Oct. 23, 1956 J. G. RUCKELSHAUS 2,768,314

RECIPROCATING MOTOR DEVICE FOR ROTATING A SHAFT

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Fig 1

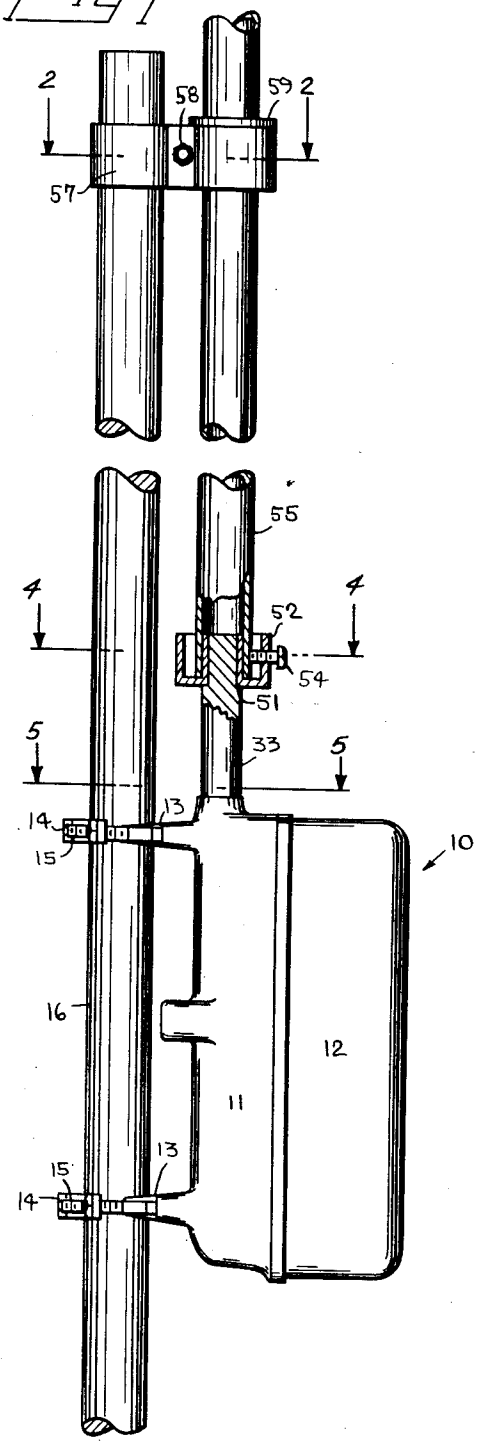
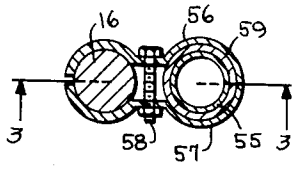


