April 27, 1937. E. A. DEMONET 2,078,902

CALL BOX

Filed Sept. 1, 1933

FIG. 2

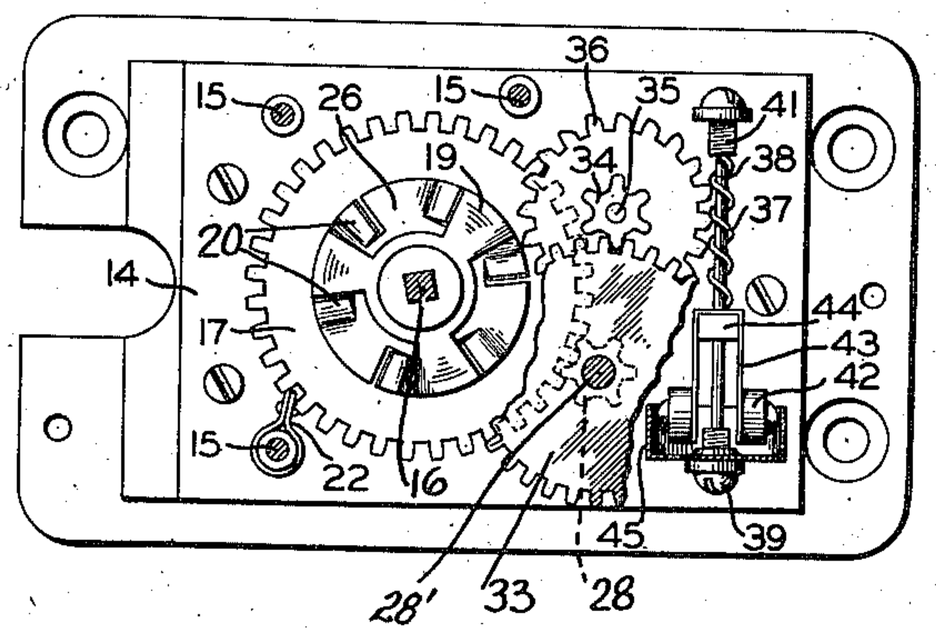
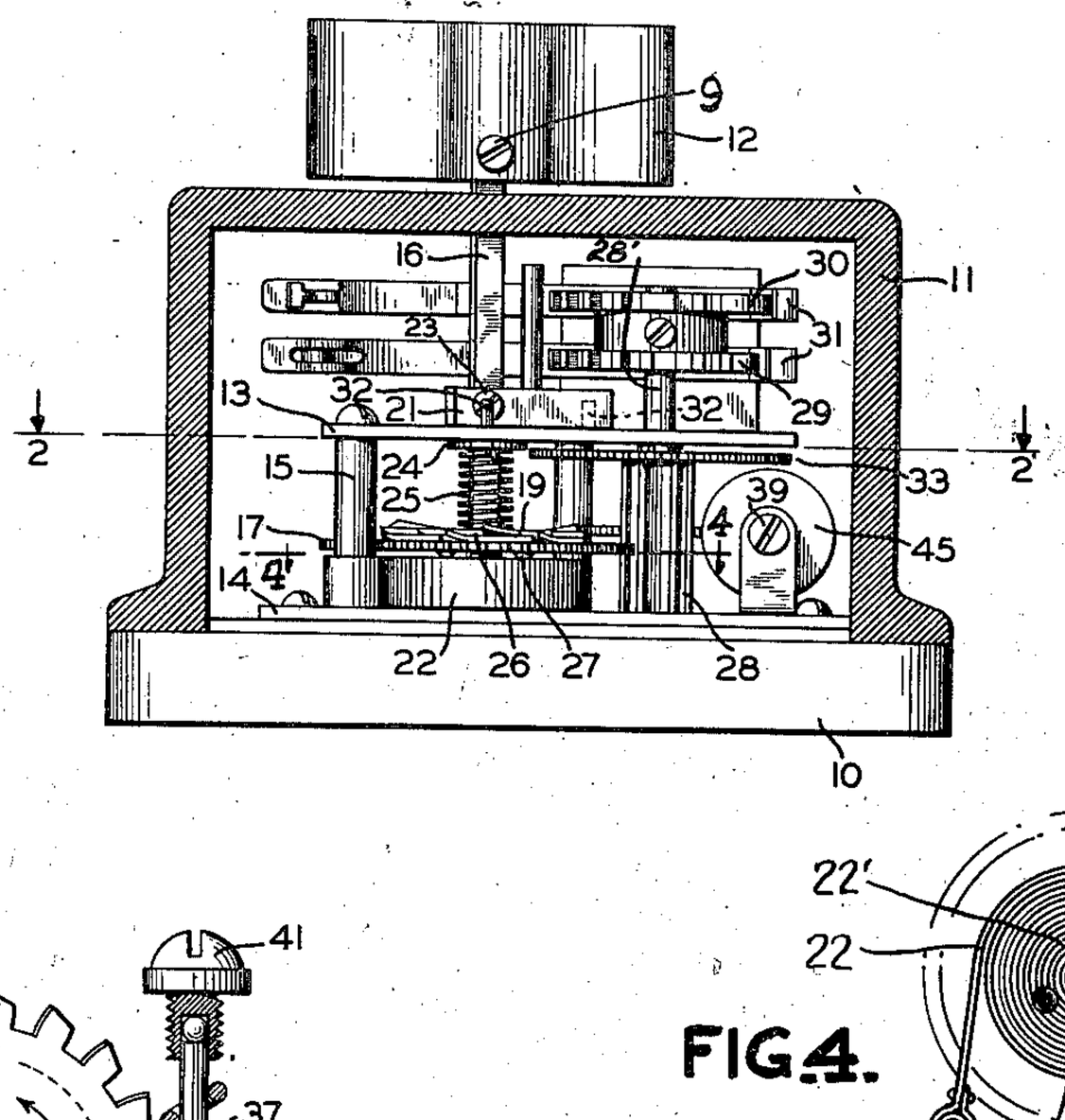


