S. A. ELLETT.

AUTOMATIC CHANGE SPEED GEARING.

APPLICATION FILED APR. 30, 1919.

1,320,460.

Patented Nov. 4, 1919.

2 SHEETS—SHEET 1.

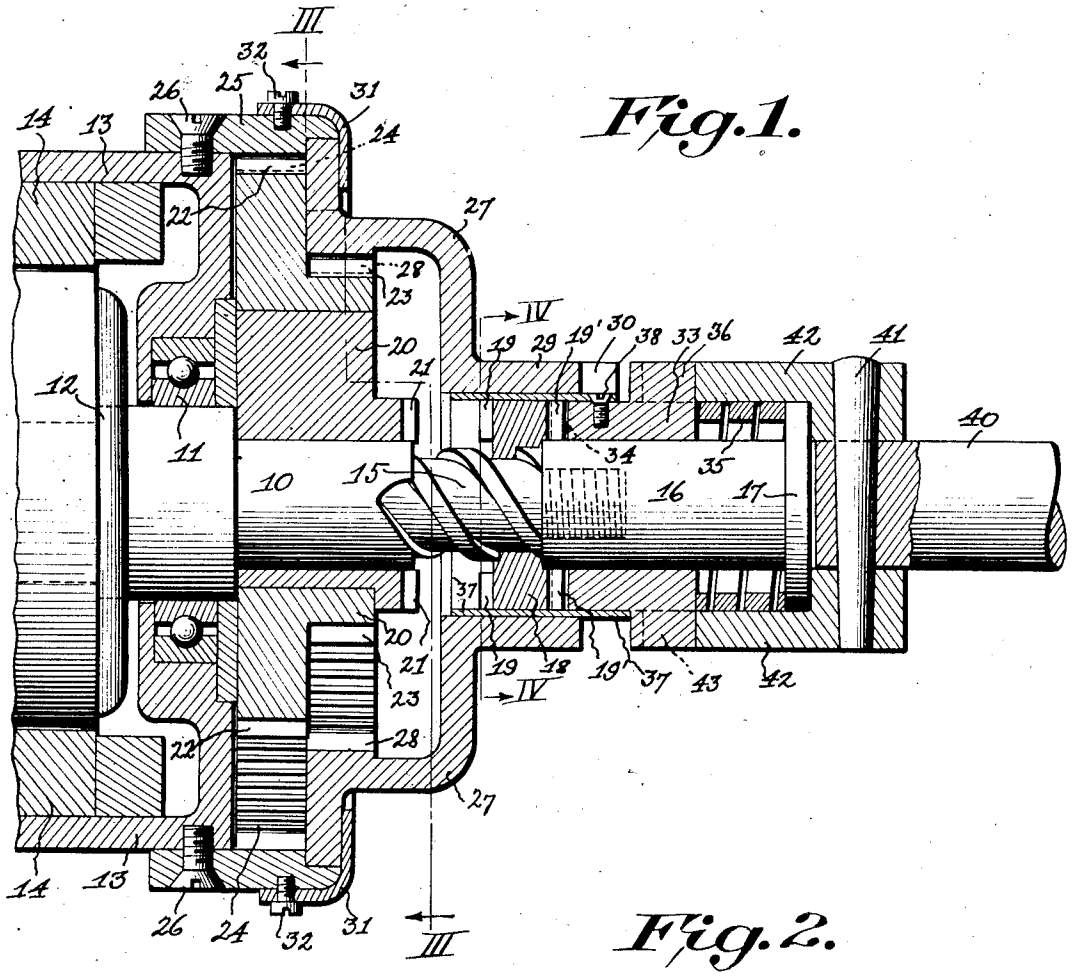
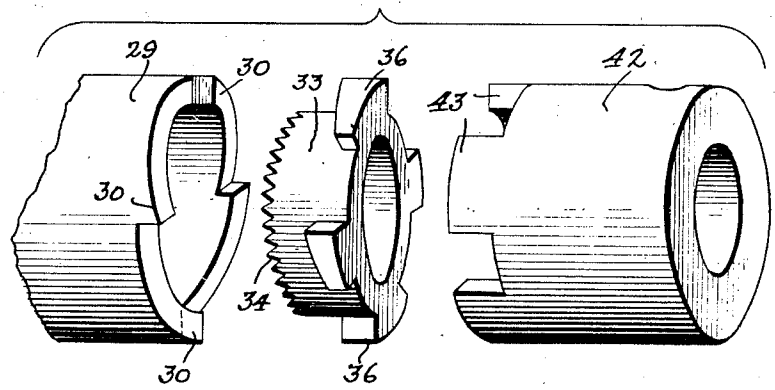


