Jan. 7, 1958 C. A. HARLESS 2,818,950

RATCHET

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Fig. 1.

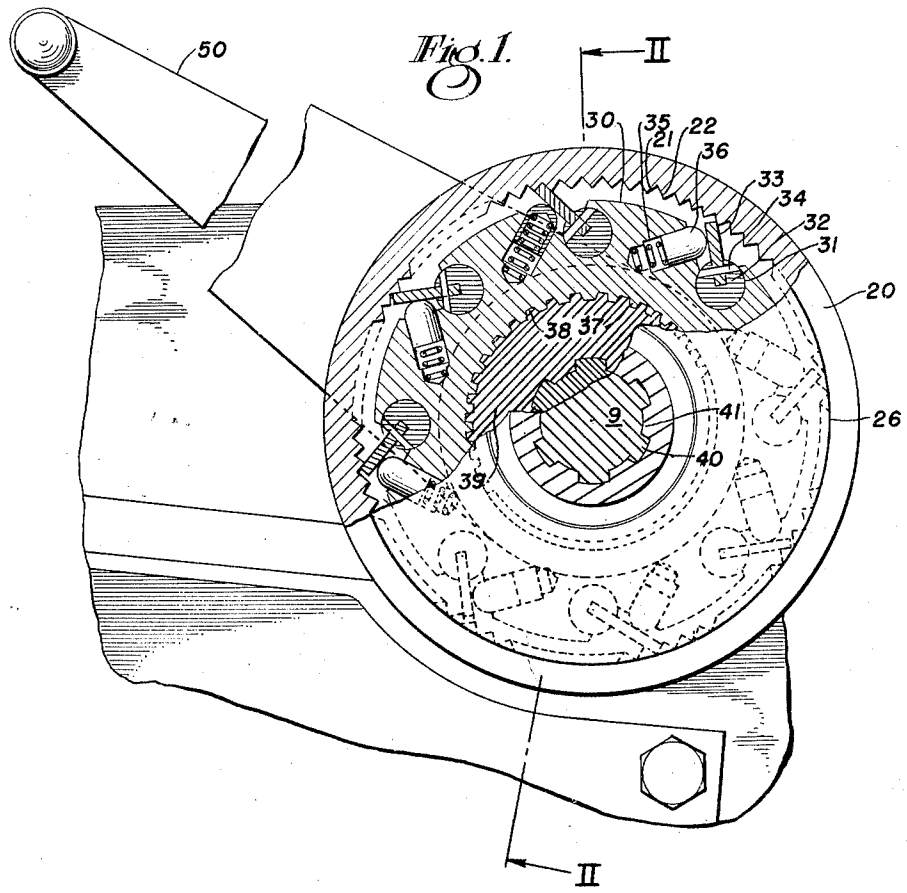


Fig. 3.

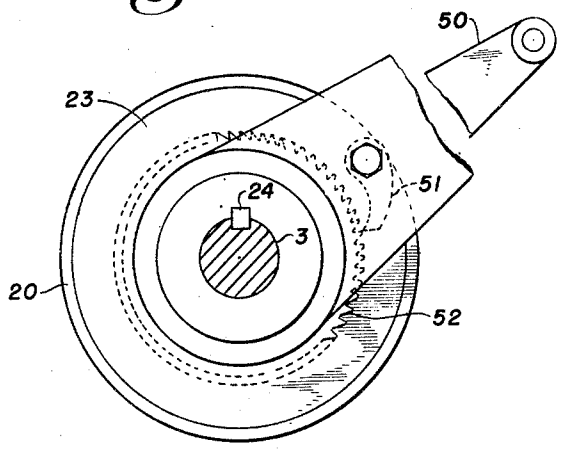
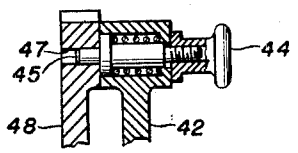


Fig. 4.



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Fig. 2.

