June 18, 1935. M. W. ROSCOE ET AL 2,005,561

FEED CONTROL FOR HAMMER MILLS

Filed July 8, 1931 3 Sheets-Sheet 1

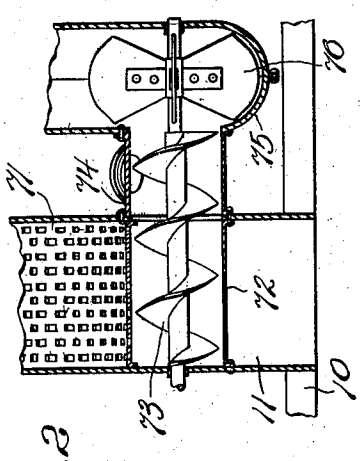

Fig. 2

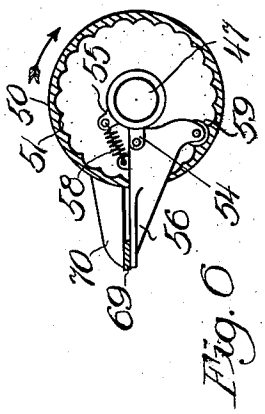

Fig. 6



Fig. 1

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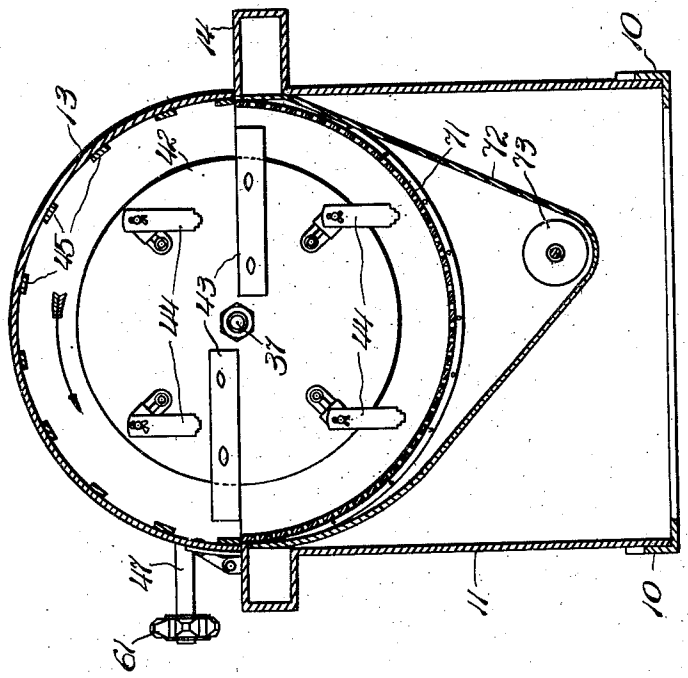