Fig. 1.

Fig. 2.



Witness.

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2 SHEETS—SHEET 2.

Fig. 3.

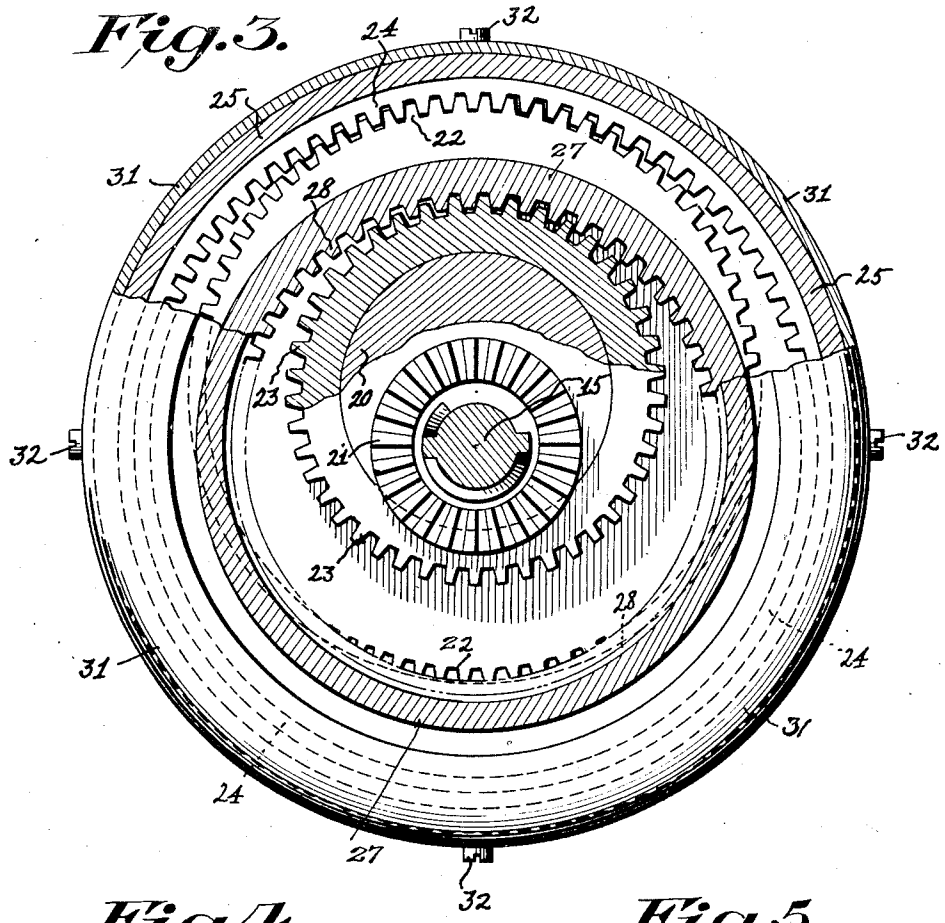


Fig. 4.