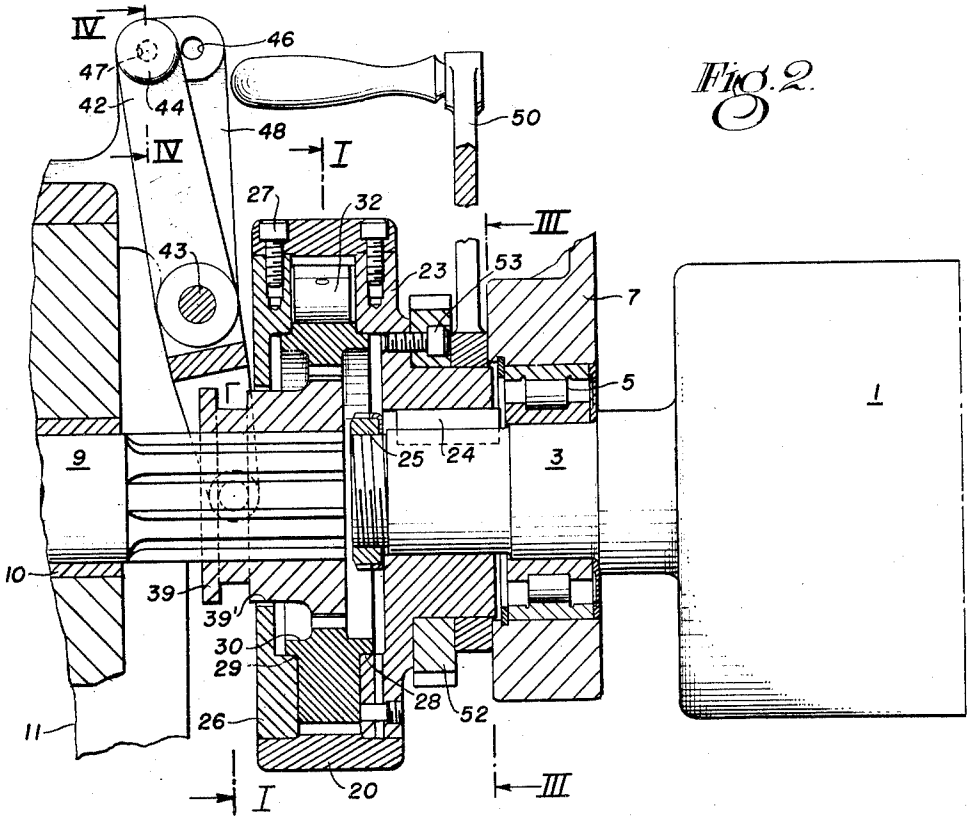
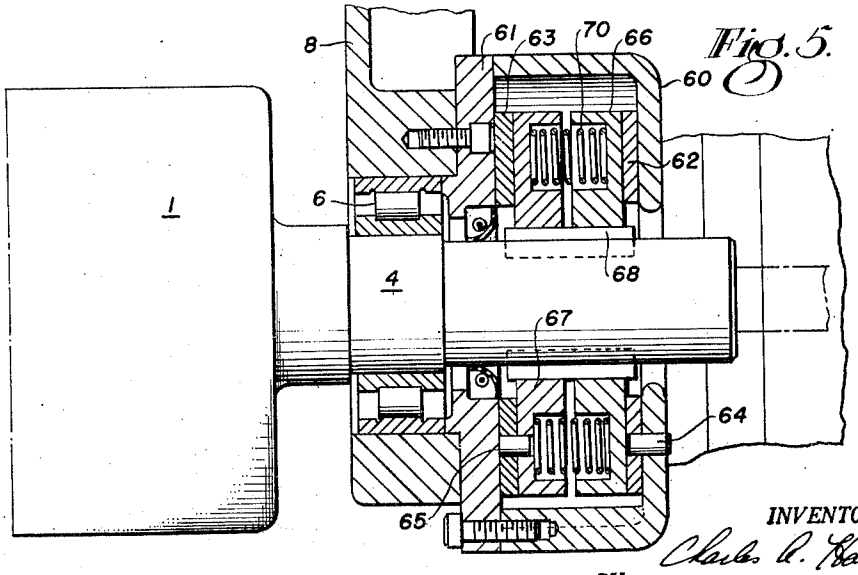


Fig. 5.



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RATCHET

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Application December 3, 1952, Serial No. 323,845

13 Claims. (Cl. 192—48)

This invention relates to improvements in ratchet drives.

It is an object of the invention to provide a ratchet drive capable of operating with fine increments of movement, with correspondingly small lost motion, while utilizing relatively coarse and strong ratchet teeth.

A further object of the invention is to provide an enclosed ratchet drive mechanism, reducing wear from foreign particles, and permitting efficient lubrication.

A still further object of the invention is to provide a ratchet gear construction, in which the parts subject to wear are readily replaceable, while the wear is reduced to a minimum.