Fig 2



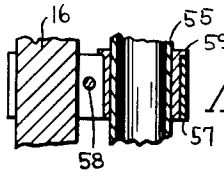


Fig 3

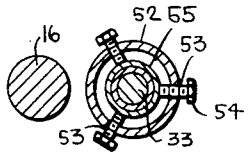


Fig 4

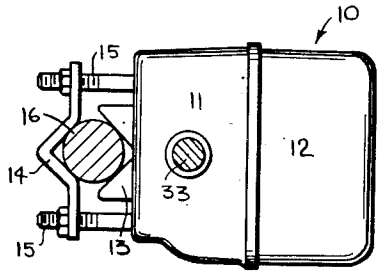


Fig 5

INVENTOR.
JOHN G. RUCKELSHAUS

BY

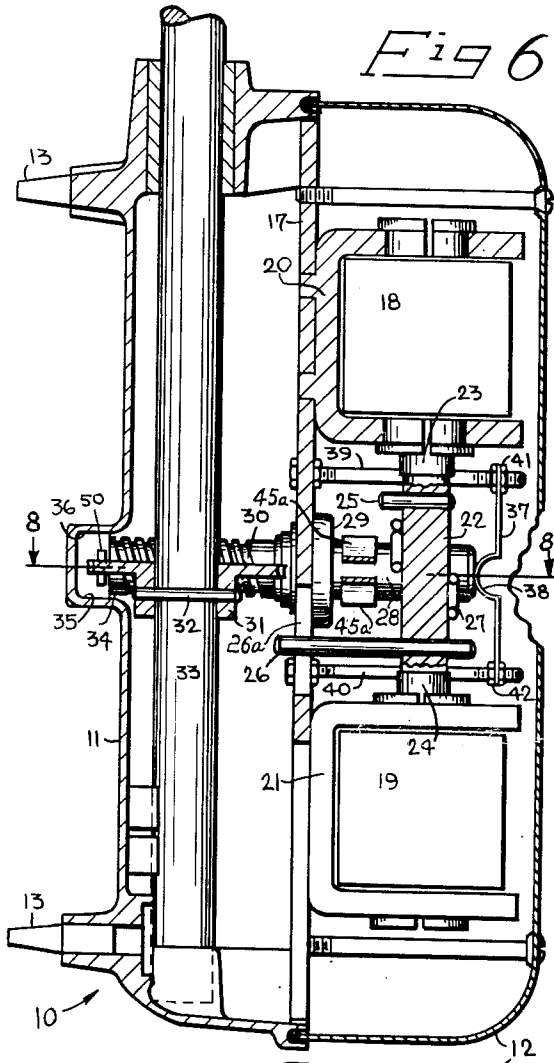
Joseph F. Padlon
ATTORNEY

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RECIPROCATING MOTOR DEVICE FOR ROTATING A SHAFT

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Fig 6



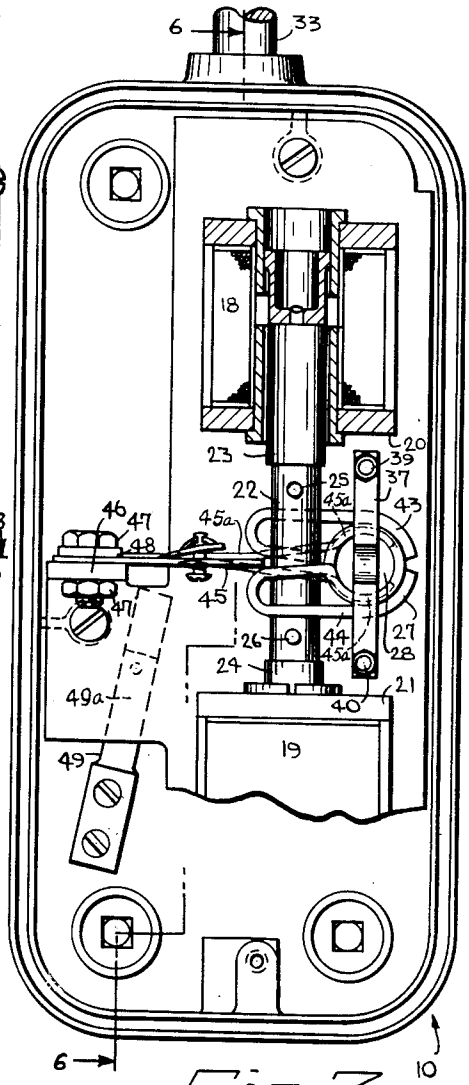


Fig 7

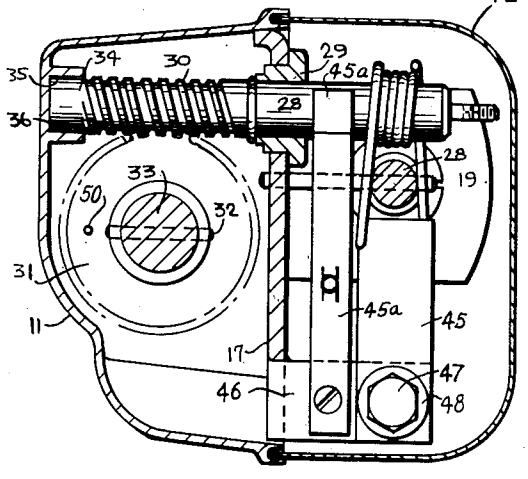


Fig 8

INVENTOR.