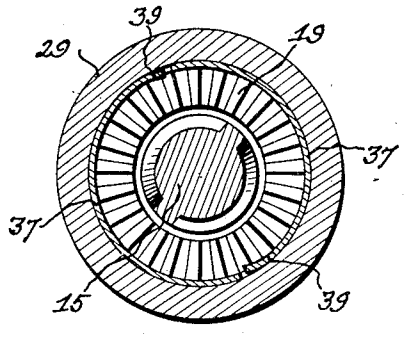
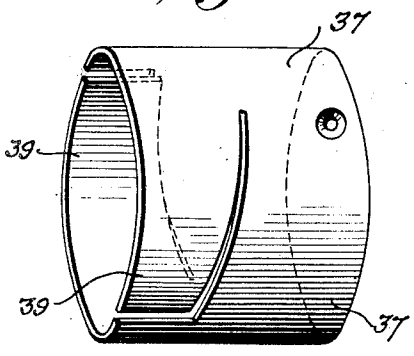


Fig. 5.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC CHANGE-SPEED GEARING.

1,320,460. Specification of Letters Patent. Patented Nov. 4, 1919.

Application filed April 30, 1919. Serial No. 293,779.

To all whom it may concern:

Be it known that I, STEPHEN A. ELLETT, a citizen of the United States, residing at Elmira, in the county of Chemung and State of New York, have invented certain new and useful Improvements in Automatic Change-Speed Gearing, of which the following is a specification.

My invention relates to change speed gearing, and more particularly, in some of its aspects, to gearing for interposition between two rotating parts, either of which may be the driver, and whereof the first, when operating as the driver, rotates the second at relatively low speed, whereas the second, when operating as the driver rotates the first at equal speed.

Gearing of this nature has many uses, one of which is its capability of being used with the electric equipment for automobiles, trucks and the like in connection with the operation of a dynamo-electric machine as a motor for starting a gas engine or as a generator driven by the gas engine. Acting as a motor the dynamo may best operate through a reduction gear to drive the engine shaft at slow speed with high torque, operating as an engine driven generator, the armature of the dynamo may be sufficiently and properly rotated at engine speed.

The objects of my invention are to provide a construction of the character above indicated in which the electric starting motor and the generator are combined in the same electric unit and to provide a mechanism of very simple arrangement, involving a minimum number of parts, each simple, durable, and easily manufactured or repaired and all related in such a manner for automatically and efficiently changing the gear ratio between electric unit and gas engine and allowing the gas engine to drive the electric unit instead of being driven by the same, thus the electric unit operates as a starting motor or a generator and the gear ratio through the electric unit to the gas engine is automatically taken care of by the herein disclosed invention.

Other and further objects of my invention will become apparent to those skilled in the art from the following description.

My invention consists of structural characteristics and relative arrangements of elements which will be hereinafter more fully described and particularly pointed out in the appended claims.

In the drawings, in which similar reference characters indicate the same parts, in the several figures of the drawings,

Figure 1 is a longitudinal vertical sectional view with parts in elevation, through a structure embodying my invention in association with a dynamo-electric machine;

Fig. 2, represents detached and perspective views of several of the elements comprising the change speed gearing;

Fig. 3, is a vertical sectional view taken on line III—III of Fig. 1;

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

Fig. 5, is a perspective of another element of the change speed gearing.

Referring to the drawings, 10 is a shaft or one of the rotatable members, and in the case illustrated is supported in the well-known form of ball-bearing 11, and fixed to the armature 12 of the usual electric motor or generator. 13 is the fixed casing which supports or carries the field magnets 14 of the electric motor-generator as is common in this class of apparatus and forms no part of the present invention. The shaft 10 is provided with a threaded portion 15 and an extension 16 having an enlarged end 17 secured to its end opposite to that of the armature 12. A nut 18 engages the threaded portion 15 of the shaft 10 and is provided with teeth or projections 19 and 19′ on its opposite faces for purposes to be presently described. Rotatably supported on the section of the shaft 10 connected with the armature 12 is an eccentric bushing 20 having on its outer end or face teeth or projections 21, adapted to be engaged by the teeth 19 on nut 18. Surrounding said eccentric bushing 20 and capable of being supported thereon as a bearing is a larger spur gear 22 and a smaller spur gear 23 integrally formed or united so that they will rotate about the axis 10 in unison or as one gear. 24 is a stationary internal gear made integral with or secured to a hollow cylindri-

cal extension 25 which is fastened to the body or casing 13 of the motor by means of screws 26. 27 is a rotating hollow sleeve having an internal gear 28 engaging the smaller spur gear 23 and a reduced cylindrical extension 29 provided with cam surfaces and notches 30, as shown in Figs. 1 and 2, and for purposes to be presently described. Said sleeve 27 is held in proper relation with respect to the gear 28 and permitted to rotate about the shaft 10 by means of a combined dust excluding and oil retaining cap 31, secured to the stationary hollow extension 25 by means of screws 32 as shown in Figs. 1 and 3.