FIG. 1



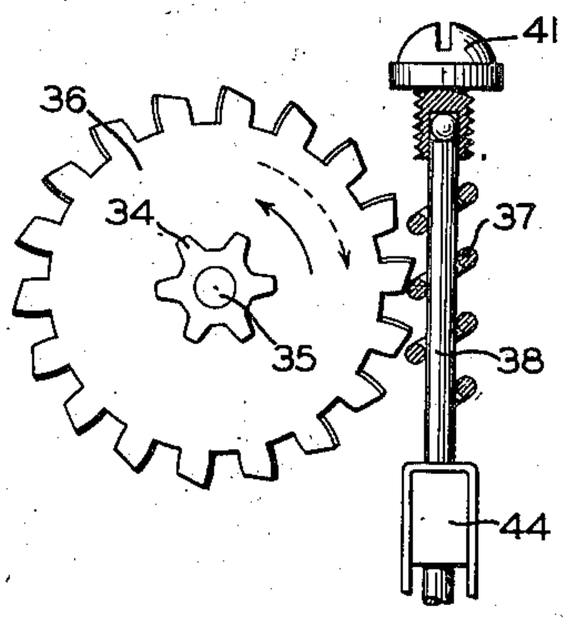
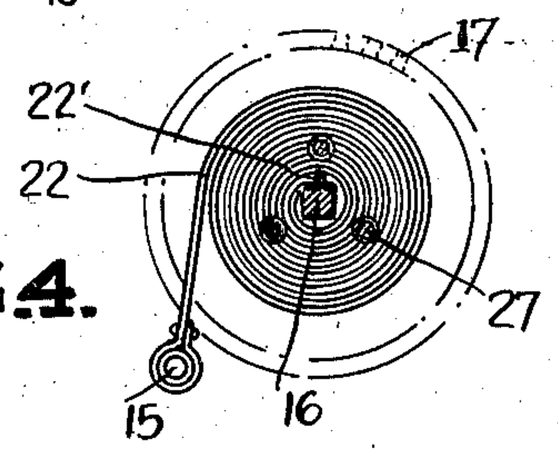


FIG. 3

FIG. 4.



