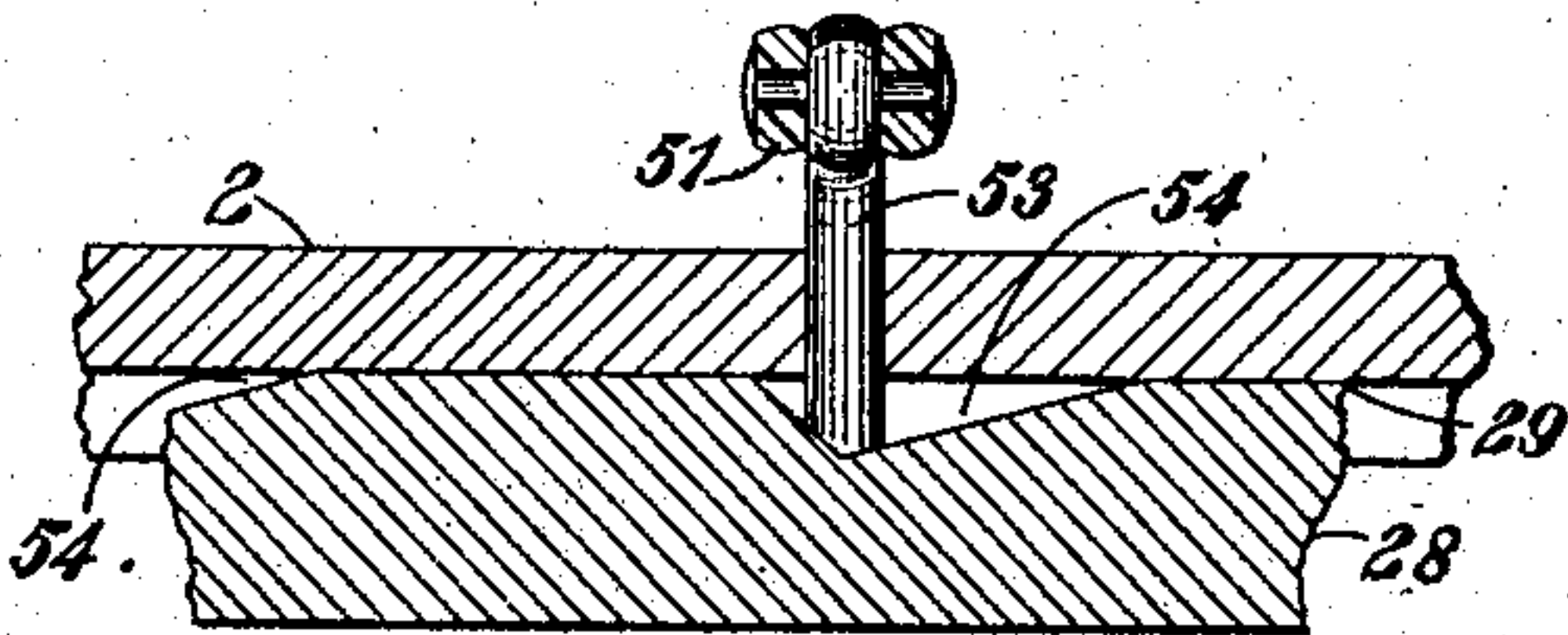


FIG. 7.