Fig. 4

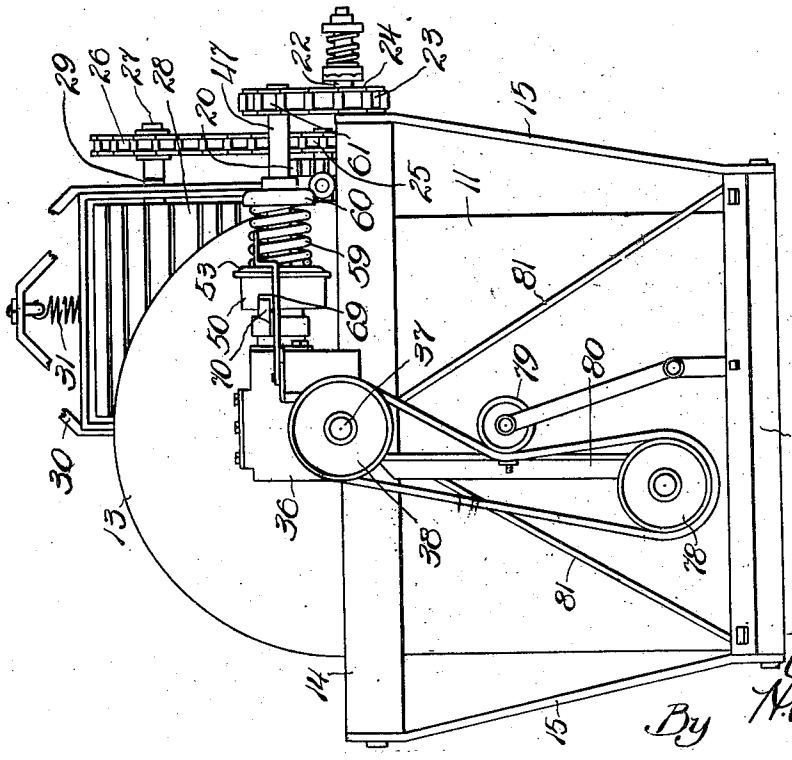

Fig. 3

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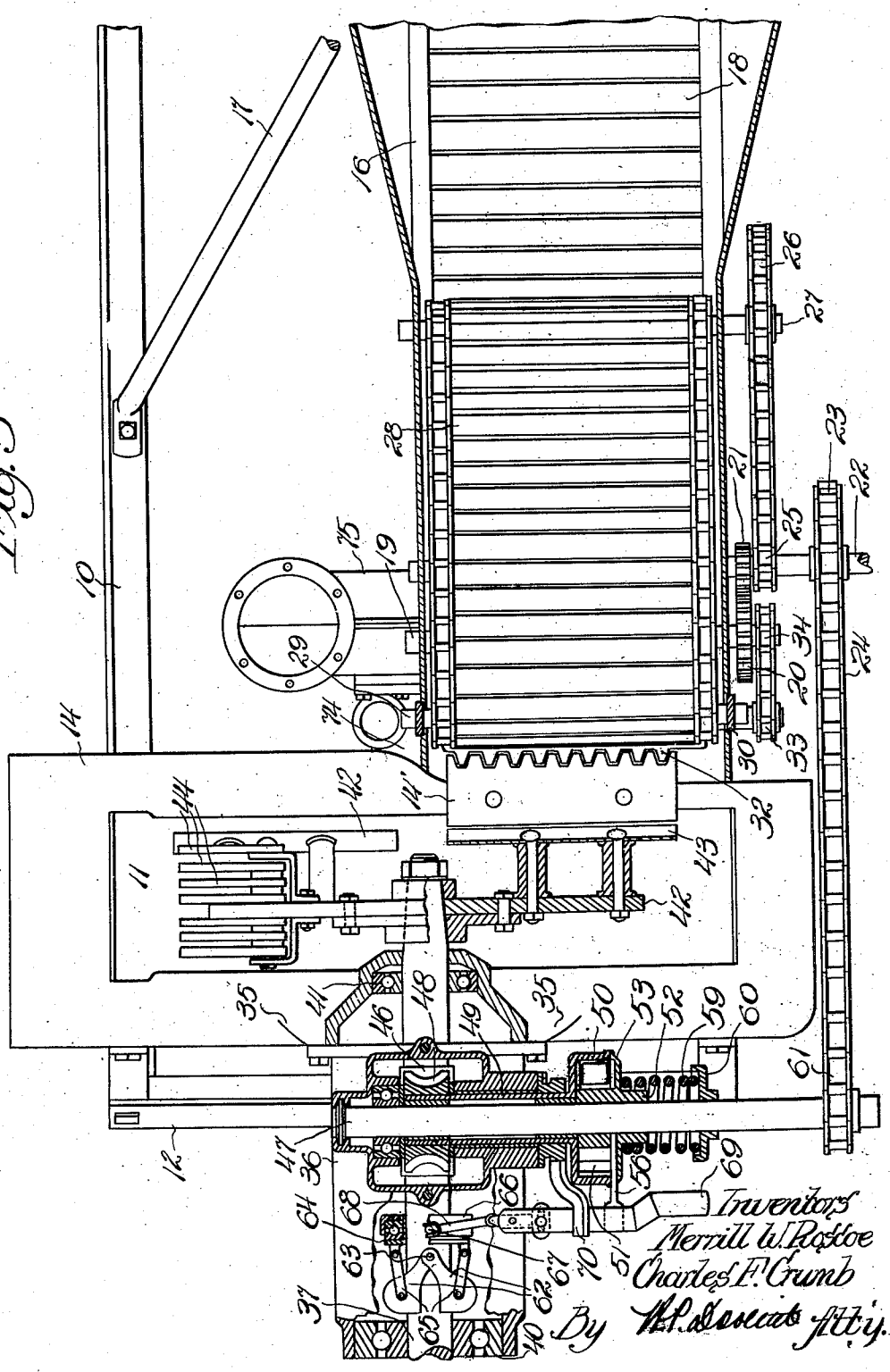
Fig. 5