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CALL BOX

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6 Claims. (Cl. 185—37)

This invention relates to apparatus, such as messenger call boxes, for sending from an outpost station to a central station a predetermined code signal which will indicate from which outpost station the call is coming.

The apparatus to which this invention relates is known in the art as call boxes and the primary object of this invention is to construct a call box mechanism for sending signals from the calling station which may be inexpensive to manufacture, yet employing component parts of simple and rigid construction.

Another object of this invention is to construct a call box employing a minimum number of component parts which may be easily and readily assembled into a complete mechanism.

A further object of this invention is to provide a spring motor escapement mechanism which will operate with the minimum wear and noise.

A still further object of this invention is to provide a worm and worm wheel escapement drive which embodies a non-reversing arrangement.

These and other objects will be apparent from the following description and claims taken in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation of the call box mechanism with the cover sectioned to expose the mechanism;

Fig. 2 is a plan view partly in section taken along the line 2—2 of Fig. 1 with the cover removed;

Fig. 3 is a detail of the worm and worm wheel illustrating the non-reversing feature, and

Fig. 4 is a section plan view of the main spring mechanism taken along the line 4—4 of Fig. 1.

Heretofore call box mechanisms have been constructed in such a manner that the various component parts of the mechanism had to be manufactured with a high degree of accuracy in order for the mechanism to function properly and have long life. Therefore, call boxes have been an item of relatively high cost considering the simplicity of the operations which they are called upon to perform.

Basically a call box incorporates a code wheel which is usually in the nature of a disk having a predetermined number of notches cut in its periphery and spaced from each other in a predetermined order so that as it rotates under a stationary brush a circuit is opened and closed in such a manner as to send out a code signal. This code wheel is rotated at a substantially uniform speed by means of a spring motor and clockwork mechanism, having an escapement for governing the speed of operation. Control means is provided for starting the operation of the clockwork mechanism and permitting it to continue until the code wheel has made a complete revolution. This is usually provided by stop mechanism on the main drive shaft which is connected to a winding handle at the front or top of the box and which permits the clock mechanism to be wound only a sufficient amount to drive the mechanism through a complete revolution of the code wheel.

Due to the fact that call boxes are installed in locations of such widely varying conditions and are operated only infrequently, it is necessary that the spring motor for driving the mechanism shall be strong enough to insure the operation of the call box at all times. Therefore, the escapement mechanism is called upon to escape a relatively large amount of motive forces. Heretofore, the escapement provided for call boxes, in substantially all cases, comprised vibrating or oscillatory escape pallets operating upon the teeth of an escapement wheel. In order for such type of escapement to be compact and capable of dissipating a large amount of motive force it has been necessary to devise the mechanism of heavy parts accurately made. Also to withstand the vibration set up by a vibratory or oscillatory escape, it has also been necessary to manufacture other parts of the call box mechanism along a corresponding scale.

However, according to this invention a type of escapement is employed which substantially eliminates vibration and which materially reduces the noise and which may be easily and cheaply made from small and inexpensive parts. With the use of this type of escapement the expensive design of the other parts of the mechanism are correspondingly cut down.

For a more complete description, reference will now be had to the drawing, which shows a base 10 upon which the mechanism is mounted, and a cover 11 arranged to fit upon the base and cover the mechanism, and a handle 12 which is rotated from one of its stop limits to the other for sending out the call.