A ratchet drive embodying the invention in a preferred form will now be described with reference to the accompanying drawing, and the features forming the invention will then be pointed out in the appended claims.

In the drawing:

Figure 1 is a view partly in end elevation and partly in section as to the ratchet mechanism, and is taken on the section line I—I of Figure 2;

Figure 2 is a side elevational view, partly in longitudinal section on the line II—II of Figure 1;

Figure 3 is a detail section taken on the line III—III of Figure 2;

Figure 4 is a detail section on the line IV—IV of Figure 2; and

Figure 5 is a view partly in side elevation and partly in central axial section, showing a drag or braking mechanism employed with the ratchet driven element.

The ratchet drive of the invention is shown as applied to the driving of a fountain roller of a printing machine, the fountain roller 1 (Figures 2 and 5) being associated with an ink fountain, as indicated fragmentarily in Figure 1, in the usual way. The shaft 3 of the roller 1 is rotatably mounted in bearings 5 and 6 carried in supporting members 7 and 8. A drive shaft 9 is mounted in a bushing 10, carried in a frame structure 11, in axial alignment with the roller 1. This shaft 9 is rocked about its axis by a means not shown, that provides for adjustment of the extent of angular movement imparted to the shaft. A clutching arrangement and the ratchet drive of the invention form the driving connection between shaft 9 and roller 1.

The ratchet drive comprises an internally toothed ratchet gear ring 20, having evenly spaced teeth including surfaces 21 for driving engagement with the driving pawls, and surfaces 22 for limiting the outward movement of the pawls when in driving position. The ring 20 is supported by a face plate and housing member 23 (Figure 2), which is carried on the shaft end 3 of the roller 1, and rotatably coupled thereto by a key 24 and held thereon by a nut 25. A second annular face plate element 26 completes the housing for the ratchet mechanism, the ring 20 being fastened to the two elements 23 and 26 as by means of screws or bolts 27. The inner faces of the elements 23 and 26 are formed with circular, rounded shoulders or abutments 28 and 29 for rotatably supporting an inner annular drive member 30, which carries the driving pawls. The

member 30 has a number of bores 31 (shown as eight in number) rotatably receiving cylindrical shaft sections 32, each of which carries a pawl. The pawls 33 are rectangular plates or pieces received in radial slots or grooves in the members 32 and held therein as by means of pins 34. The periphery of the member 30 adjacent each bore 31 is cut away, as indicated, to accommodate the required movement of the pawl, and has further bores or sockets 35 accommodating the spring pressed plungers 36, which urge the pawls toward engaging or driving position (clockwise in Figure 1).

Internally the member 30 is formed with spline gear teeth 37, cooperating with mating spline gear teeth 38 on a clutch member 39 which is slidable axially of the shaft 9, and coupled thereto by cooperating spline gear teeth 40 and 41. A clutch handle 42 is pivoted on a shaft 43 (Figure 2) is connected to the member 39 by the usual clutch ring and yoke, and is provided with a releasable catch member as shown in Figure 4, so that the clutch handle may be freed for movement by pushing out of the knob 44 and locked in either engaging or disengaging position by releasing the knob so as to permit pin 45 to engage in either bore 46 or 47 in bracket 48 attached to the frame structure 11, which supports the clutch handle or lever 42. Outwardly of the spline teeth 38, the clutch member 39 has a circular hub 39', the annular face plate 26 fitting close around this hub to provide an effective oil housing enclosure.

A manually operable clutch handle 50 (Figure 2) may also be provided, being rotatably mounted on a hub of the member 23 and having a pawl 51 (Figure 3) adapted to engage in a ring 52 provided with ratchet teeth, and which is fixed to the ratchet housing member 23 as by means of bolts 53.

While the ratchet drive of the invention is not limited to use with driven elements equipped with drag or braking mechanism, it possesses particular advantage in such use. A drag for the roller 1 is shown in Figure 5, and comprises a housing structure formed of elements 60 and 61 bolted to the frame element 8, and including friction plates 62 and 63 held from rotation by pins 64 and 65. Cooperating annular friction elements 66 and 67 are mounted on the shaft end 4 (Figure 5) and rotatably coupled thereto by keys 68. Springs 70 between the elements 66 and 67 urge them apart axially against the plates 62 and 63, creating the desired friction for preventing overrunning of the roller 1 by reason of its inertia.