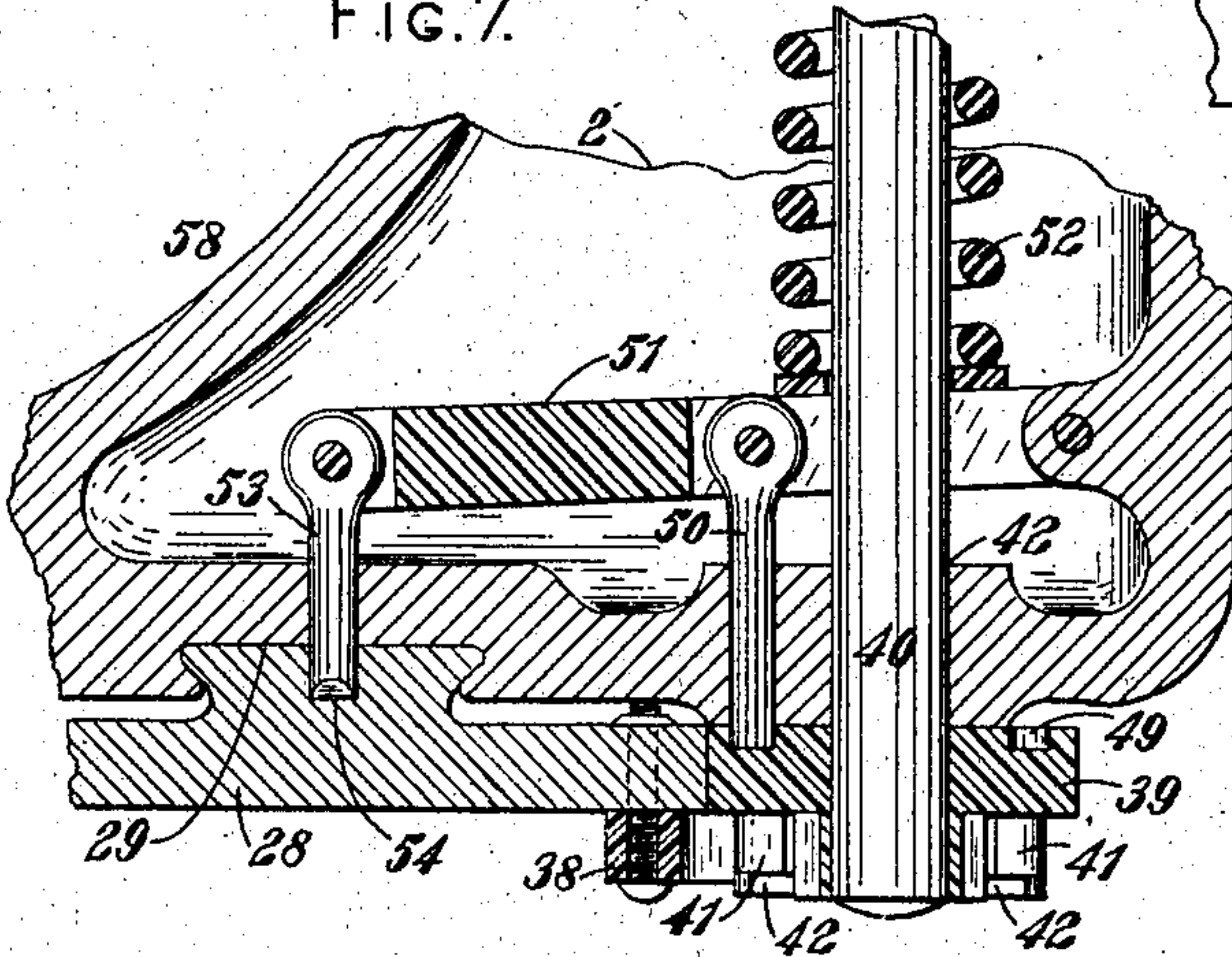


FIG. 9.