The call box mechanism itself comprises upper and lower frame plates 13 and 14 between which the spring motor and clockwork mechanism is assembled. The plates are held apart by spacing posts 15 of which there are three. The plates 13 and 14 are pierced for admitting the various shafts and screws of the mechanism. The motor mechanism embodies a main drive shaft 16

which carries a main drive gear 17 loosely mounted thereon, a click pawl 19, a stop arm 21 and the handle 12. A drive spring 22 has its outer end looped about one of the spacer posts 15 and its winding end secured to the drive shaft by means of the usual pin protruding therefrom and engaging in a slot at the inner portion of the spring in a well known manner. The drive shaft extends from below the bottom plate 14 up through the top plate 13 and through an opening in the cover 11 to engage the operating handle 12.

It will be observed that the main drive shaft 16 is a square bar having the same cross section from end to end. This type of drive shaft has many advantages over the ordinary round shaft in that it embodies keying surfaces throughout its length making it unnecessary to prepare special surfaces for mounting the various elements. The outer end of the drive shaft extends into a square hole in the handle which is held to the shaft by any suitable locking means as by a screw 9. The stop arm 21 is provided with a square hole to permit it to slide into place over the drive shaft and is held by set screw 23 just above plate 13. Next below plate 13 is a thrust washer 24 which provides a seat for compression spring 25 surrounding the drive shaft. The lower end of the compression spring is seated against a spider member 19 which acts as the driving ratchet pawl. The pawl 19 is provided with a square hole at the center by means of which it is keyed to the drive shaft and is free to move longitudinally along the shaft against the action of the compression spring 25. Below the pawl is a ratchet plate member 26 which is made fast to the main drive gear 17 by means of rivets 27. The teeth of the ratchet are struck up from the plate.

When these elements are assembled on the drive shaft the elements in order are: the main spring 22, the drive gear 17 resting together with its associated ratchet 26 on the upper side of the drive spring 22, the pawl 19, the spring 25 and the thrust washer 24. The compression spring 25 interposed between the floating pawl and the upper plate performs two functions, the function of holding the pawl member 19 in yielding engagement against the ratchet plate member 26 so that the click action may take place and also the function of holding the main drive gear 17 in proper position.

Referring particularly to Figure 2, it will be seen that the pawl member 19 embodies three radially extending arms having their forward edges straight and their rearward edges bent slightly upward. The ratchet member on the other hand embodies six teeth 20 which are formed by striking up arcuate segments from the plate 26. The edges of the struck up portions are arranged to be engaged by the forward edges of the pawl arms when the spring 22 is exerting a drive action on the gear. For winding the drive spring the main drive shaft is turned by gripping the handle 12 as shown in Fig. 1 and rotating it clockwise. As the pawl member moves over the ratchet disk the bent up portion of the back of the pawl arms rides on the upstanding ratchet teeth so as to elevate the pawl plate until the arms click over the ratchet teeth. Upon releasing the handle 12, it will be seen that the loosely mounted gear 17 is caused to rotate in a counterclockwise direction through the action of the spiral spring 22 through the intermediary of the pawl 19 and the teeth of the ratchet plate 26. In an alternative arrangement the ratchet teeth, instead of being formed from a plate or disk, may be struck up from the body of the main gear. In either case the operation of the ratchet pawl is substantially the same.

With this arrangement the main gear 17 engages the pinion 28 of the shaft 28' which carries the code disks 29 and 30. Arms 31 engage the teeth of the disks as they rotate to produce signals in a well known manner.

It will be observed that the ratchet plate employs six teeth and provides six positions in which the pawl may engage the ratchet. The ratio of the number of teeth in the pinion 28 to the main gear is such that the shaft 28' makes a complete revolution for one sixth of a revolution of the main gear. In order to limit the operation of the code disks to the sending of one code series of signals for each winding operation of the handle, the movement of the drive shaft 16 is limited by means of suitable stop pins 32 spaced in such angular relation as to permit the arm 21 to turn a little more than one sixth of a revolution therebetween. The pin upon which the arm normally rests arrests the action of the main spring upon the drive gear by stopping the motion of the main shaft. The other pin arrests the winding motion of the main shaft when the handle is turned the distance of one sixth of a revolution plus the distance allowed for insuring the click arms of the pawl dropping in place.

