B. E. CLOUGH.

MECHANICALLY OPERATED HORSE POWER COMPUTING MACHINE.

APPLICATION FILED MAR. 4, 1916.

1,242,771.

Patented Oct. 9, 1917.

3 SHEETS—SHEET 1.

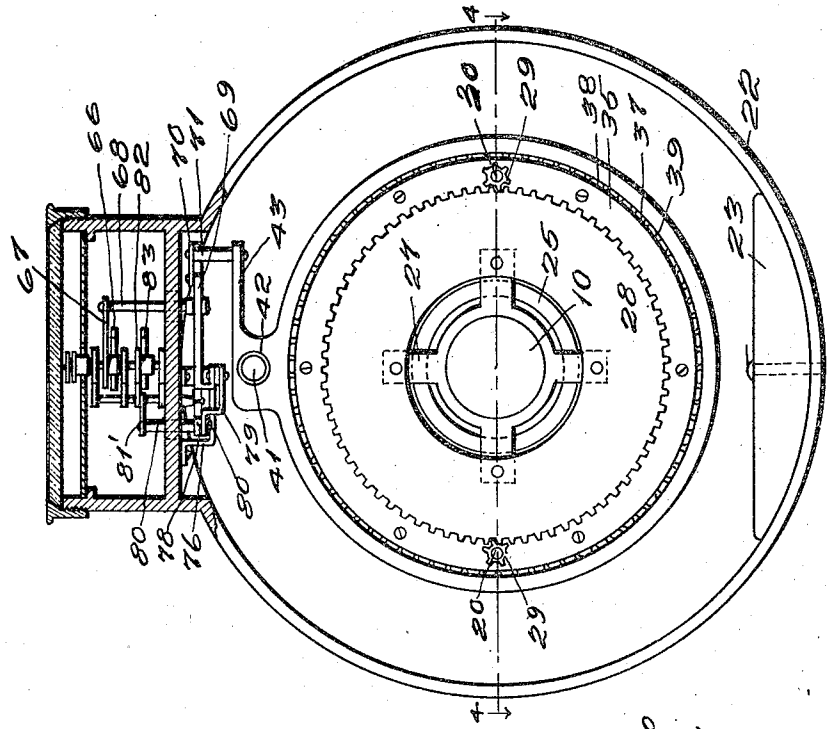


Fig. 1.

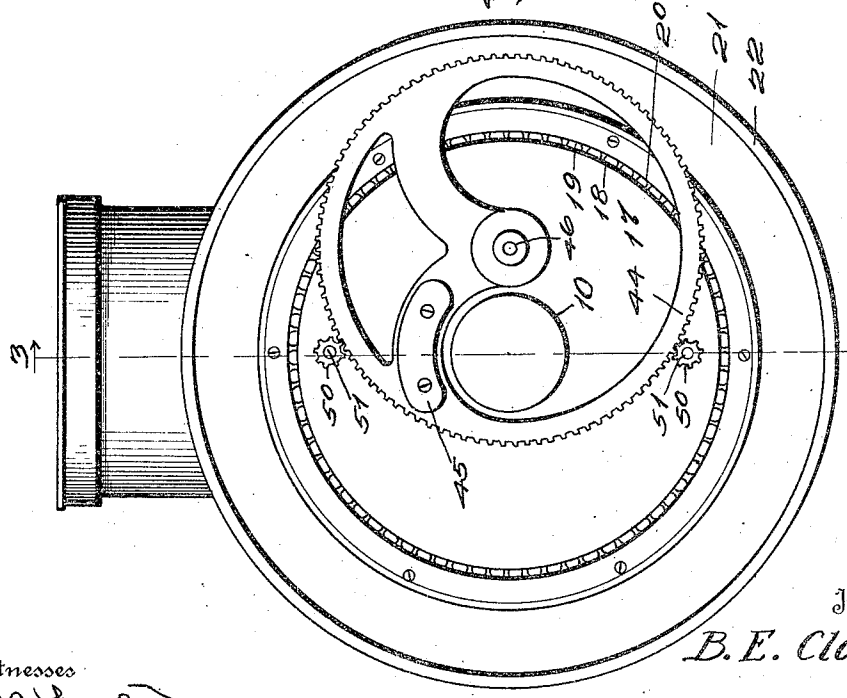


Fig. 2.

Witnesses

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3 SHEETS—SHEET 2.

Fig. 2.