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# UNITED STATES PATENT OFFICE

2,005,561

## FEED CONTROL FOR HAMMER MILLS

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Application July 8, 1931, Serial No. 549,386

6 Claims. (Cl. 83—11)

This invention relates to a hammer mill. More particularly it relates to means for controlling the feeding of material to a mill.

In the operation of material reducing devices such as feed mills, it is very essential that means be provided for controlling the material fed to the mill to prevent choking and to assure proper operation of the mill. In mills of the type using hammers for reducing the material it is particularly essential that the speed of the rotor which carries the hammers be maintained. As the effectiveness of such mills depends largely upon the peripheral speed of the hammers any retarding of the speed by overfeeding rapidly slows down the mill as the effectiveness is lessened with decreasing speed. It is, therefore, obvious that with mills of the hammer type it is desirable that means be provided for positively and quickly stopping feed at the instant the speed of the rotor begins to decrease.

An object of the present invention is to provide a hammer mill carrying knives and rotors constructed in a novel manner. The principal object is to provide in such a mill a feed controlling means operative to positively and quickly cut off the feed when the speed of the mill decreases below a predetermined rate.

Another object is to provide in combination with a mill of the hammer type, means for driving associated mechanisms such as a blower and a feed mixing device.

These and other objects, which will be apparent, are obtained by the construction shown in the drawings, in which:

Figure 1 is a side elevation of a hammer mill embodying the features of the invention;

Figure 2 is a sectional view through the material removing and blower mechanism;

Figure 3 is an end elevation of the same device shown in Figure 1;

Figure 4 is a cross section through the rotor housing, showing the material reducing elements mounted therein;

Figure 5 is a plan view with the upper housing removed to show the material reducing means. A portion of Figure 5 is also in section to show the driving and governing mechanism; and

Figure 6 is an enlarged sectional view through the clutch, showing the essential elements thereof.

The mill of this invention is mounted on a frame structure built up largely of angle bars. A pair of angle bars 10 form the base on which the frame structure is constructed. Said bars are bent upwardly at the ends to provide runners upon which the mill may be slid from one position to another. A rotor housing consists of a lower portion 11 mounted on members 12 extending transversely across the bars 10, and an upper portion 13 substantially semi-circular in cross section. A cast rotor supporting frame 14 is positioned between the two portions of the rotor housing and is secured by bars 15 and other members not shown in the drawings. The frame 14 extends around the housing portions 11 and 13 and provides means for mounting the various elements making up the device. A cutter bar 14', as best shown in Figure 5, is mounted on the frame 14 at one side thereof. A conveyor unit 16 of a conventional construction extends radially from the housing and is positioned to deliver across the cutter bar 14'. Said conveyor unit, in addition to being secured to the frame 14, is held in position by bracing bars 17. The conveyor unit is provided with flared side members. A conveyor belt 18 is mounted on a roller at the outer end of the conveyor unit, not shown in the drawings, and on a driving roller at the forward end of the conveyor mounted on the shaft 19. The shaft 19 carries a gear 20 which is driven by a gear 21 mounted on a shaft 22. The shaft 22 carries a chain sprocket 23, which is driven by chain 24, as will be hereinafter described. The shaft 22 also carries a sprocket 25, which drives a sprocket 26 mounted on a shaft 27. The shaft 27 carries means for driving a feed belt 28, which extends forwardly downwardly and is supported at the forward end by sprockets mounted on a shaft 29. The shaft 29 is mounted on a slidable vertically extending support 30, which is resiliently pulled downwardly by a spring 31.