JOHN G. RUCKELSHAUS
BY
Joseph J. Padlon
ATTORNEY

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RECIPROCATING MOTOR DEVICE FOR ROTATING A SHAFT

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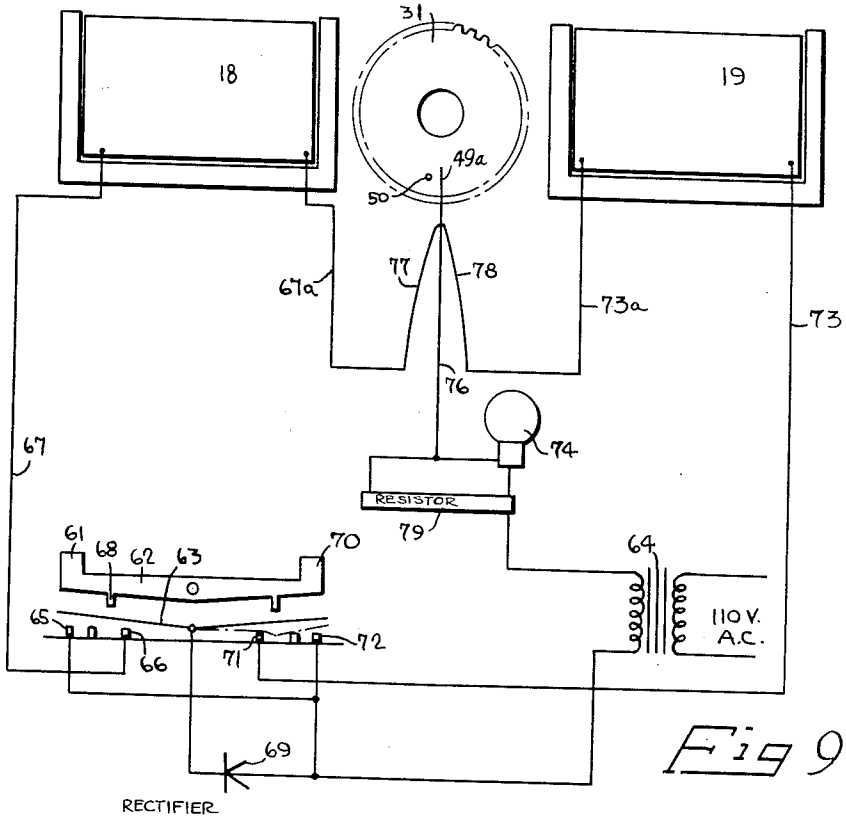


Fig 9

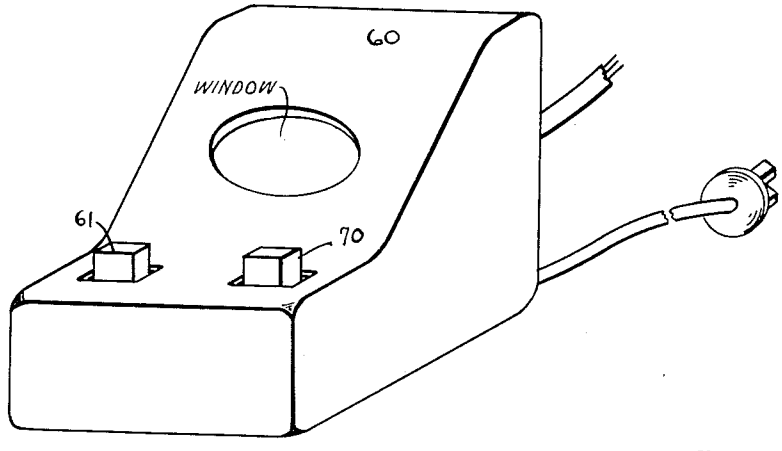


Fig 10

INVENTOR.
JOHN G. RUCKELSHAUS

BY Joseph F. Padlon

ATTORNEY

United States Patent Office 2,768,314 Patented Oct. 23, 1956

2,768,314

RECIPROCATING MOTOR DEVICE FOR ROTATING A SHAFT

John G. Ruckelshaus, Madison, N. J.