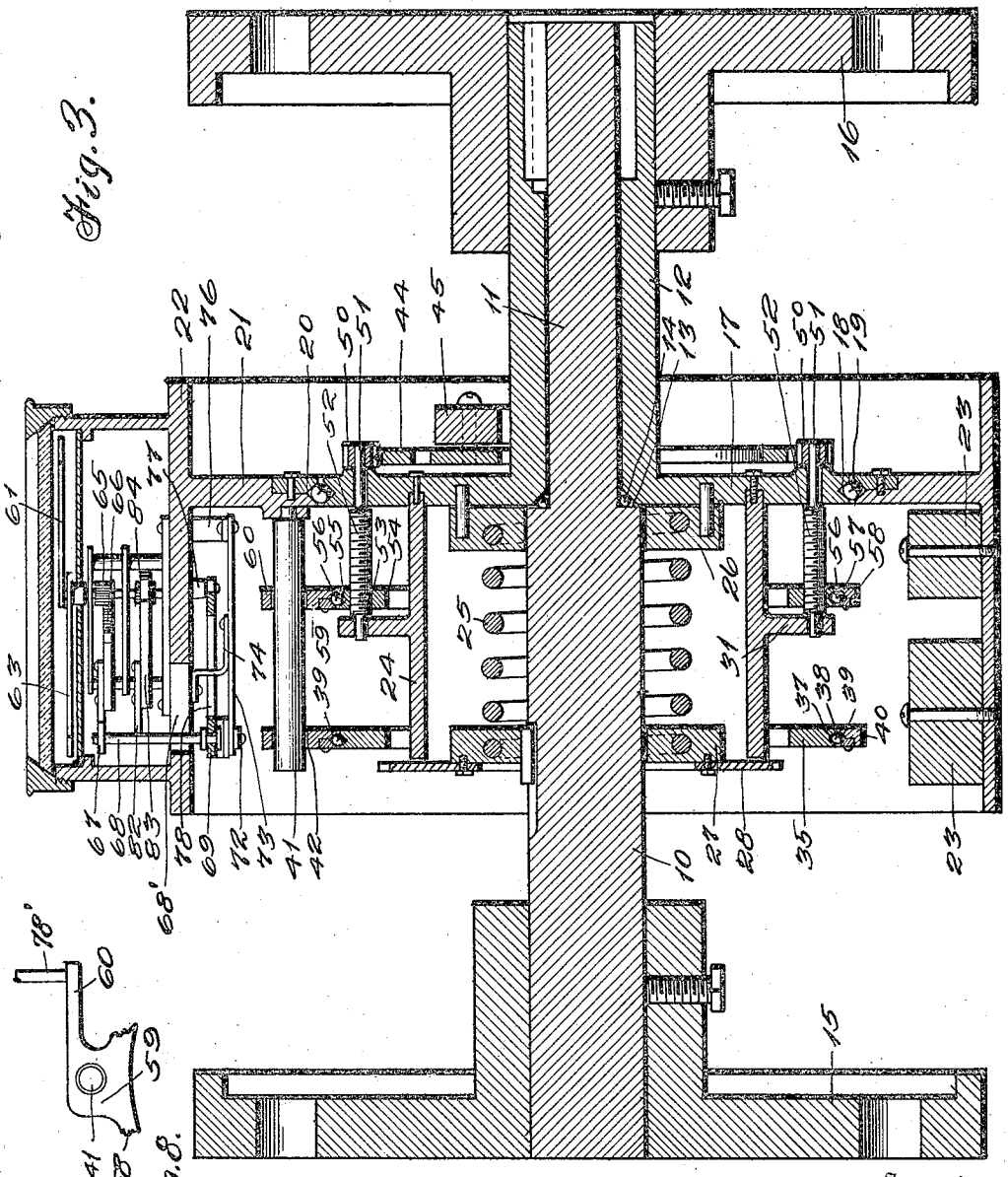


Fig. 8.

Witnesses

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3 SHEETS—SHEET 3.

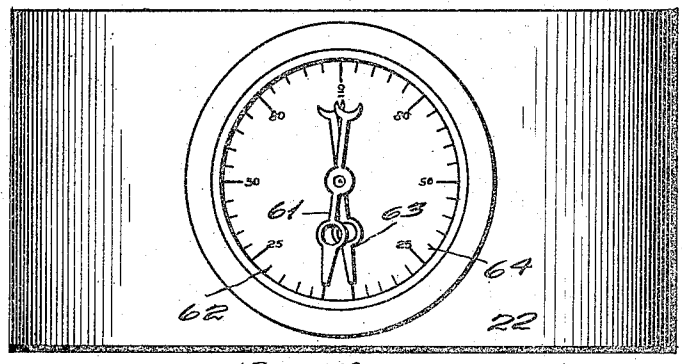


Fig. 5.