Forwardly of the shaft 19, which carries the forward end of the conveyor, a feed roller 32 is rotatably mounted and driven by means of a sprocket 33 mounted in alignment with a sprocket 34 on the shaft 19 and connected thereto by a driving chain. The frame 14 is provided with reinforced portions 35, which provides means for rigidly securing thereto a casing 36, which contains means for mounting the main driving shaft 37. The driving shaft 37 is provided with a driving pulley 38 and a second pulley 39 for driving the blower utilized in the device. The shaft extends through the casing 36 and is rotatably mounted centrally thereof by ball bearings 40 and 41 at the ends of the casing.

A rotor 42 is mounted on one end of the shaft within the frame 14 and is adapted to rotate in the housing portions 11 and 13. The rotor 42

carries a plurality of knives 43, positioned to cooperate with the cutting bar 14'. A plurality of swinging hammers 44 are mounted at spaced points around the periphery of the rotor. As best shown in Figure 4, a plurality of breaker bars or concaves 45 are positioned around the top of the housing portion 13. Said housing portion is pivoted on the frame 14 so that it may be raised for access to the interior of the housing.

A worm 46 is mounted on the shaft 37 within the casing 36. A shaft 47 is rotatably mounted in a portion of the casing 36, which extends upwardly, as shown in Figure 3. The shaft 47 carries a worm gear 48 which is adapted to mesh with the worm 46 and is driven thereby. A sleeve 49 mounted for rotation with the shaft 47 carries a drum 50 which is provided interiorly thereof with a plurality of depressions 51. A hub member 52 is slidably and rotatably mounted on the shaft 47 and is provided with a lateral flange 53 which closes the open end of the drum 50.

As shown in Figure 6, the hub 52 is provided with a pair of short extensions 54 and 55. A clutch throwout member 56 is pivoted on the extension 54. A roller 57 pivotally mounted on a portion of the member 56 is positioned to engage the depressions 51 in the drum 50. A spring 58 is connected to the member 56 and to the extension 55. Said spring normally holds the roller 57 into engagement with the depressions 51 in the drum. The member 56 extends outwardly beyond the flange 53 on the hub 52 and is provided with a flattened end for a purpose to be hereinafter described. A spring 59 abuts against a stop 60 secured to the shaft 47 and against the flange 53 to maintain said flange in position against the drum 50.

A chain sprocket 61 is mounted on the shaft 47 in alignment with the chain sprocket 23 and drives said chain sprocket and the feeding mechanism connected thereto by means of the chain 24.

The casing 36 also provides space for mounting a fly ball governor. A pair of fly balls 62 are pivoted on a pin 63 extending through the shaft 37. A sleeve 64, slidably mounted on the shaft 37, is attached by links 65 to the fly balls 62. An annular member 66 is provided with trunnions 67 which are engaged by a throwout collar or member 68. The annular member 66 and the sleeve member 64 are rotatably supported with respect to each other by ball bearings positioned between them. The throwout member 68 is pivoted on the casing 36 and has a portion extending outwardly from said pivot. A clutch throwout lever 69 is adjustably secured to said extension. The throwout lever 69 is adapted to engage the member 56, as will be hereinafter described. A stop 70, rigidly secured to the casing, extends outwardly therefrom above the throwout lever 69.

Within the lower portion 11 of the housing a screen 71 is positioned around the rotor, spaced outwardly from the path described by the swinging hammers 44. A partition member 72 extends from each side of the screen downwardly to form a trough-like receptacle, in the bottom of which an auger 73 is mounted. The auger 73 extends through one wall of the housing through a tubular member 74, into a fan casing 75. Fan blades 76 are mounted within the fan casing 75 on the shaft which carries the auger. Said shaft extends through the other side of the housing and through a supporting member 77, which rotatably supports said shaft in suitable bearings. A pulley 78 mounted on the outer end of the shaft is driven by a belt from the pulley 39. An idle pulley 79 is provided for maintaining the belt at the proper tension. Supporting bars 80, 81 and 82 constitute means for maintaining the supporting member 77 and the casing 36 in rigid position.