Application August 14, 1950, Serial No. 179,115

19 Claims. (Cl. 310—24)

This invention relates to a reciprocating motor device for rotating a shaft and more particularly to an electrically operated actuating mechanism for rotating shafts and the like, such as used in fire control mechanisms, radio, radar, range and direction finders, television, and the like.

The present invention is a continuation, in part, of my invention described, shown and claimed in my co-pending application Serial Number 55,779, filed October 21, 1948, entitled "Drive Mechanism" and issued as Patent No. 2,682,175, dated June 29, 1954.

An object of my invention is to provide a device for imparting rotary movement to shafts, antennas, or the like, in either rotary direction.

Another object of my invention is to provide an electrically operated device for rotating shafts through selected angles by imparting to said shafts a succession of smooth and rapid impulses.

Still another object of my invention is to provide an economically made, easily assembled, efficient, electrically operated mechanism for imparting a succession of desired rapid short or long impulses to a receiving shaft to rotate the same in a clockwise or counter-clockwise direction.

One further object of my invention is to provide an impulse imparting mechanism operated either by A. C. or D. C. current for producing rapid short impulses, or slow long impulses for rotating through any desired degree a shaft or like powered unit.

A more specific object of my invention is to provide an energizable clutch mechanism and a circuit in combination therewith, utilizing either A. C. or D. C. current for selectively effecting short rapid impulses or long relatively slow impulses to rotate a shaft or similar powered unit.

Still another and more specific object of my invention is to provide a shaft rotator by means of which there is transmitted a series of successive impulses to a shaft or like unit to rotate the same clockwise or counter-clockwise.

Other objects and advantageous features of my invention will become apparent from the herein following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an elevational, fragmental, partly broken away view of a preferred embodiment of the invention;

Figs. 2, 3 and 4 are sectional views taken on lines 2—2, 3—3 and 4—4, respectively, of Fig. 1;

Fig. 5 is a top plan view taken on line 5—5 of Fig. 1;

Fig. 6 is a longitudinal sectional view of the actuating mechanism taken on line 6—6 of Fig. 7;

Fig. 7 is a front sectional, partly broken away view of the actuating mechanism shown in Fig. 6;

Fig. 8 is a sectional view taken on line 8—8 of Fig. 6;

Fig. 9 is a diagrammatic or schematic view of the circuit forming part of the embodiment; and

Fig. 10 is a perspective view of a control mechanism forming part of the embodiment of my invention.

In my previously filed, hereinabove indicated, application, it will be noted that I provide an electrically operated clutch device containing energizing means adapted to cause a series of rapid oscillatory movements which are transmitted by various means in said device to a shaft so as to move the same in any desired rotary direction. By my present invention I have improved upon said device so as to produce the desired rotary movement of shafts of any type or character in a much simpler manner than that described in my previously filed application.

Referring now to the drawings in which similar reference characters denote like parts throughout, I provide an actuating mechanism 10, having a base or supporting member 11, and a cover 12 fixed thereto in any suitable manner, as will be hereinafter described more fully. Said base 11 is provided with a plurality of outwardly extending V-shaped members 13 and are integral with the support and are spaced relatively of each other. Adapted to coact with said members and paired therewith is a plurality of V-shaped brackets 14, relatively adjustable with respect to support or base 11 by means of adjustable lugs 15 forming clamps for mounting device 10 onto a mast or shaft 16, as shown more clearly in Figs. 1 and 5 of the drawing.

Said support 11 is provided with a floor 17 having spaced electro-magnetic coils 18 and 19 whose yokes 20 and 21, respectively, are fixed to said member 11 in any suitable manner, such as shown more specifically in Fig. 6. Extending through said coils 18 and 19 is an energizable core or armature shaft 22 provided with a pair of opposed terminal core members 23 and 24, each of which is adapted to slide in and out of the respective coils when either of said coils is energized. It will be noted that said shaft is provided with a pair of spaced stop pins 25 and 26. Pin 25 is shorter than pin 26 and each of the pins is adapted to form abutting contact with a clutch or spring member 27. Furthermore, pin 26 because of its length extends through slot 26a in floor 17 and is adapted to prevent the shaft from turning during energization of the coils 18 and 19. Said pins, as indicated above, are adapted to form contact with spring 27 and are intended to prevent the slipping or sliding of said spring which, as shown, is curled around an actuable shaft 28. It will be noted that said shaft 28 is disposed at right angles to said first shaft 22 and extends through a bushing 29 mounted on to the floor 17 of the base member 11. Said latter shaft 28, it will be noted, extends through said bushing in the bottom of said housing and is cut to form a helical gear 30, as shown, which is in mesh with gear 31 which in turn is fixed by means of pinion 32 on to a rotary shaft 33. The end 34 of shaft 28 is fitted into bushing or bearing 35 mounted in a recess 36 of the base member 11.