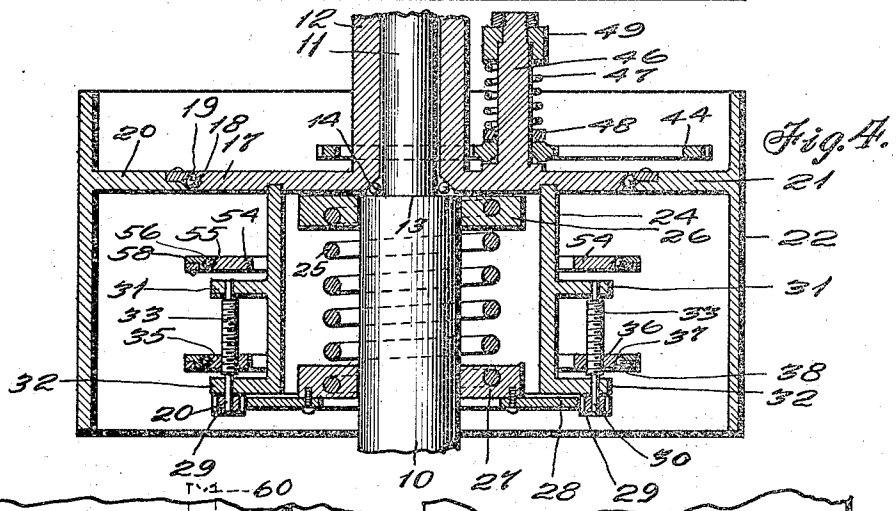


Fig. 4.

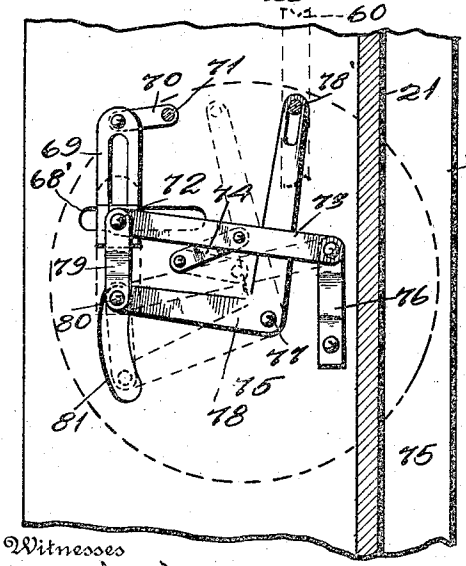


Fig. 6.

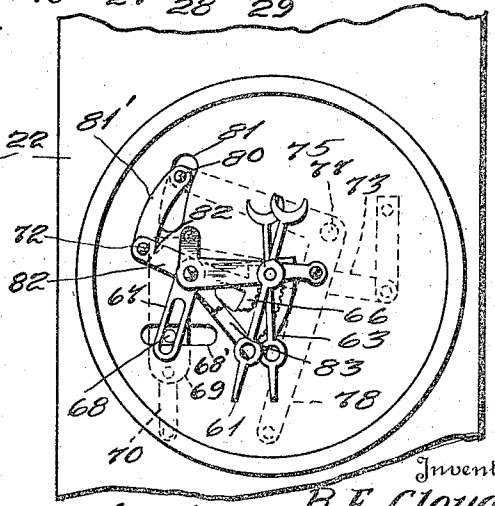


Fig. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

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MECHANICALLY-OPERATED HORSE-POWER-COMPUTING MACHINE.

1,242,771. Specification of Letters Patent. Patented Oct. 9, 1917.

Application filed March 4, 1916. Serial No. 82,264.

To all whom it may concern:

Be it known that I, BERT E. CLOUGH, a citizen of the United States, residing at Battle Creek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Mechanically-Operated Horse-Power-Computing Machines, of which the following is a specification.

My invention relates to improvements in apparatus for ascertaining or computing the horse power of a prime mover or motor, and preferably also for indicating the speed at which the horse power is determined.

An important object of the invention is to provide a machine of the above mentioned character, embodying wholly mechanical means for computing the horse power from the ascertained speed and torque.