Rotatably supported and surrounding the extension 16 of the shaft 10 is a member 33 having teeth or projections 34, see Figs. 1 and 2, for engaging the corresponding teeth or projections 19′ on nut 18, said member 33 being normally pressed toward the nut 18 and extension 29 and notches 30 of sleeve 27 by means of coil spring 35 interposed between said member 33 and enlarged end 17 of the shaft extension 16. On the rotatable member 33 are also formed a series of cam surfaces and notches 36 (see Fig. 2) adapted to engage and coöperate with the cam surfaces and notches 30 on the adjacent extension 29 of sleeve 27, and 37 is a retarder or clutching sleeve (see Figs. 4 and 5,) which is secured at one end by means of a screw 38 or other means to the rotatable member 33, and is so arranged and interposed between the extension 29 and nut 18 as to have its inwardly springing sections 39 have not only a frictional and clutching engagement with said nut 18 so as to grip and revolve it on the threaded portion 15 of shaft 10, but also forming a retarding member when the gas engine is at rest for purposes as will be presently understood.

40 is the rotary shaft which is fastened to the gears or other suitable means for conveying rotary motion to the gas engine shaft for the purpose of starting the gasolene motor and needs no further illustration. Attached to the end of this shaft 40 by means of a pin 41 or other means, is a hollow cylindrical prolongation 42 (see Figs. 1 and 2), adapted to surround the extension 16, enlarged end 17 and coil spring 35 and is provided at its end with projections or notches 43 which are adapted to be always in engagement with the similarly disposed notches and projections 36 on rotatable member 33.

The parts being constructed and arranged as herein described, the operation of the device is as follows:

On energizing the electric motor the armature 12 is rotated which transmits its motion to the shaft 10 and threaded portion or spiral 15 causing the non-rotatable clutch nut 18 to be pulled over and forcing the projections or teeth 19 on said nut 18 in engagement with the projections or teeth 21 of the eccentric bushing 20 and hence locking said bushing 20 to the shaft 10; thereby revolving the bushing 20 in unison with the shaft 10. Motion in an opposite direction is then imparted to the larger spur gear 22 which meshes with the stationary internal gear 24 and the corresponding rotation of the smaller spur gear 23 meshing with the internal gear 28 causes the sleeve 27 to rotate about the shaft 10. During the foregoing described operation the member 33 is continuously in engagement with the sleeve 27 by reason of the fact that the coil spring 35 constantly forces the projections or notches 36 on member 33 in engagement with the notches or projections 30 on the extension 29, of said sleeve 27, and as previously described, the notches or projections 36 of member 33 are always in engagement with the notches or projections 43 on cylindrical prolongation 42 keyed to shaft 40, and hence the rotation of the armature 12 and shaft 10 is transmitted to gas engine shaft through the various elements 12, 10, 18, 20, 22, 24, 23, 28, 27, 33, 42 and 40 in the order recited, and the gears may be so proportioned and laid out for any reduction and while I have shown the spur gear 22 with sixty-four teeth, spur gear 23 with forty-two teeth, internal gear 24, with seventy-six teeth and internal gear 28 with fifty-four teeth any other ratios may be used if so desired.