In order to prevent any creepage of said shaft 28 in said base 11, there is provided a tensioned spring plate 37, having a curved portion 38 pressing against the free end of said shaft 28. Said spring plate 37 is held against the end of the shaft by means of spaced stud members 39 and 40, respectively, extending from the floor 17 of said support 11 and held in position relatively therewith by means of nut members 41 and 42, respectively. It will be noted that the tension of said spring 37 can be adjusted by setting nut members 41 and 42 at any desired distance on the upper threaded portion of said studs.

Said clutch or spring member 27, it will be noted, is curled around gear shaft 28 in such a manner as to hug the same and permit movement of said shaft without, however, impeding any return or oscillating movement on the part of the spring when it is being used. Said spring 27, furthermore, is so made that it is provided with terminal portions 43 and 44, respectively,

which are turned inwardly towards each other but at different sections around said gear shaft 28, at the same time providing an inverted V space between the terminal portion, as shown more clearly in Fig. 7, to accommodate therebetween one or more spring plates 45. Said spring plate, it will be noted, is mounted at one end to a spring bracket support 46 extending from floor 17 and held in relatively fixed position therewith by means of washer and set screws 47 and 48, respectively. The upper portion of said spring plate is free and can be moved either to the right or to the left of its longitudinal axis by the fold 43 or 44 of spring 27 depending upon which of said coils 18 or 19 is energized. When said shaft 22 is energized, it will be carried toward either coil 18 or 19 depending on which of them is conducting electric current. If, for example, coil 19 is energized, core 24 is drawn thereinto whereby pin 25 makes contact with end 43 of spring 27 which, in turn, is impeded in its longitudinal movement by spring 45. At the same time the movement is taking place, spring 27 coiled around shaft 28 will tighten and rotate it in a counter-clockwise direction. Once the tension of spring 27 around shaft 28 is released, said shaft is held rigidly by means of a detent clamp or brake member 45*a* fixed in any suitable manner to bracket support 46. Said detent prevents the return movement of shaft 28 after it has been actuated by spring 27.

Underneath said floor 17 is mounted stop means 49 having a flexible extension 49*a* forming a signal light switch when in contact with a pin 50 extending perpendicularly from the face of gear wheel 31 for opening and closing respective circuits, as will be hereinafter more clearly described and as illustrated in Fig. 9 of the accompanying drawings.

Said rotatable shaft 33, it will be noted, extends upwardly from the lower end of said base 11, as shown more clearly in Figs. 1 and 6, and is provided with a reduced terminal portion 51 on to which is seated a concentric collar 52 provided with a plurality of spaced openings 53 for holding set screws 54. Said concentric collar 52 is adapted to accommodate therein the terminal portion of a shaft such as an antenna shaft 55 being retained in relatively vertical position with respect to mast 16 by said clamps 56 and 57. Said clamps are held together against said mast 16 and shaft 55 by means of bolt 58. It will be further noted that a portion of said clamp is provided with a bushing 59 to permit rotation therein of said antenna shaft 55.