A further object of the invention is to provide a machine of the above mentioned character, which is highly convenient in use, and reliable in operation.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation of the apparatus, the upper portion thereof being shown in section, for the purpose of illustration,

Fig. 2 is an elevation of the opposite side thereof,

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 2,

Fig. 4 is a horizontal sectional view taken on line 4—4 of Fig. 1,

Fig. 5 is a plan view of the gage mechanism,

Fig. 6 is a bottom plan view of lever mechanism to actuate the movable parts of the gage mechanism,

Fig. 7 is a plan view of the same, and,

Fig. 8 is a side elevation of a crank and associated elements.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates a main shaft having a reduced cylindrical portion 11, upon which is rotatably mounted a sleeve 12. The shaft 10 has shoulders 13, forming with the inner end of the sleeve 12 a cavity for the reception of bearing balls 14, as shown. Rigidly connected with the outer end of the shaft 10 is a disk 15, adapted to be clamped or otherwise connected with the rotatable member of the prime mover to be tested. Rigidly connected with the outer end of the sleeve 12 is a similar disk 16, to be clamped or rigidly connected with the rotatable member of the load.

The sleeve 12 is provided with a flange 17, provided upon its periphery with a groove or race-way 18 receiving bearing balls 19. These bearing balls also project into an annular groove or race-way 20, formed in a flange 21. The flange 21 is preferably formed integral with an annular housing or casing 22. The lower end of the housing or casing is equipped with a weight or weights 23, tending to hold the same stationary in a vertical position. Rigidly connected with the flange 17 is an inner housing 24.

The relative turning movement of the shaft 10 with respect to the sleeve 12 in a clockwise direction is opposed by a torque coil spring 25, one end of which is attached or anchored in a ring 26, rigidly attached to the flange 17. The other end of the spring 25 is attached or anchored within a ring 27, which is keyed or otherwise rigidly attached to the shaft 10.

Bolted or otherwise rigidly attached to the ring 27 for rotation therewith is a ring-gear 28, shown more clearly in Figs. 3 and 4. This ring-gear engages pinions or gears 29, carried by shafts 30. These shafts have their opposite ends rotatably mounted within openings formed in a flange 31 and lugs 32. The shafts 30 have their intermediate portions enlarged and screw-threaded, as shown at 33. The numeral 35 designates an inner shifting ring, having screw-threaded openings 36, receiving a screw-threaded portion 33 of the shafts 30. The inner shifting ring 35 is provided upon its periphery with an annular groove or race-way 37, receiving bearing balls 38, also operating within an inner annular groove or race-way 39, formed in an outer co-acting shifting ring 40. From the foregoing description it is obvious that when the shaft 10 turns with relation to the sleeve 12, the ring-gear 28 will turn the screw-threaded shafts 30 upon their axes, which will in turn move the co-acting shift-

ing rings 35 and 40 to the right. The inner shifting ring 35 is not only shifted to the right but must rotate with the shafts 30 and the housing 24, while the outer co-acting ring 40 is nonrotatable but is free to shift laterally. The rotation of the outer shifting ring 40 is prevented by the use of one or more guide studs or rods 41, rigidly attached to the flange 21. The guide rod 41 operates through an apertured head 42, formed integral upon the upper end of the outer shifting ring 40, as clearly shown in Fig. 1. The head 42, as shown in Fig. 1, carries a laterally extending crank 43, as shown.

Centrifugally operated means for operating the gage mechanism, comprises a centrifugal wheel or member 44, (Figs. 2 and 4) which is eccentrically pivoted upon the flange 17 and has a large opening for the reception of the sleeve 12 and has a weight 45. As clearly shown in Fig. 4, the wheel 44 is rotatably mounted upon a stud or trunnion 46, preferably cast integral with the flange 17. Surrounding this stud 46 is a torque coil spring 47, one end of which is attached to a ring 48 rigidly attached to the wheel 44. The outer end of the spring 47 is attached to a ring 49 clamped or otherwise rigidly secured to the stud 46. It is thus apparent that the spring 47 will oppose the clockwise rotation of the wheel or member 44, due to centrifugal action. The centrifugal wheel or member 44 is in the form of a gear wheel having gear teeth to engage gears or pinions 50, as shown more clearly in Figs. 2 and 3. These gears are rigidly mounted upon the shafts 51, journaled through openings in the flanges 17 and 31, as shown. The shafts 51 have intermediate enlarged screw-threaded portions 52, as shown. The screw-threaded portions 42 operate within screw-threaded openings 53, formed in an inner shifting ring 54. This inner shifting ring is provided with an outer groove or race-way receiving, bearing balls 56, also operating within an annular groove or race-way 57, formed in a co-acting outer shifting ring 58. This outer shifting ring 58 is provided with an apertured head 59 sliding upon the guide rod or stud 41, as more clearly shown in Fig. 3. The head 59 carries a laterally extending crank 60, as shown.