The number of teeth on the wheel 20 is preferably related to the number of pawls 33, so as to obtain a fine adjustment or increment of movement, and so as also to reduce and equalize wear as far as possible. This result may be achieved by utilizing evenly spaced ratchet teeth and evenly spaced pawls, the number of teeth not being an integral multiple of the number of pawls, so that the angular interval between adjacent pawls exceeds an integral multiple of the angular interval between adjacent teeth by a fraction of a tooth interval. In the structure shown, there are eight pawls 33 spaced equally around the member 30, and, hence, separated by 45° from each other. Ninety evenly spaced teeth are provided on the inner surface of the ring 20, the tooth spacing, accordingly, being 4°. Assuming a given pawl to be in driving engagement with a tooth (as in the case of the uppermost pawl in Figure 1), it follows that the next tooth in order (clockwise in Figure 1) will be 1° from driving engagement with a tooth of the wheel 20; the next pawl will be 2° from engagement; the third pawl will be 3° from engagement; while the fourth pawl, or lowermost pawl in Figure 1, will again be in driving engagement with a tooth of the wheel 20. If it should happen at any given time in the operation of the ratchet that no pawl is in driving engagement with a tooth of the ring

20, it will be apparent that the amount of rotation of the inner driving member 30 required to bring a pawl into such engagement, will always be less than 1°. Thus, with teeth which are spaced 4° apart and may be correspondingly rugged, an increment of movement of maximum lost motion of 1° is obtained.

It is preferred that the number of pawls and teeth be even, so that a pair of diametrically opposite pawls will engage. The reaction of the pawls against the member 30 will thus be substantially a pure couple, involving no tendency to shift the member transversely of its axis of rotation, so that wear of the bearing surfaces supporting this member in the face plates is reduced to a minimum. However, an odd number of teeth or an odd number of evenly spaced pawls may be used and thereby obtain much finer increments of movement of the roller 1.

Assuming no overrunning of wheel 20 by reason of inertia of the driven element 1, there will generally be a shifting at each stroke of the ratchet, of the pawls which are in driving engagement with teeth of the wheel 20, and also of the teeth which are engaged. For example, if Figure 1 be taken to represent the completion of a ratchet stroke through 15° of arc, it will be apparent that following the idle stroke (clockwise) of the inner drive member 30, the teeth of the pawls which engage on the next working stroke will not be those which engaged upon the previous stroke, but the adjacent pawls in the clockwise direction, etc. As the ratchet drive is adjusted from time to time for different angles of stroke, the relationship between the pawls and the teeth of the wheel 20 continually changes, the various pawls operating sometimes to engage with one tooth and then another, and the order of engagement of the pawls from stroke to stroke varying with the angular adjustment. Wear is thus thoroughly equalized.

The pawls are preferably rectangular, as shown in Figure 1, and are mounted radially of their supporting shafts 32. The driving thrust thus does not tend to wedge the pawls into the teeth openings of the member 20, nor does it tend to dislodge them. The tips of the pawl plates 33 are preferably case hardened to reduce wear to a minimum, and the ratchet wheel 20 is also suitably hardened.

By following around Figure 1, starting with the uppermost pawl, the relative movement between pawls and ratchet teeth on the idle stroke will be apparent, and it will be observed that this is a sliding movement involving but little wear, as the pressure exerted by the spring plungers 36 may be comparatively light. It will also be observed that when the edges of the plates 33 or of the teeth in the ratchet wheel 20 are slightly worn, the operation will not be impaired materially. Should objectionable wear occur after long use, the ratchet is readily reconditioned or repaired by merely replacing plates 33 or the wheel 20, or both, as may be required.

What is claimed is:

1. A ratchet drive comprising a ratchet ring having an even number of evenly spaced ratchet teeth, a cooperating rotatable pawl member having evenly spaced pawls arranged in diametrically opposite pairs for cooperating with the said teeth, the spacing between adjacent pawls exceeding an integral multiple of the spacing between the teeth, by an amount equal to the spacing between adjacent teeth divided by the number of pairs of pawls.

2. A ratchet drive comprising an outer ring having an even number of evenly spaced internal ratchet teeth, an inner member having evenly spaced pawls arranged in diametrically opposite pairs for cooperating with the said teeth, the spacing between adjacent pawls exceeding an integral multiple of the spacing between the teeth, by an amount equal to the spacing between adjacent teeth divided by the number of pairs of pawls.