After the gas engine has been started by the rotation of the shaft 40, the rotatable member 33 is able to spring out and disconnect the sleeve 27 by reason of their coöperating cam surfaces disengaging the notches and projections 30 and 36 on said sleeve 27 and member 33 as will be readily understood by reference to Fig. 2, when the energizing current is shut off in the electric motor and the armature 12 and shaft 10 come to rest. Shaft 40 still rotating and driven by the gas engine causes the prolongation 42 and member 33 to continue to revolve and the retarder or clutching sleeve 37 attached to member 33 and frictionally engaging the nut 18 rotates said nut 18 on the threaded portion 15 in such a manner as to force its teeth or projections 19′ to engage the teeth or projections 34 on said member 33 and at the same time compress the spring 35 and draw the projections and notches 36 on the member 33 from any possible engagement or interference with the projections and notches 30 on sleeve 27. When the parts are in this last described position and relation, the electric motor with its armature is driven as an electric generator by the gas engine through the elements

40, 42, 33, 18, and 10, in the order given with ratio of one to one, and shaft 10 and armature 12 making one revolution to one of shaft 40, directly connected and without intermediate gears.

From the foregoing disclosure of the construction and operation of my gearing it will be seen that all the objects and advantages recited in the statement of invention have been fully and efficiently carried out and of such form as will not necessitate the use of highly skilled mechanics to assemble or repair the same.

It is obvious that various other forms and modifications may be made without departing from the essential features and principle of my invention and I do not wish to be understood as limiting myself to the specific and preferred construction herein shown and described.

What I claim is:—

1. A change speed gearing comprising a rotatable shaft, a clutching nut carried by said shaft, means on said shaft for engaging and reciprocating said clutching nut, spur gears, means engaged by said nut for rotating said spur gears, a fixed gear in mesh with one of said spur gears, a rotatable sleeve constructed and arranged to be rotated by another of said spur gears and having means for interlocking with a member rotatable about and movable on said shaft, a member rotatable about and movable on said shaft and having means for engaging and interlocking with said sleeve, means on said rotatable and movable member for engaging said clutching nut and disengaging said nut from the means for rotating said spur gears, a second rotatable shaft and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

2. A change speed gearing comprising a rotatable shaft, a clutching nut carried by said shaft, means on said shaft for engaging and reciprocating said clutching nut on said shaft, spur gears surrounding and rotatable about said shaft, means engaged by said nut for rotating said spur gears, a fixed internal gear surrounding said shaft and in mesh with one of said spur gears, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with another of said spur gears, a member rotatable about and movable on said shaft and having notches adapted to be engaged or disengaged by said notches on said sleeve, means on said rotatable and movable member for engaging said clutching nut and disengaging said nut from the means for rotating said spur gears, a second rotatable shaft and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

3. A change speed gearing comprising a rotatable shaft, a clutching nut carried by said shaft, means on said shaft for engaging and reciprocating said clutching nut on said shaft, connected spur gears surrounding and rotatable in unison about said shaft, means engaged by said nut for rotating said spur gears, a fixed internal gear surrounding said shaft and in mesh with one of said spur gears, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with another of said spur gears, a member rotatable about and movable on said shaft and having notches adapted to be engaged or disengaged by said notches on said sleeve, means on said rotatable and movable member for engaging said clutching nut and disengaging said nut from the means for rotating said spur gears, a second rotatable shaft and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

4. A change speed gearing comprising a rotatable shaft, a clutching nut carried by said shaft, means on said shaft for engaging and reciprocating said clutching nut on said shaft, two united spur gears of different diameters surrounding and rotatable in unison about said shaft, means engaged by said nut for rotating said spur gears, a fixed internal gear surrounding said shaft and in mesh with the spur gear of larger diameter, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with the spur gear of smaller diameter, a member rotatable about and movable on said shaft and having notches adapted to be engaged or disengaged by said notches on said sleeve, means on said rotatable and movable member for engaging said clutching nut and disengaging said nut from the means for rotating said spur gears, a second rotatable shaft and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