From the foregoing description, it is obvious that when the centrifugally operated wheel or member 44 turns upon its pivot, such turning movement will be imparted to the gears or pinions 50, which rotate the shafts 51. The rotation of the shafts 51, through the medium of their screw-threaded portions 52, cause the rings 54 and 58 to move laterally, the ring 54 revolving while the ring 58 is non-rotatable. The ring 58 is thus shifted to the right.

As clearly shown in Fig. 5, the numeral 61 designates a speed indicating hand or pointer, adapted to coöperate with a speed indicating scale 62. The numeral 63 designates a horse power hand or pointer coöperating with a scale 64, indicating horse power. The hand or pointer 63 receives its rotation from a pinion 65, engaged by a quadrant 66, (Figs. 3 and 7) which is turned by a slotted crank 67. This slotted crank receives a pivoted member 68, operating within a slotted slide 69. The pivot member 68 also operates in a guide slot 68′, as shown. This slotted slide has its outer end pivotally connected with a link 70, having pivotal connection with a stud 71, which is carried by the crank 43 of the shifting ring 40, as shown in Fig. 1. As more clearly shown in Fig. 6, the slide 69 has its end bent over and is pivoted at 72 with a lever 73. This lever 73 has pivotal connection between its ends with a lever 74, pivoted to a plate or base 75, as shown. The lever 73 is pivoted at its end with a lever 76, pivoted to the plate or base 75. Pivotally mounted upon the base 75, as shown at 77, is a bell crank lever 78. One arm of this bell crank lever is pivotally connected with a link 79, by means of a pivot member 80, operating within a slot 81. The link 79 is pivotally connected with the free end of the lever 73 and the slide 69 at the point 72. The upper end of the pivot element 80 extends upwardly beyond the base 75 and is pivotally connected thereabove with a link 81′. This link 81′ has pivotal connection with a crank 82, connected with a quadrant 83 engaging a pinion 84, which turns the pointer 61. Particular attention is called to the fact that the slots 68′ and 81 are arranged at substantially a right angle. When the lever 73 is swung to a position so that the pivot 72 coincides with the pivot 68, the movement of the slide 69 will impart no movement to the hand 63. When the lever 73 is moved in the opposite direction, the extent of movement that the slide 69 will move the pivot 63, correspondingly increases. The free end of the lever 78 has a pivot element 78′, secured to the crank 60 of the head 59, formed upon the ring 58. It is thus apparent that the pivot 68 will move the horse power indicating hand or pointer in accordance with the combined movement of the torque and speed shifting rings.

The operation is as follows:

The wheel 15 is clamped or otherwise rigidly attached to the rotatable member of a prime mover or motor while the wheel 16 is clamped to the rotatable member of the load. Upon starting the prime mover to be tested, there is very little, if any, load. As the speed builds up, the centrifugal wheel 44 turns upon its pivot 46, turning the pinions 50. The rotation of these pinions turns the

shafts 51, causing the rings 54 and 58 to move inwardly. The inward movement of the ring 58 is transmitted to the bell crank lever 78 through the medium of the crank 60 and associated elements. This movement of the bell crank lever swings the speed pointer or hand 61 to the left along the scale 62, thus indicating the speed at which the prime mover is operated. As the load is applied, the shaft 10 turns with relation to the sleeve 12. This turning movement is transmitted to the gear 28, which engages and drives the gears 29. The rotation of the gears 29 is imparted to the shafts 30, and the screw-threaded portions of these shafts shift the ring 35 inwardly toward the flange 31. This movement of the ring 35 affects a corresponding movement of the ring 40. The inward movement of the ring 40 is transmitted to its crank 43. The crank 43 swings the slide 69 upon its pivot 72, and the position of this pivot is determined by the position of the bell crank lever 78. The lateral inward movement of the slide 69 is imparted to the pivot element 68 operating in the slot 68′. This pivot element has connection with the crank 67, which turns the toothed segment 66, in turn operating the pointer 63. The pointer is thus made to travel to the right in proximity to the scale 64, for indicating the horse power of the prime mover.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:

1. In apparatus of the character described, a plurality of rotatable members adapted to turn with relation to each other and to be connected between a prime mover and the load, yielding means to oppose the turning movement of one member with relation to the other member, indicating mechanism operated by the relative turning movement of the members, and centrifugal means operated by one member and connected with the indicating mechanism to influence its action.