3. A ratchet drive according to claim 2, in which the outer ring has ninety teeth and the inner member has eight pawls.

4. A ratchet drive mechanism comprising an outer ring having a plurality of evenly spaced internal ratchet teeth, means cooperating with the outer ring to form a housing, an inner ratchet member having a plurality of sets of evenly spaced pawls, the number of pawls being related to the number of teeth so that one pawl of each set engages a tooth simultaneously with one pawl of each other set, means formed on the inner ratchet member and the housing for rotatably supporting the inner ratchet member in the housing, means for mounting the housing upon a shaft for supporting the ring and inner ratchet member in spaced relation to the shaft end, a clutch member slidable in the inner member, and means for mounting the clutch member slidably on the end of a shaft aligned with the first mentioned shaft, the housing having an opening accommodating the said clutch member.

5. A ratchet drive mechanism comprising an outer ring having an even number of evenly spaced internal ratchet teeth, means cooperating with the outer ring to form a housing, an inner ratchet member having a plurality of pairs of diametrically opposite and evenly spaced pawls, the number of pawls being related to the number of teeth so that one such pair of pawls engages a pair of ratchet teeth simultaneously, means formed on the inner ratchet member and the housing for rotatably supporting the inner ratchet member in the housing, means for mounting the housing upon a shaft for supporting the ring and inner ratchet member in spaced relation to the shaft end, a clutch member slidable in the inner member, and means for mounting the clutch member slidably on the end of a shaft aligned with the first mentioned shaft, the housing having an opening accommodating the said clutch member.

6. A ratchet drive mechanism comprising an outer ring having internal ratchet teeth, means cooperating with the ring to form front and back housing walls, an inner ratchet member carrying pawls for cooperating with the said teeth, a shaft rotatably coupled to the said inner ratchet member, and means formed on the inner ratchet member and housing means for rotatably supporting the said inner member in the housing independently of the said shaft.

7. A ratchet drive mechanism comprising an outer ring having internal ratchet teeth, a pair of face plates attached to the ring and forming an oil housing therewith, one of the said face plates having means for attaching it to a shaft end in supported and driving relation thereto, the other of the said face plates having an axial circular opening, an inner ratchet member carrying pawls for cooperating with the said teeth, means formed on the inner ratchet member and face plates for rotatably supporting the said inner member in the housing, and a drive member for the inner ratchet member passing through the said circular opening and having a circular hub fitting therein for completing the oil housing.

8. A ratchet drive member according to claim 7, in which the drive member and inner ratchet member having cooperating splines and comprising also means mounting the drive member slidably for engaging and disengaging with the inner ratchet member.

9. A ratchet drive mechanism comprising an outer ring having internal ratchet teeth, a pair of face plates attached to the said ring for forming a housing, means for mounting one of the said face plates on a shaft for supporting the ring therefrom and forming a drive connection between the ring and the said shaft, an internal ratchet drive member carrying pawls in cooperating relation to the teeth of the said ring, means for rotatably supporting the said inner ratchet member in the housing, an axially movable clutch member slidably positioned within the inner drive member, the clutch member and inner ratchet member having cooperating spline teeth, the clutch mem-

ber having also a circular hub, and the second said face plate having a circular opening fitting around the same to complete an oil housing.

10. A ratchet drive mechanism comprising a ring having internal ratchet teeth, face plates attached to the ring to form a housing, an inner drive member rotatably carried in the housing and having a plurality of axial bores spaced around its periphery and openings from said bores through its periphery, pawl members comprising short shafts carrying pawl plates and rotatably and slidably carried in the said bores with the plates projecting through the said openings in cooperating position with relation to the teeth, the face plates having bearing surfaces for the ends of the said short shafts, for maintaining them in predetermined position axially of the inner member.

11. A ratchet drive mechanism according to claim 10, in which the short shafts have slots receiving the pawl plates and transverse pins holding the plates within the slots.

12. A ratchet drive mechanism according to claim 10, in which the inner member has bores extending transversely of the first mentioned bores and comprising spring

pressed plungers within the said transverse bores and engaging the pawl plates for urging them outwardly toward the outer ring.

13. A ratchet drive mechanism comprising an outer ring having a plurality of evenly spaced ratchet teeth, means coperating with the outer ring to form a housing, a ratchet member having a plurality of pawls supported to engage the ratchet teeth, a shaft rotatably coupled to the said ratchet member, and means formed on the ratchet member and the housing for rotatably supporting the ratchet member in the housing independently of the said shaft.

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