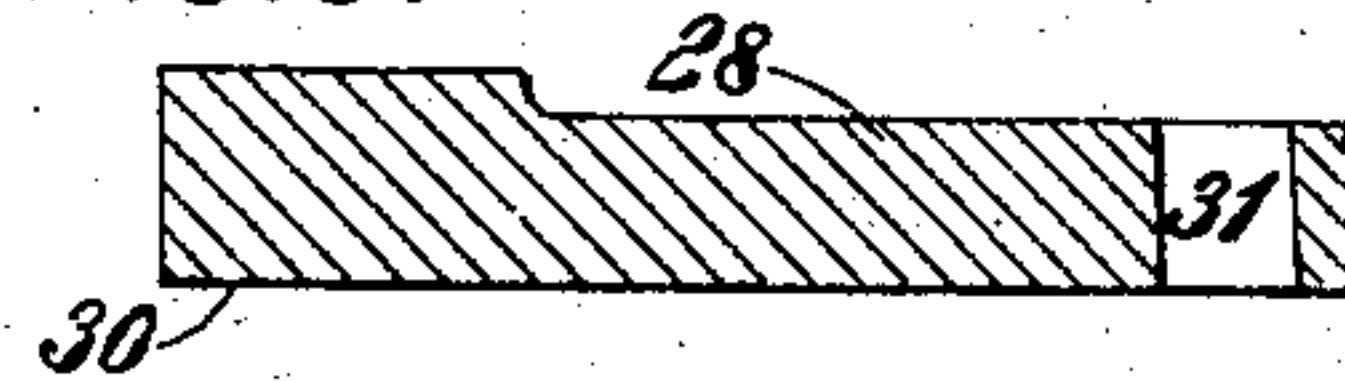
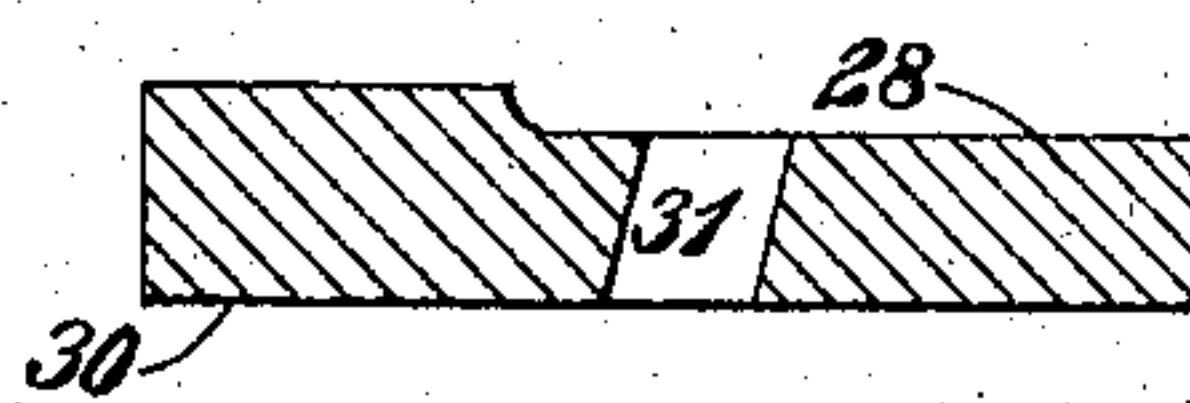


FIG. 10.



Witnesses:
Clarence L. Perdue.
A. S. Ludlow.

Inventor:
Isaac M. Foster
By James T. Rausey
Attorney.

UNITED STATES PATENT OFFICE.

ISAAC M. FOSTER, OF WEST COVINGTON, KENTUCKY.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 791,618, dated June 6, 1905.

Application filed November 8, 1904. Serial No. 231,882.

To all whom it may concern:

Be it known that I, ISAAC M. FOSTER, a citizen of the United States, residing at West Covington, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Variable-Speed Mechanism, of which the following is a specification.

My invention relates to apparatus for varying the speed of a machine by the application of power to it through different combinations of gear-wheels, the object being to provide a convenient means for forming a sufficient number of different combinations to give a machine the proper working speeds.

My invention consists in mounting the several gear-wheels in a manner and in providing such accessories that half the speed variations within the capacity of the machine may be obtained by the operation of a single lever and that all of them may be obtained by the operation of only two levers and in the combination and arrangement of parts, as will be more fully described herein.

In the accompanying drawings, Figure 1 is a vertical section through the center line of the driving-shaft. Fig. 2 is an inverted plan of my invention. Fig. 3 and Fig. 4 are enlarged inverted plan views of part of the gear-sliding accessories. Fig. 5 is a vertical section on the line *x x* of Fig. 2. Fig. 6 is an enlarged sectional detail of part of the locking device for the wheel shown in Figs. 3 and 4. Fig. 7 is an enlarged sectional detail of the wheel and part of the locking device. Fig. 8 is an enlarged plan of the wheel and parts of the cam-plate, showing the alinement of the various members. Fig. 9 and Fig. 10 are sections of the slotted portion of the cam-plate on the lines *y y* and *z z*, respectively, of Fig. 2, further illustrating the shape of the slot.

The construction of my invention is as follows:

The driving-shaft 1 is suitably journaled in the housing 2 at 3 and is provided with means for giving it constant motion, as at 4. The driving-shaft may be connected and disconnected by means of the clutch 5. Inside the housing 2 the shaft carries the gear-wheels 6, 7, 8, 9, and 10 of different diame-

ters and rigidly attached thereto. A driven shaft 11 is journaled in the housing at 12 and is provided with means for transmitting its motion to a machine of which the speed is to be varied, as at 13. Inside the housing the driven shaft carries loosely the large gear-wheel 14 and the small gear-wheel 15. Between these gear-wheels is a clutch 16 for rigidly connecting either of them to the shaft 11. This clutch is operated by the lever 17, the link 18, and the fork 19.