Actuating mechanism or device 10 is connected to a circuit schematically shown in Fig. 9, and is operated from the control box 60, as shown in Fig. 10, and usually installed near the television set or near the operator. In the operation of the device when button 61 of rocker arm 62 is depressed, contact spring 63 connects coil 18 to transformer 64 through contacts 65 and 66 on line 67 and 67*a* thus making coil 18 oscillate on 60 cycle A. C. and actuate spring clutch 27 on shaft 28 so as to rotate said shaft in one direction, slowly, due to the short but rapid impulses in the coil while operating on 60 cycles. By pressing button 61 much harder, bump 68 on the rocker 62 contacts spring member 63 thereby opening contact 65 and allows a current to flow through rectifier 69 in control box 60. It will be noted that said rectifier 69 is normally shorted out of circuit when spring 63, contacts 65 and 66 are all connected together. When said rectifier is placed in circuit, coil 18 oscillates on pulsating direct current at 30 cycles and allows armature 22 to move more slowly, and at the same time, much further than when the alternating current is used. This action at 30 cycles gives clutch member 27 more motion and revolves shaft 28 much faster.

By pressing button 70, the same action with respect to coil 19 is obtained for reverse actuating direction of clutch 27 and movement of shaft 28. The current in this case goes through spring 63, contacts 71 and 72 via lines 73 and 73*a*.

In the control box 60 with transformer 64 and switch spring 63 is a pilot light 74 or an indicator, not shown, having a movable pointer and which could be substituted for a pilot light as shown in Fig. 10. Light 74 is normally on until pin 50 touches either contact 76 causing it to open either contact 77 in one direction or contact 78 in the other direction, depending on whether coil 18 or 19 is energized. Each time the circuit is closed, the light goes on or the indicator 75 moves until pin 50 on gear 31 rotates into position where it forces contacts 76 and 77 to open when coil 18 is being actuated or contacts 76 and 78 to open when coil 19 is actuated. When these switch contacts 76 and 77 or 76 and 78 open, the respective coil, being actuated, is turned off and pilot light 74 goes out or indicator 75 moves to end position. This warns the operator that rotator has reached the end of its rotation and to press the other button 61 to reverse the rotation of shaft 28. Resistor 79 across light 74 or indicator 75 provides the voltage to light the pilot light or move the indicator. Wires 67, 73, and contact 76 are generally in the form of a three wire cable running from rotator to control box near the TV set. Transformer 64 is used to meet Underwriters requirement that not over 24 volts can be run up the mast unless installed with BX cable by an electrician.

From the foregoing, it will be noted that I provide by my invention a device for varying and delivering rapid impulses, particularly in high frequency waves which can actuate any type of mechanism requiring selective control for rotary movement from a slight to a great change. Furthermore, the rotary movement can be imparted in a clock or counter-clockwise direction. Also, the rectifier in the device allows the armature to go slow and give greater power to the device for actuating shafts.

While a preferred embodiment of my invention has been illustrated and described, it is to be understood that modification as to form, arrangement of parts and use of materials may be made without departing from the spirit and scope of my invention as claimed.

I claim:

1. Apparatus for rotating shafts and the like comprising a rotatable element, tensionable clutch means in connection with and surrounding a part of the rotatable element adapted to grip and actuate the same to apply torque thereto, electro response energizable means in connection with the clutch means for operating the same, stop means for contacting the clutch means and limiting the movement of the clutch means, and means for shifting the gripping of the clutch means to permit rotation of said rotatable element in a desired rotary direction.

2. Apparatus for rotating a shaft comprising spring clutch means in connection with and for gripping said shaft and applying torque thereto, stop means in operable connection with the first named means, reciprocable energizable means adapted to actuate the second means for permitting alternate contacting of the spring clutch means for alternately gripping and loosening said clutch on said shaft operating said shaft, a brake member for said shaft for holding the same when not actuated by the clutch and tension means adapted to set up oscillating contact with the second named means and deliver impulses to the shaft therethrough.

3. Electrically operated apparatus for transmitting a succession of rapid rotational impulses to a shaft and the like, comprising operable means in connection with said shaft, gripping means surrounding the operable means for rotating the same, a reciprocable member for operating said gripping means to produce a clamping and rotational action on the operable means, energizable means for said reciprocable member adapted upon actuation thereof to

impart a rapid succession of impulses to the surrounding means, a detent member for said operable means to fix the same when not operated by said gripping means, and an electrical circuit in connection with the energizable means adapted to selectively operate the same to produce desired rotation of said shaft in either a clockwise or counter-clockwise direction.