A second gear wheel 33 made fast to the shaft 28' engages the pinion 34 on the shaft 35 of the escape worm wheel 36. The escape worm wheel engages the worm 37 on a shaft 38 which is mounted between screws 39 and 41 set in members struck up from the bottom plate 14.

In manufacture the shaft 28' and 35 are made from stock bars known as pinion rod which may be obtained very cheaply in any quantity from regular commercial stock. The shaft 28' is formed by turning down the upper portion or the section of rod to the proper size to form a journal and to receive the code disks 29 and 30. The lower journal of the shaft is likewise formed by turning down the other end of the pinion rod. The gear wheel 33 is mounted upon a section of the shaft which is turned down just a sufficient amount to form shoulders on the pinion teeth against which the gear may rest. The gear is stamped out with a central hole of star-shape of a suitable size to fit over the stub teeth below the shoulders. The shaft and gear is assembled by pressing the gear on the stub teeth and held in place by upsetting the portion of the teeth extending beyond the gear or by soldering the gear in place or other suitable means. The worm gear shaft 35 is formed in substantially the same manner by turning down one end of the pinion rod from which the shaft is formed to admit the worm gear substantially in the same manner as just described for the foregoing shaft. Journals are formed on the opposite ends of the shaft 35 by turning the pinion rod down to suitable size. From this it will be observed that these two shafts may be made very cheaply with a minimum number of operations and without supplying any additional elements or parts to complete the shaft or gear unit.

The escapement shaft 38 escapes the driving force of the main spring by the use of well known restrained fly-ball type of governor. This comprises a pair of weights 42 carried by spring arms 43 extending longitudinally of the shaft and se-

cured to collar 44 which is rigid with the shaft. The weights are arranged to rotate internally of a drum or collar member 45. As the rotating weights gain speed they move out against the spring action of the arms 43 until they engage the inner surface of the drum. This engagement tends to slow down the speed of rotation of the governor shaft, decreasing the force with which the weights engage the drum. As is well understood, a definite or predetermined speed is quite well maintained by the equalization between the tendency of the rubbing action on the drum to increase as the speed increases and the tendency for it to decrease as the speed drops against the friction produced by the weights as they engaged the drum.

Carrying out the idea of inexpensive companion parts, the worm 37 of the governor or worm shaft 38 is formed by winding a wire spirally about the shaft and soldering or welding the same thereto. This forms a combined worm and worm gear which under test has operated to the equivalent of 20 years average life service of a call box mechanism without appreciable wear.

One of the conditions encountered in employing a worm and worm wheel escapement in a clock work mechanism which is wound by rotating the main drive shaft in the reverse direction, particularly in mechanisms of the type herein provided in which a considerable amount of friction is present, is the likelihood of this friction being sufficient to cause the gear train to rotate in a reverse direction. This is particularly objectionable for call box mechanisms employing a code disk making contact with fingers or the like for sending out a code signal. Besides causing the disk to send out a false signal, if it should rotate while the finger is in a reverse direction it might also become jammed against the finger contacts.

It is therefore desirable to provide means to prevent the worm shaft from rotating in a reverse direction with the type of escapement employed in this mechanism. This is accomplished in a very simple manner without employing any over running clutch or ratchet feature such as usually required. The non-reversing means is provided by sloping or cutting back the points of the teeth of the worm wheel 36 so that when the same is urged in a reverse direction as indicated by the dotted line arrow in Fig. 3, the end of the teeth instead of the back face thereof engages the worm 37 along its sloped surface and exerts a thrust upon the worm shaft 38 largely in a transverse direction instead of longitudinally as in the case of the ordinary driving engagement with the forward face of the tooth. This transverse thrust against shaft 38 instead of tending to rotate the same, causes it to bind between the end of the tooth and its bearings in the screws 39 and 41. Therefore the worm wheel 36, as soon as it engages the worm 37 in a reverse direction, will produce the aforesaid binding action as long as the force in the direction of the dotted arrow remains. This will be during the period in which the operating handle 12 is rotated in the clockwise or main spring winding direction. As soon as the spring is wound and the handle released, force is applied to rotate the worm wheel 36 in the direction of the solid arrow and the face of the teeth moved around into driving engagement with the worm, permitting the mechanism to operate until the main drive shaft is rotated through its limited movement in the manner heretofore described.