5. A change speed gearing comprising a rotatable shaft, a clutching nut carried by said shaft, a threaded portion on said shaft for engaging and reciprocating said clutching nut on said shaft, two united spur gears of different diameters surrounding and rotatable about said shaft, means engaged by said nut for rotating said spur gears, a fixed internal gear surrounding said shaft and in mesh with the spur gear of larger diameter, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with the spur

gear of smaller diameter, a member rotatable about and movable on said shaft and having notches adapted to be engaged or disengaged by said notches on said hollow sleeve, means on said rotatable and movable member for frictionally engaging said clutching nut to prevent rotation of said nut about the shaft, and means for disengaging said nut from the means for rotating said spur gears and locking said rotatable and movable member and nut to the shaft to rotate therewith, a coil spring normally forcing said movable member into engagement with said sleeve and nut, a second rotatable shaft, and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

6. A change speed gearing comprising a rotatable shaft, a clutching nut carried by and reciprocable on said shaft, means on said shaft for engaging and reciprocating said clutching nut on said shaft, a bushing eccentrically supported and rotatable about shaft, spur gears carried by and surrounding said bushing and shaft, means on said bushing and nut for locking the same together and rotating said bushing and spur gears about the shaft, a fixed internal gear surrounding said shaft and in mesh with one of said spur gears, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with another of said spur gears, a member rotatable about and movable on said shaft and having notches adapted to be engaged or disengaged by said notches on said sleeve, means on said rotatable and movable member for engaging said clutching nut and disengaging said nut from the means for locking said nut and bushing together, a second rotatable shaft, and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

7. A change speed gearing comprising a rotatable shaft, a clutching nut carried by and reciprocable on said shaft, means on said shaft for engaging and reciprocating said clutching nut on said shaft, a bushing eccentrically supported and rotatable about shaft, connected spur gears of different diameters carried by and surrounding said bushing and shaft, means on said bushing and nut for locking the same together and rotating said bushing and spur gears about the shaft, a fixed internal gear surrounding said shaft and in mesh with the spur gear of large diameter, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with the spur gear of small diameter, a member rotatable about and movable on said shaft and having notches adapted to be engaged or disengaged by said notches on said sleeve, means on said rotatable and movable member for engaging said clutching nut and disengaging said nut from the means for locking said nut and bushing together, a second rotatable shaft, and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

8. A change speed gearing comprising a rotatable shaft, a clutching nut carried by and reciprocable on said shaft, means on said shaft for engaging and reciprocating said clutching nut on said shaft, a bushing eccentrically supported and rotatable about shaft, connected spur gears of different diameters carried by and surrounding said bushing and shaft, means on said bushing and nut for locking the same together and rotating said bushing and spur gears about the shaft, a fixed internal gear surrounding said shaft and in mesh with the spur gear of large diameter, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with the spur gear of small diameter, a member rotatable about and movable on said shaft and having notches adapted to be engaged by or disingaged from said notches on said sleeve, means on said rotatable and movable member for frictionally engaging said clutching nut to prevent rotation of said nut about the shaft, and means disengaging said nut from the means for locking said nut and bushing together, a second rotatable shaft, and means for continuously and slidingly connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

9. A change speed gearing comprising a rotatable shaft, a clutching nut carried by and reciprocable on said shaft, a threaded portion on said shaft for engaging and reciprocating said clutching nut on said shaft, a bushing eccentrically supported and rotatable about shaft, two connected spur gears of different diameters carried by and surrounding said bushing and shaft, means on said bushing and nut for locking the same together and rotating said bushing and spur gears about the shaft, a fixed internal gear surrounding said shaft and in mesh with said spur gears of larger diameter, a sleeve having engaging notches and rotatable about said shaft and provided with an internal gear meshing with said spur gear of smaller diameter, a member rotatable about and movable on said shaft and having notches adapted to be engaged by or disengaged from said notches on said sleeve, means on said rotatable and movable

member for engaging said clutching nut and disengaging said nut from the means for locking said nut and bushing together, means for locking said rotatable and movable member and nut to the shaft, a coil spring normally forcing said movable member in engagement with said sleeve and nut, a second rotatable shaft, and means for continuously connecting said second rotatable shaft to said member rotatable and movable on said first mentioned rotatable shaft.

In testimony whereof I affix my signature.

STEPHEN A. ELLETT.