In the operation of the mill, as above described, power is applied by a belt to the pulley 38, thereby driving the main shaft 37. The rotor 42, carried by the shaft 37, is thereby put into operation with the blades 43 rotating past the cutter bar 14' in cutting relation with respect thereto. The hammers 44 are thrown out radially, thereby taking a path which lies closely adjacent the breaker bars 45 and also closely adjacent the screen 71. Material to be operated upon, such for example as corn stalks, is fed by the conveyor belt 18 into the throat of the machine. The feed apron 28, pressed downwardly at its forward end by the support 30, cooperates with the conveyor belt 18 to deliver the material over the cutter bar. The feed roller 32 also cooperates to feed material over the cutter bar 14'. The material is cut into short lengths by the blades 43 and is further reduced by the hammers 44 until it reaches a size which will pass through the perforations in the plate 71. This plate may be removable so that a plate having openings of any desired size may be used. The feeding means, as above described, is operated by the chain 24 through the intermediate chains and gears, previously described in detail. The worm gear 41, carried on the shaft 47, drives the worm gear 48 mounted on the sleeve 49. The sleeve 49 is freely rotatable with respect to the shaft 47. Said sleeve carries the drum 50, which is one portion of a clutch, the other portion of which is carried on the hub 52, mounted for rotation on the shaft 47. It will be understood, therefore, that the clutch provides means for independent rotation of the sleeve 49 and the shaft 47 and for clutching said two members for rotation together. As shown in the small view in Figure 6, the clutch may be disengaged by downward pressure on the member 56. As the complete clutch is rotating when the device is in operation, it is obvious that downward pressure on the member 56 is obtained by retarding the rotation of said member.

The fly ball governor controls the operation of the clutch by altering the relative angular position of member 69. When the mill is put into operation and the shaft 39 obtains a speed sufficient for operation of the reducing means carried on the shaft, the fly balls 62 swing outwardly and transmit said motion through the links 65 to the sleeve member 64. Said member is thereby moved axially with respect to the shaft 37. The angular member 66 is also moved in the same direction, thereby swinging the inner end of the throwout collar 68. This motion is transmitted to the throwout lever 69. The different elements are so positioned that when the shaft 37 has obtained a speed sufficient for operation of the reducing means, the lever 69 is moved an angular distance sufficient to disengage it from the clutch operating member 56. The spring 58 then pulls the roller 59 into engagement with the depressions 51 in the drum 50, thereby locking the hub member 52 with respect to the sleeve 49, whereby the shaft 47 is put into rotation. By means of the chain 24,

said shaft drives the feeding means, as previously described.

When an excess of material is being fed to the mill, or due to the nature of the material the action of the rotor is such that the speed decreases, the fly balls 62 are pulled inwardly together with the spring 62', thereby altering the relative angular position of the collar 68 and throwing the lever 69 in towards the clutch operating member 56. Due to the large reduction obtained by the worm 46 and the worm gear 48, the sleeve 49 and the other elements rotating with it when the clutch is in engaged position, are traveling at a comparatively low rate of speed. By such an arrangement it is possible to throw in the lever 69 and engage the member 56 without injury to any of the parts. As there is comparatively little inertia in the conveyor driving elements and the conveyor belts, and as a considerable resistance is usually being encountered by this mechanism at a heavier rate of feed, said elements stop almost instantaneously upon the disengaging of the clutch. The delivery of material being thus immediately stopped, the rotor and the reducing units carried thereby may continue to operate without additional material until the material being acted upon is cleared sufficiently for the rotor to again attain the predetermined operating speed. It has been found that in the operation of this mill, the clutch will be thrown out before sufficient material has been fed to the reducing means to choke it to any considerable extent and that the clutch is again engaged and material is again fed immediately upon the attainment of the proper speed of the rotor.

It is to be understood that applicant has shown only a preferred embodiment of his feed controlling means as applied to a particular type of mill. All such uses of the feed controlling means are contemplated in mills of similar construction or any other devices in which the principle may be utilized. Applicant desires to limit his claim to invention only by the scope of the appended claims.

What is claimed is:

1. A mill comprising a casing having a feed opening on one face, power driven feeding means adjacent said opening, a main drive shaft extending into the casing, reducing means mounted on said shaft within the casing, means for driving said shaft at a comparatively high rate of speed, a second shaft connected by means of a positive clutch and speed reduction means to the main shaft for operation thereby at a comparatively low rate of speed, means for connecting said second shaft to the feeding means, an actuating arm extending from the clutch, a governor mounted on the main shaft, and means connected to said governor operative to engage said actuating arm.