Pivoted concentrically with the gears 14 and 15, outside the housing, are the arms 20, which are rigidly connected under the bottom of the housing by the transverse portion 21 and extend upward to carry the intermediate shaft 22, which is journaled at 23 therein. Rigidly mounted on the intermediate shaft 22, within the housing, are the small gear-wheel 24 and the large gear-wheel 25, in mesh with the large gear-wheel 14 and the small gear-wheel 15, respectively. Between the gear-wheels 24 and 25 the gear-wheel 26 is feathered on the intermediate shaft 22 and may be placed in mesh with any one of the gear-wheels 6, 7, 8, 9, and 10 by swinging the arms 20, carrying the gear-wheel 26, far enough away from these gear-wheels to clear them in passing, sliding it along the shaft to a point opposite the gear-wheel desired in the combination, and then swinging the arms back, carrying the gear-wheel 26 into mesh with it.

The transverse portion 21 of the arms 20 has the pin 27 in its middle portion, and a cam-plate 28 is supported by the housing 2 at 29 and at 30 above the transverse portion of the arms. The cam-plate 28 is provided with the serpentine slot 31 for the guidance of the pin 27 projecting upward into it and is confined by its supports 29 and 30 to motion parallel to the shafts 1, 11, and 22. This motion is imparted to it by means of the lever 32, connected by the link 33 to the rack 34, the small gear 35, in mesh with this rack, and the large gear 36, rigidly attached to the small gear concentric therewith and in mesh with the rack 37 on the front edge of the cam-plate. This differential gearing is provided to obviate the long swing which the lever 32

would require if directly connected to the cam-plate in throwing the plate through its full stroke. This swing would be very objectionable in the long lever required when the counter-shaft is placed in the upper part of a room. The cam-plate 28 is cut away so it will not interfere with the arms 20 at any point of its stroke and is provided with the lugs 38, extending past its rear edge. The cam-wheel 39, rigidly mounted on the portion of the shaft 40 extending below the housing, has the pivoted lugs 41 on its lower face adapted to be engaged by the lugs 38 on the cam-plate. The shaft 40 is journaled in the housing 2 at 42 and 43, is supported by the head 44, and carries the pinion 45, rigidly attached near the bearing 43. The pinion 45 is in mesh with the rack 46, which slides on the guide 47, and has arms 48, flanking the gear-wheel 26, allowing it to revolve or be swung by the arms 20, but controlling its movement parallel to its shaft. The cam-wheel 39 has depressions 49 in its upper face to receive the locking-pin 50, extending through the housing, whereby the above-described mechanism may be held stationary. The locking-pin 50, which is attached to the lever 51, is held in the depression 49 by the spring 52 acting on the lever only when the pin 53, near one end of the lever, is in one of the depressions 54 in the cam-plate 28. The sides of the depressions 54 are inclined to the line of motion of the cam-plate, so as to gradually raise the pin 53. The lever 32 is provided with an arc having notches 55 and has suitable mechanism 56 for locking it in any one of the notches.

Beginning with the gear-wheel 26, in mesh with the gear-wheel 8, as shown, and unlocking the lever 32 and moving it continuously away from the housing 2, the cam-plate 28 will be moved in the same direction and the arms 20 will be caused by the sides of the slot 31 to swing the gear-wheel 26 away from the gear-wheel 8 far enough to clear the adjacent larger gear-wheel 9. Meanwhile the pin 53 has been raised by the side of the depression 54 unlocking the cam-wheel 39. The lug 38 now engages the pivoted lug 41, the spring 42 yields until the lug 41 engages the cam-wheel rigidly at 57, when the cam-wheel revolves, acting through the pinion 45 and the rack 46 to slide the gear-wheel 26 opposite the gear-wheel 9. When this has been accomplished, the engaging portions of the lugs 38 and 41 have become parallel to the line of motion of the cam-plate and the cam-wheel 39 ceases to revolve. The pin 53 begins to descend the side of the next depression 54, allowing the locking-pin 50 to enter the next depression 49 on the cam-wheel 39, preventing the gear-wheel 26 from leaving its new position longitudinally of its shaft. The part of the slot 31 now engaging the pin 27 causes it to swing the gear 26 into mesh with

the gear 9, effecting the new combination. The lug 38 now disengages the pivoted lug 41, which is thrown into its radial position again by its spring 42 ready to be engaged by the lug 38 on its return, thus making the operation reversible at will. The lever 32 is locked in the next notch 55, holding the cam-plate and the arms 20 stationary, thus maintaining the gear-wheels in mesh.