4. In an electrical device, a rotatable element, a support for said element, tensionable clutch means for gripping and transmitting rotary motion to said element, said clutch means being adapted to alternately become loose and tight around said element energizable means for delivering impulses to said clutch means to clamp and produce rotary motion to said element, and means for shifting said first named means from one rotary direction to another.

5. In an electrical device, a rotatable shaft element, a base support for said element, tensionable spring clutch means surrounding said element for gripping and transmitting rotary motion to said element when said clutch is under tension, energizable means for delivering impulses to said clutch means to produce rotary motion to said element, braking means for said element for rigidly positioning the same when not rotated and electric circuit means for shifting said first named means from one rotary direction to another.

6. A shaft rotator comprising a base member, means extending from said base for mounting the same, covering means for said base member, a rotatable shaft in the base member, two-way vibratory means mounted on the base consisting of a plurality of solenoids, an armature and two way tensionable clutch means on said armature, said clutch means when actuated gripping said shaft, brake means for the shaft, and electric circuit means whereby when one of the solenoids is energized, said vibratory means turns the shaft in one direction, and when the other solenoid is energized, the vibratory means turns the shaft in another direction, said vibratory means transmitting a series of successive, continuous impulses to provide an even rotary motion to said shaft.

7. A rotator according to claim 6 in which the shaft is provided with gear means for imparting rotational energy to a shaft.

8. A rotator according to claim 6 provided with electrical control means in connection with the shaft for selectively rotating the shaft in a clockwise or counterclockwise direction, said control means comprising a two-way circuit, contacting means for the circuit, a rectifier, a transformer, and a resistor in said circuit, said means being adapted to show the desired completed rotation of said shaft in either direction.

9. The combination for actuating a shaft in any desired rotary direction, comprising a plurality of solenoids, switch control means for selectively operating said solenoids, an electrical circuit in connection with said switch control means and the solenoids, a transformer in connection with said circuit adapted to impart oscillations to the solenoids, geared means operable upon energization of said solenoids, normally closed contact means in electrical connection with the geared means, indicator means in connection with the geared means whereby said geared means after having reached its limit of movement will open said contact means, a resistor in said electrical circuit for said indicator means, a rectifier in said circuit interconnecting said resistor and switch control means adapted to impart pulsating D. C. oscillations to either of said solenoids whereby upon actuation of said switch control means the type of impulses delivered to said geared means from the solenoid may be selectively changed from rapid short impulses to slow long impulses and vice versa.

10. An electrically operable shaft actuator, comprising a shaft, gear means on said shaft, a geared shaft in connection with said gear means, a tensionable clutch mounted on said geared shaft for gripping the same, a plurality of solenoids, armature means energizable by either of said solenoids, drive means on said armature adjacent said clutch for tensioning said clutch when said armature means is oscillated by either of said solenoids thereby supplying torque to said geared shaft, a stop member adjacent said clutch adapted to impede the movement of said clutch when actuated by said armature means, a brake member around said geared shaft to prevent return movement of the same, and an electrical circuit in connection with said solenoids adapted to energize either one to produce desired directional rotary rotation of said shaft.

11. An electrically operable shaft actuator comprising a shaft, gear means on said shaft, a geared shaft in connection with said gear means, limiting means on said gear means adapted to signal the limit of rotational movement of said shaft, a spring clutch surrounding part of said geared shaft, a plurality of solenoids, core means energizable by either of said solenoids, spaced drive means on said core adjacent said clutch selectively adapted to tension said clutch to apply torque to the geared shaft when said core means is energized and oscillated, a stop member adjacent said clutch adapted to impede the movement of said clutch when actuated by said core means, detent means around the geared shaft to prevent return movement of the same, and an electrical circuit in connection with said solenoids adapted to energize either one to produce desired directional rotary rotation of said shaft.

12. An electrically operable shaft actuator comprising a shaft, gear means on said shaft, a geared shaft in connection with said gear means, limiting means on said gear means adapted to signal the limit of rotational movement of said shaft, a spring clutch wound around said geared shaft for applying torque thereto, a plurality of solenoids, core means energizable by either of said solenoids, spaced means on said core limiting said clutch adapted to actuate the clutch when said core means is energized and oscillated, a stop member adjacent said clutch adapted to impede the movement of said clutch when actuated by said core means, spring tensioned stop means abutting one end of said geared shaft to retain the same in longitudinal position, a brake member around the geared shaft to prevent return movement of the same, and an electrical circuit in connection with said solenoids adapted to energize either one to produce desired directional rotary rotation of said shaft.