The non-reversing means just described, besides acting to prevent reverse rotation of the worm wheel, also acts to apply a braking action to the worm shaft as soon as the gear train ceases to rotate. This is due to the fact that if the worm continues to rotate after the worm wheel has stopped, the worm will move into engagement with the sloped end of a tooth and produce substantially the same jamming action as just described, thereby applying resistance to rotation which stops the worm shaft almost instantly. As a result the mechanism does not continue to rotate beyond the point set by the limit stop of the main drive shaft assuring that the code disk is stopped substantially in the same position at the end of each period of rotation.

Referring briefly now to Fig. 4, I have shown a plan view of the main spring 22. The inner end of the spring is secured to the shaft 16 by a pin 22', and its outer end is fastened to the spacing post 15. It will be observed that the convolutions of the spring are in close relationship and the rivet heads 27 are sufficiently broad and flat so that the latter may ride on the upper edge of the spring without slipping down between the convolutions and causing the gear 17 to be held against rotation. Since turning the winding handle, in order to operate the call-box, only tightens the spring 22, the convolutions of the latter will never separate sufficiently to allow the gear 17 to slip down.

From the foregoing description it will be observed that a call box operating mechanism has been devised which may be made up of rugged inexpensive parts which can be produced by simple machine operations. Most of the parts can be produced by simple stamping and milling operations. Although the various parts are easily produced, each one is substantial and rugged and will be able to perform its function under the circumstances of hard usage to which it may be subjected.

It will further be apparent that the number of parts entering into the mechanism have been cut down to a minimum. The intermediate gear and pinion shafts being formed as a single unit with the complete shaft and gear comprising only two units is a considerable reduction in the number of parts ordinarily employed.

Furthermore, it will be apparent that according to this invention a call box mechanism has been provided by means of the foregoing novel construction which is extremely rugged in construction and accurate in operation and which incorporates parts capable of withstanding extreme abuse and wear and which may be more cheaply manufactured than the types heretofore used.

Although the principles of this invention have been illustrated in a single type of call box mechanism, it is to be understood that they may be applied to other mechanisms without departing from the spirit of this invention and it is desired that it be subject only to the limitations imposed by the prior art or set forth in the appended claims.

What I claim is:

1. In a call box, a drive mechanism comprising a main spring and a winding handle connected together by a single drive shaft, a stop arm secured rigidly to said shaft, cooperating stops engageable by said arm to limit the movement of said shaft, a drive gear mounted loosely upon said shaft and disposed with one face substantially in abutting relation to said main spring,

said drive gear carrying a plurality of ratchet teeth upon its upper face, a pawl element keyed to the shaft but movable longitudinally thereof whereby it may be cammed past said teeth in a reverse direction and a spring for holding the pawl into engagement with the ratchet teeth.

2. A call box embodying upper and lower frame plates, a motive mechanism comprising a main spring disposed adjacent to the lower plate, a winding handle connected to the main spring by a single drive shaft, a stop arm disposed adjacent the upper plate and secured rigidly to said shaft, cooperating stops engageable by said arm to limit the movement of said shaft, a drive gear mounted loosely upon said shaft and disposed with one face in abutting relation to said spring, said drive gear having a plurality of ratchet teeth struck up from its upper face, a pawl keyed to the drive shaft but movable longitudinally thereof, whereby it may be cammed past said teeth in a reverse direction, said pawl embodying a plurality of arms arranged to engage simultaneously a corresponding number of said ratchet teeth, and a compression spring disposed between the upper plate and said pawl for holding the same into engagement with the ratchet teeth.