It will be seen that by means of the mechanism above described any of the gear-wheels 6, 7, 8, 9, and 10 may be made to revolve the driven shaft 11 either through the gear-wheels 24 and 14 or through the gear-wheels 25 and 15, permitting ten different speeds of the driven shaft 11 to be obtained from one speed of the driving-shaft 1 by the operation of the levers 17 and 32, which would operate through a comparatively short distance near the floor with the counter-shaft at a reasonable height. The sides of the slot 31 incline at a constantly-varying angle to allow the pin 27 to assume its various positions, as is suggested by the sections shown in Figs. 9 and 10. The construction of the entire machine is such that the housing 2 forms a practically dust-proof casing and has the oil-basin 58 in its lower portion for the lubrication of the gear-wheels.

It is obvious that my invention is adaptable for use with various forms of power-transmission mechanism and the precise construction here shown is not essential thereto except as set forth in the following claims.

I claim—

1. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a pivoted arm, a shaft mounted in said arm, a gear-wheel thereon adapted to mesh with any one of the gear-wheels on said driving-shaft, and a cam-plate adapted to operate said arm for the purposes specified.

2. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft, a gear-wheel thereon, a pivoted arm, an intermediate shaft mounted in said arm, a gear-wheel thereon, meshing with the gear-wheel on said driven shaft, a gear-wheel thereon adapted to transmit motion from any one of the said gears on said driving-shaft to said intermediate shaft, and a cam-plate adapted to operate said arm for the purposes specified.

3. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating said driving-shaft, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel thereon adapted to transmit motion from any one of said gear-wheels on said driving-shaft to

said intermediate shaft, and a cam-plate adapted to operate said arm for the purposes specified.

4. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for operating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof, but to rotate therewith and to transmit motion from any one of said gear-wheels on said driving-shaft to said intermediate shaft.

5. In a variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof, but to rotate therewith and to transmit motion from any one of said gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft and means whereby said cam-plate slides said gear-wheel lengthwise of its shaft for the purposes specified.

6. In a variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating said gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm, parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft and a gear-wheel thereon adapted to transmit motion from any one of said gear-wheels on said driving-shaft to said intermediate shaft, and a cam-plate confined to motion parallel to said shafts, adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft, a lug on said cam-plate, a cam-wheel adapted to be revolved intermittently by said lug, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shafts whereby said cam-plate slides said gear-wheel lengthwise of said shaft for the purposes specified.

7. In a variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in

said arm parallel to said driven shaft, a gear-wheel thereon meshing with the gear-wheel on the said driven shaft and a gear-wheel mounted thereon adapted to slide lengthwise thereof but to rotate therewith and to transmit motion from any one of the gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts and adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft, a lever differentially geared to said cam-plate, a lug on said plate, a cam-wheel adapted to be revolved intermittently by said lug, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear on said intermediate shaft whereby the cam-plate slides the gear-wheel lengthwise of the shaft by the operation of said lever for the purposes specified.

8. In a variable-speed mechanism, a driving-shaft, means for rotating the shaft, gear-wheels rigidly mounted on said shaft, a driven shaft journaled parallel to said driving-shaft, gear-wheels loosely mounted thereon, means for connecting said loosely-mounted gear-wheels rigidly to said driven shaft singly, arms pivoted concentric to said loosely-mounted gear-wheels, an intermediate shaft journaled therein parallel to said driven shaft, gear-wheels rigidly mounted thereon meshing with the loosely-mounted gear-wheels on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof but to rotate therewith, a cam-plate confined to motion parallel to said shafts, and adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel on said intermediate shaft with the gears on said driving-shaft a lug on said plate, a cam-wheel adapted to be revolved by said lug, a pinion rigidly connected to said cam-wheel, a rack to mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a lever connected to said cam-plate and means for locking said lever whereby said gear-wheel, slidably mounted on said intermediate shaft, is meshed and unmeshed, moved lengthwise on its shaft or maintained in mesh by the operation of said lever.