13. In an electrically operable device according to claim 12, an electrical circuit comprising a plurality of solenoids, energizable means in said solenoids adapted to rotate geared means in any desired rotational direction, said geared means having a pin thereon, control means in said circuit adapted to energize either of said solenoids so as to produce desired rotational movement in said gear, transformer means in connection with said circuit whereby the solenoids can be oscillated by a series of short impulses, rectifier means in said circuit adapted upon actuation to produce a series of relatively slow impulses, and indicator means in said circuit adapted to show the limit of movement of said gear means.

14. In combination, an electric motor comprising a base, a rotatable shaft mounted upon said base, a solenoid mounted upon said base, a spring clutch mounted upon said shaft, a spring member on said base, an armature actuatable by the solenoid, one end of said armature being engageable with one end of said spring clutch, and with the spring member on said base, electrical means for vibrating said armature when current is passed through the solenoid causing said armature to vibrate and impart one way short impulses to the spring clutch thereby causing said shaft to rotate, and detent means for said shaft to brake the same.

15. In combination, an electric motor comprising a base, a pair of solenoids mounted on said base, an armature extending from one solenoid to the other, a shaft mounted on the base, a spring clutch mounted on said shaft, said spring clutch being so mounted that one end

of it engages a pin when one solenoid pulls the armature in one direction, and the other end engages another pin on the armature when the other solenoid pulls the armature in the other direction, a spring mounted on the base so as to engage either end of the spring clutch that is being engaged by the pin so that when alternating or pulsating current is passed through the solenoid it vibrates the armature against the spring, through the spring clutch, imparting short, fast, unidirectional impulses to the shaft causing it to rotate in one direction when one solenoid is turned on, and in the other direction when the other solenoid is turned on.

16. In combination, an electric motor comprising a base, a pair of solenoids mounted on said base, an armature extending from one solenoid to the other, a shaft mounted on the base, a spring clutch mounted on said shaft, said spring clutch being so mounted that one end of it engages a pin when one solenoid pulls the armature in one direction, and the other end engages another pin on the armature when the other solenoid pulls the armature in the other direction, a spring mounted on the base so as to engage either end of the spring clutch that is not being engaged by the pin so that when alternating or pulsating current is passed through the solenoid it vibrates the armature against the spring, through the spring clutch, imparting short, fast, unidirectional impulses to the shaft causing it to rotate in one direction when one solenoid is turned on, and in the other direction when the other solenoid is turned on, means for reducing the speed of the motor, and means for connecting the shaft of the motor to a mast to rotate the same.

17. In an electrical device, a support, a spring secured to the support, a rotatable element, an armature, a reversible overrunning clutch engaged between the spring and armature, electro-magnetic means to cause the armature and spring to vibrate the over-running clutch so as to impart short, fast, uni-directional impulses to the rotatable element, and move it, detent means for said shaft to prevent return movement of said shaft when not rotated, and electro-magnetic means for shifting the over-running clutch to determine the direction of rotation of the rotatable element.

18. In a clutch device, a rotatable element, a tensionable armature, an oscillating gripping element actuated by said armature adapted to intermittently engage said rotatable element and rotate the same by a series of short rapid continuous impulses, spring means engaging the oscillating element, and electro-magnetic shifting means for causing the oscillating element to impart selective continuous uni-directional impulses to the rotatable element.

19. In combination, an electric motor comprising a base, a rotatable shaft mounted upon said base, a solenoid mounted upon said base, an over-running clutch mounted upon said shaft, a resilient member on said base, an armature actuatable by the solenoid, one end of said armature being engageable with one end of said overrunning clutch, and with the spring member on said base, electrical means for vibrating said armature when current is passed through the solenoid causing said armature to vibrate and impart one way short impulses to the spring clutch thereby causing said shaft to rotate, and detent means for said shaft to brake the same.

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