2. In a feed grinder, a housing, a drive shaft extending into said housing, a reducing rotor mounted on said shaft within the housing, power driven means for feeding material to said housing, a power transmitting shaft positioned at right angles to the main drive shaft, means for connecting said shaft for driving the feeding means, a member mounted on said shaft normally freely rotatable with respect thereto, clutch means for engaging said member with said shaft, means for continuously rotating said member from the main drive shaft, an actuating arm extending from the clutch means, a centrifugal governor operated from the main drive shaft, and means connected to said governor operative to engage said clutch arm at a predetermined speed of rotation of the main shaft.

3. A feed grinder comprising, in combination, a housing, a horizontal drive shaft extending into said housing, means for driving said shaft at a high rate of speed, a reducing rotor mounted on said shaft within the housing, means for feeding material to be reduced into the housing, a power transmitting shaft positioned at right angles to the drive shaft, means for connecting said shaft to the feeding means, means including high reduction gearing and a positive clutch for connecting said shaft to the drive shaft, a pawl actuating arm extending from the clutch, a centrifugal governor mounted on the driven shaft for operation thereby, and an actuating lever pivotally mounted on the housing and operatively connected at one end to said governor and positioned with its other end located for engagement with the pawl actuating arm of the clutch at a predetermined position of the governor.

4. A feed grinder comprising, in combination, a housing, a horizontal drive shaft extending into said housing, means for driving said shaft at a high rate of speed, a reducing rotor mounted on said shaft within the housing, means for feeding material to be reduced into the housing, a power transmitting shaft positioned at right angles to the drive shaft, means for connecting said shaft to the feeding means, means including high reduction gearing and a positive clutch for connecting said shaft to the drive shaft, said clutch consisting of a flanged internally notched member secured to the driven shaft for continuous rotation therewith, a carrier member connected to the transmitting shaft for rotation therewith, and an engaging pawl mounted on said member and operative to engage the notched member, said pawl including a lever arm extending therefrom, a centrifugal governor mounted on the drive shaft for operation thereby, and an actuating lever pivotally mounted on the housing and operatively connected at one end to said governor and positioned with its other end located for engagement with the pawl lever arm of the clutch at a predetermined position of the governor.

5. A feed grinder comprising, in combination, a housing, a horizontal drive shaft extending into said housing, a reducing rotor mounted on said shaft within the housing, power driven means for feeding material into the housing, a horizontal power transmitting shaft positioned at right angles to the drive shaft, a sleeve rotatably mounted on said shaft, a worm wheel carried by said sleeve, a worm on the drive shaft positioned to continuously drive said worm wheel, a clutch member carried by said sleeve, a clutch member carried by the power transmitting shaft, pawl means mounted on said member operative to connect said clutch means together, said member including a disengaging lever extending radially therefrom, a centrifugal governor mounted on the drive shaft, and a lever pivoted on the housing and operatively connected to said governor, said lever being positioned to positively engage the disengaging lever at a predetermined speed of the driving shaft.

6. A feed grinder comprising, in combination, a housing, a horizontal drive shaft extending

into said housing, a reducing rotor mounted on said shaft within the housing, power driven means arranged at one side of the housing for feeding material there into axially of the rotor, a power transmitting shaft positioned at the other side of the housing at right angles to the drive shaft, a sleeve rotatably mounted on said shaft, a worm wheel carried by said sleeve, a worm on the drive shaft positioned to continuously drive said worm wheel, a clutch member carried by said sleeve, a clutch member carried by the power transmitting shaft, pawl means mounted on said member operative to connect said clutch members together, said means including an actuating lever extending radially therefrom, a centrifugal governor mounted on the drive shaft, and a lever pivoted on the housing and operatively connected to said governor, said lever being positioned to positively engage the pawl actuating lever at a predetermined speed of the driving shaft.

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CHARLES F. CRUMB.

## CERTIFICATE OF CORRECTION.

Patent No. 2,005,561. June 18, 1935.

MERRILL W. ROSCOE, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 65, claim 5, for "means" read members; and line 66, of said claim 5, for "members" read means; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of August, A. D. 1935.

Leslie Frazer
Acting Commissioner of Patents.

(Seal)