3. A call box embodying upper and lower frame plates, a motive mechanism comprising a drive shaft, a main spiral spring surrounding said shaft and having its inner end secured thereto, said spring being disposed adjacent said lower frame plate, a winding handle connected to said drive shaft, a stop-arm disposed above and adjacent said upper frame plate and secured rigidly to said shaft, a pair of cooperating stops engageable by said arm to limit the rotational movement of said shaft, a drive gear mounted loosely on said shaft between the upper frame plate and the main spring and adjacent the latter, said drive gear having a plurality of ratchet teeth struck up from its upper face, a pawl on said shaft rotatable therewith and movable longitudinally therealong, and a compression spring surrounding said shaft between the upper frame plate and said pawl for urging the latter into contact with said drive gear to maintain the pawl in a position to engage the ratchet teeth thereon, whereby the downward force of said compression spring, acting through the pawl and drive gear against the main spring secured to said shaft, maintains the lower end of said shaft in the bearing.

4. In a call box mechanism the combination of a spring motor assembly including a drive shaft, a code wheel, a gear train connecting said code wheel with said drive shaft, a winding handle for rotating said drive shaft in a reverse direction to wind said motor, a governor comprising a worm shaft carrying fly-ball weights disposed to rotate within a restraining cup, a wire formed as a spiral and secured about said shaft for forming the worm, a worm wheel disposed in driving engagement with said worm, the teeth of said worm wheel having a forward engaging face formed at a slight angle from a radial line and a reverse engaging face formed at a slight angle from a tangential line, whereby normal driving action occurs between the wheel and worm when the wheel tends to rotate in a forward direction, and whereby when the worm wheel tends to rotate in a reverse direction it becomes locked against the worm due to the fact that the major component of the thrust exerted against the worm by the wheel is in a direction transversely of the worm shaft.

5. In a call box mechanism the combination of a spring motor assembly including a drive shaft, a code wheel, a gear train connecting said code wheel with said drive shaft, a winding handle for rotating said drive shaft in a reverse direction to wind said motor, a governor shaft carrying a worm, a worm wheel for driving said shaft, the teeth of said worm wheel having a forward engaging face formed along a substantially radial line and a reverse engaging face formed along a chord at a slight angle from a tangential line, whereby normal driving action between the wheel and worm when the wheel tends to rotate in a forward direction exerts a force against the worm, the major component of which is parallel to the axis of the worm shaft and whereby when the wheel tends to rotate in a reverse direction the action of the reverse engaging face of the teeth upon the worm produces a force, the major component of which is in a direction transversely of the worm shaft causing the wheel to become locked against the worm, preventing the reverse rotation of the worm wheel.

6. In a call box drive mechanism, a motor assembly comprising upper and lower frame plates, a main shaft extending through said plates and beyond the upper plate, a winding handle carried on the upper end of the shaft, a member disposed against the upper face of the upper plate and secured to the shaft to provide means for restraining the shaft against downward longitudinal movement, a motor spring disposed to surround the shaft between the plates adjacent to the lower plate and having its inner end secured to the shaft at a point spaced sufficiently from said lower plate to provide for free movement of the spring over the lower plate, a drive gear mounted to rotate freely upon the shaft and disposed with its lower face in abutting relation to said spring, said drive gear having a plurality of ratchet teeth struck up from its upper face, a spider-plate pawl surrounding the shaft and embodying a plurality of arms arranged to engage simultaneously a corresponding number of said ratchet teeth, said pawl being keyed to the drive shaft for transmitting the driving force of the spring to the gear wheel, but movable longitudinally thereof whereby it may be cammed past said teeth when the shaft is rotated in a reverse direction for winding the spring, and a compression spring disposed between the upper plate and said pawl, said spring acting to hold the pawl plate in position against the gear and the gear against the main spring and through said parts acting to exert a force downwardly upon the shaft at the point where the main spring is secured to the shaft and in this manner holding said parts in assembled position and providing means for restraining the shaft against upward movement.

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