2. In apparatus of the character described, a plurality of rotatable members adapted to turn with relation to each other and to be connected between a prime mover and the load, yielding means to oppose the turning movement of one member with relation to the other member, indicating mechanism operated by the relative turning movement of the members, centrifugal means carried by the other member and operated thereby, and means connecting the centrifugal means and the indicating mechanism to influence the action of the indicating mechanism.

3. In apparatus of the character described, a pair of attaching members to be connected between the prime mover and the load and adapted to turn with relation to each other, yielding means to oppose the turning movement of one attaching member with relation to the other, a movable member, driving connecting means between one of the first named attaching members and the movable member, a second movable member connected with the first named movable member and adapted to be shifted thereby, centrifugally operated means connected with the other attaching member, driving connecting means between the centrifugally operated means and the second named movable member, and indicating mechanism actuated by the second named movable member.

4. In apparatus of the character described, a pair of members to be connected between the prime mover and the load and adapted to be turned with relation to each other, yielding means to oppose the relative turning movement of the members, a pivoted lever, driving connecting means between the pivoted lever and one member, a second pivoted lever connected with the first named pivoted lever and adapted to be shifted thereby, a centrifugally operated member carried by the other of said members, driving connecting means between the centrifugally operated member and the second named lever, and indicating mechanism actuated by the second named lever.

5. In apparatus of the character described, a support provided with a slot, a slotted slide mounted to move upon the support, a lever pivoted to the support and having pivotal connection with the slide to move it longitudinally and thereby shift its pivot point, a pivot element operating in engagement with the slotted slide and within the slot of the support, indicating mechanism moved by the pivot element, a pair of members to be arranged between a prime mover and the load and adapted to turn with relation to each other, yielding means to oppose the turning movement of one member with relation to the other, means operated by the turning movement of one member with relation to the other to swing the pivoted lever, centrifugally operated means carried by the other member, and means operated by the centrifugally operated means to move the slotted slide.

6. In apparatus of the character described, a support having a slot formed therein, a slotted slide mounted upon the support and adapted to move longitudinally transversely across the slot, an element pivoted to the slotted slide and adapted to shift it longitudinally, centrifugally operated means to

move the element, torque operated means to swing the slotted slide upon its pivot, and indicating mechanism embodying an element projecting into the slotted slide to be moved thereby.

7. In apparatus of the character described, a shaft, a sleeve rotatable upon the shaft, an attaching member secured to one end of the shaft, a second attaching member secured to the sleeve, a torsional coil spring connected with the shaft and sleeve to oppose their relative turning movement, a gear connected with the shaft for rotation therewith, a laterally movable outer ring, relatively stationary guide means for the ring, an inner ring connected with the outer ring and rotatable with relation thereto and adapted to shift the first named ring laterally and having screw-threaded openings formed therein, screw-threaded shafts arranged near the first named shaft and having engagement within the screw-threaded openings of the inner ring, pinions secured to the screw-threaded shafts and engaging the gear, and indicating mechanism operated by the movement of the outer ring.

8. In apparatus of the character described, a shaft, a sleeve rotatably mounted upon the shaft and being provided with a radially extending flange, an attaching member secured to the shaft, a second attaching member secured to the sleeve, a torsional coil spring connected with the shaft and sleeve to oppose their relative turning movement, a gear connected with the shaft for rotation therewith, a relatively stationary support carried by the flange, guide pins connected with the relatively stationary support, a laterally movable outer ring having openings to receive the guide pins, an inner ring connected with the outer ring and rotatable with relation thereto and adapted to shift the first named ring laterally and having screw-threaded openings formed therein, a supporting member secured to the relatively stationary support, screw-threaded shafts carried by the supporting member and having engagement within the screw-threaded openings of the inner ring, pinions secured to the screw-threaded shafts and engaging the gear, and indicating mechanism operated by the lateral movement of the outer ring.

In testimony whereof I affix my signature in presence of two witnesses.

BERT E. CLOUGH.

Witnesses:
ALBERT N. FORD,
VIOLA G. HUGGETT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents Washington, D. C."