9. In a variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating said gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, a gear-wheel thereon adapted to transmit motion from any one of said gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts and adapted to swing said arm, a lug on said plate, a cam-

wheel adapted to be revolved intermittently by said lug, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a lever connected to said cam-plate and means for locking the lever whereby the slidably-mounted gear-wheel is meshed and unmeshed, moved lengthwise of its shaft or maintained in mesh by the operation of said lever.

10. In variable-speed mechanism, a driving-shaft, means for rotating said shaft, gear-wheels rigidly mounted on said shaft, a driven shaft journaled parallel to said driving-shaft, gear-wheels loosely mounted thereon, means for connecting said loosely-mounted gear-wheels rigidly to said driven shaft singly, arms pivoted concentric to said loosely-mounted gear-wheels, an intermediate shaft journaled therein parallel to said driven shaft, gear-wheels rigidly mounted thereon meshing with the loosely-mounted gear-wheels on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof but to rotate therewith, a cam-plate confined to motion parallel to said shafts and adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel on said intermediate shaft with the gears on said driving-shaft, a lug on said plate, a cam-wheel adapted to be revolved by said lug, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a lever geared to said cam-plate, and means for locking the lever, whereby said slidably-mounted gear-wheel on said intermediate shaft is meshed and unmeshed, moved lengthwise on its shaft or maintained in mesh by the operation of said lever.

11. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon in mesh with the gear-wheel on the driven shaft, and a gear-wheel thereon adapted to transmit motion from any one of the said gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts, adapted to swing said arm on its pivot to mesh and unmesh the slidably-mounted gear-wheel on said intermediate shaft, a lug on said cam-plate, a cam-wheel, a lug pivoted thereon adapted to be engaged by the lug on said cam-plate and to engage said cam-wheel to rotate it, a pinion rigidly secured to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a lever connected to the cam-plate and means for locking the lever.

12. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel thereon, adapted to transmit motion from any one of the said gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft, a lug on said cam-plate, a cam-wheel, means for automatically locking and unlocking the cam-wheel, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a lever connected to said cam-plate and means for locking the lever.

13. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel thereon adapted to transmit motion from any one of the gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts adapted to swing said arm on its pivot to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft, a lug on said cam-plate, a cam-wheel having a depression therein, a locking-pin, a spring engaging said locking-pin in said depression, means whereby said plate disengages said pin from within said depression, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a lever connected to said plate and means for locking the lever.

14. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driving-shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel thereon adapted to transmit motion from any one of the said gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts adapted to swing said arm on its pivot to mesh and unmesh the slidably-mounted

gear-wheel on said intermediate shaft, a lug on said cam-plate, a cam-wheel, means for automatically locking and unlocking the cam-wheel, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft, a rack on said cam-plate, a gear in mesh with said rack, a smaller gear rigidly secured to said gear concentric thereto, a shorter rack in mesh with said smaller gear, a lever, means for locking said lever, and a link pivoted to the lever and to said shorter rack for the purposes specified.

15. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driven shaft, a gear-wheel thereon in mesh with the gear-wheel on said driven shaft, and a gear-wheel thereon adapted to transmit motion from any one of the gear-wheels on said driving-shaft to said intermediate shaft, a cam-plate confined to motion parallel to said shafts, having surfaces inclined to the line of said motion and adapted to swing said arm on its pivot to mesh and unmesh the gear on said intermediate shaft, a lug on said cam-plate, a cam-wheel having a depression therein, a locking-pin, a lever attached thereto, a spring engaging said locking-pin in said depression, a pin attached to said lever and engaging said inclined surface on said cam-plate as, and for, the purposes specified.

16. In variable-speed mechanism, a driving-shaft, means for rotating the shaft, gear-wheels rigidly mounted on said shaft, a driven shaft journaled parallel to said driving-shaft, gear-wheels loosely mounted thereon, means for connecting said loosely-mounted gear-wheels rigidly to said driven shaft singly, arms pivoted concentric to said loosely-mounted gear-wheels, an intermediate shaft journaled therein parallel to said driven shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof but to rotate therewith, a cam-plate confined to motion parallel to said shafts and adapted to swing said arms to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft with the gears on said driving-shaft, a rack on said cam-plate, a gear in mesh with said rack, a smaller gear rigidly secured to said gear concentric thereto, a shorter rack in mesh with said smaller gear, a lever, means for locking the lever, a link pivoted to said lever and to said shorter rack, a lug on said cam-plate, a cam-wheel, a pivoted lug thereon adapted to be engaged by the lug on said cam-plate and to engage said cam-wheel to rotate it, a pinion rigidly

connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel slidably mounted on said intermediate shaft, whereby said gear-wheel is successively unmeshed, moved lengthwise of its shaft, meshed, and maintained in mesh by the operation of the lever connected to the cam-plate.

17. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driven shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof, but to rotate therewith, a cam-plate confined to motion parallel to said shafts and adapted to swing said arm to mesh and unmesh the gear-wheel slidably mounted on said intermediate shaft with the gears on said driving-shaft, a rack on said cam-plate, a gear in mesh with said rack, a smaller gear rigidly secured to said gear concentric therewith, a shorter rack in mesh with said smaller gear, a lever, means for locking said lever, a link pivoted to said lever and to said shorter rack, a lug on said cam-plate, a cam-wheel, a lug pivoted thereon yieldably held radially thereof and adapted to be engaged by the lug on said cam-plate regardless of the direction of motion of said plate parallel to the shafts, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion, an arm on said rack engaging the gear-wheel on said intermediate shaft and means for automatically locking and unlocking said cam-wheel for the purposes specified.

18. In variable-speed mechanism, a driving-shaft, gear-wheels thereon, means for rotating the gear-wheels, a driven shaft parallel to said driving-shaft, a gear-wheel thereon, an arm pivoted concentric to said gear-wheel, an intermediate shaft mounted in said arm parallel to said driven shaft, a gear-wheel thereon meshing with the gear-wheel on said driven shaft, and a gear-wheel mounted thereon to slide lengthwise thereof but to rotate therewith, a cam-plate confined to motion parallel to said shafts having surfaces inclined to the line of said motion and adapted to swing said arm to mesh and unmesh the gear-wheel on said intermediate shaft with the gears on said driving-shaft, a rack on said cam-plate, a gear in mesh with said rack, a smaller gear rigidly secured to said gear concentric therewith, a shorter rack in mesh with said smaller gear, a lever, means for locking said lever, a link pivoted to said lever, and to said shorter rack, a lug on said cam-plate, a cam-wheel having a depression therein, a lug pivoted thereon yieldably held radially thereof and adapted to be engaged and disengaged

by the lug on said cam-plate regardless of the direction of motion of said cam-plate parallel to the shafts, a locking-pin, a lever attached thereto, a spring engaging said locking-pin in
5 said depression, a pin attached to said lever and engaging said inclined surface, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion having an extension engaging the gear-wheel slidably mounted
10 on said intermediate shaft substantially as, and for, the purposes specified.

19. In variable-speed mechanism, a driving-shaft, means for rotating the shaft, gear-wheels rigidly mounted thereon, a driven
15 shaft, gear-wheels loosely mounted thereon, means for rigidly attaching the loosely-mounted gear-wheels to said driven shaft singly, arms pivoted concentric to said loosely-mounted gear-wheels, an intermediate shaft
20 journaled therein, gear-wheels rigidly mounted on said intermediate shaft and in mesh with said loosely-mounted gear-wheels, a gear mounted on said intermediate shaft to slide longitudinally thereof but to rotate
25 therewith and adapted to mesh with any one of the gear-wheels rigidly mounted on said driving-shaft and transmit motion to said intermediate shaft, a cam-plate confined to motion parallel to the shafts, having surface

inclined to the line of said motion and adapted to swing said arm on its pivot to mesh and
30 unmesh the gear slidably mounted on said intermediate shaft, a rack on said plate, a gear in mesh with said rack, a smaller gear rigidly connected to said gear concentric therewith,
35 a shorter rack in mesh with said smaller gear, a lever, means for locking the lever, a link pivoted to said lever and to said shorter rack, a lug on said cam-plate, a cam-wheel having a depression therein, a lug thereon yieldably
40 held radially thereof adapted to be engaged and disengaged by the lug on said cam-plate regardless of the direction of motion of said plate parallel to said shafts, a locking-pin, a lever connected thereto, a spring engaging
45 said locking-pin in said depression, a pin connected to said lever and engaging said inclined surface, a pinion rigidly connected to said cam-wheel, a rack in mesh with said pinion having an extension engaging the gear-wheel
50 slidably mounted on said intermediate shaft substantially as, and for, the purposes specified.

ISAAC M. FOSTER.

Witnesses:

JAMES N. RAMSEY,
CLARENCE L. PERDEW.