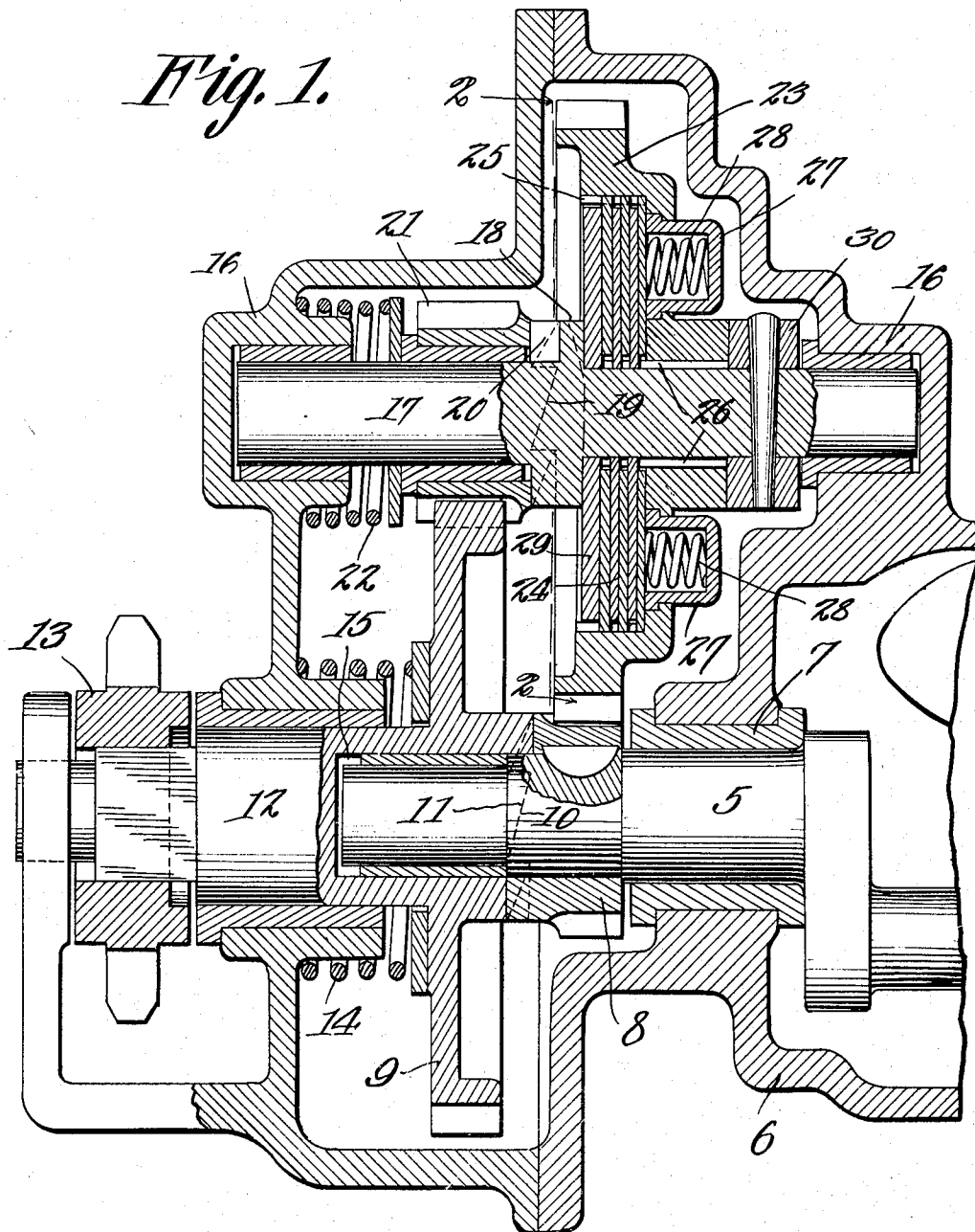


F. H. WALKER.
GEARING.
APPLICATION FILED AUG. 29, 1914.

1,156,869.

Patented Oct. 12, 1915.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 2.

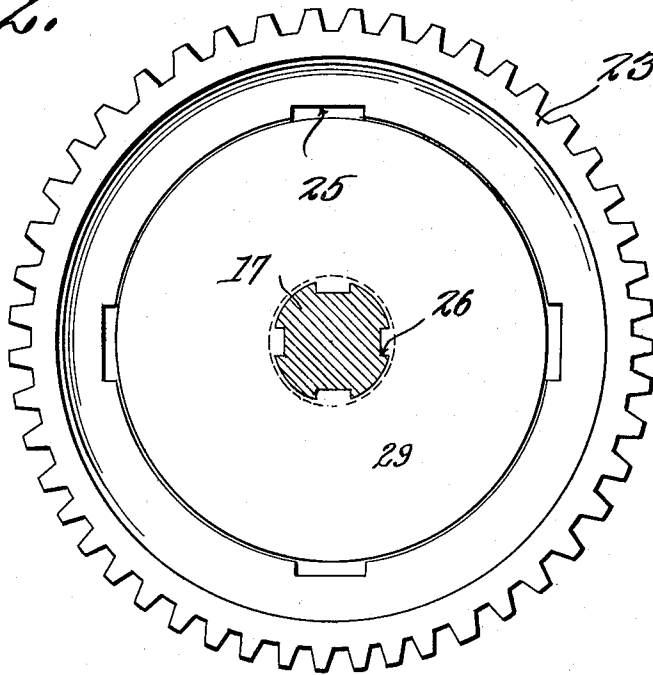
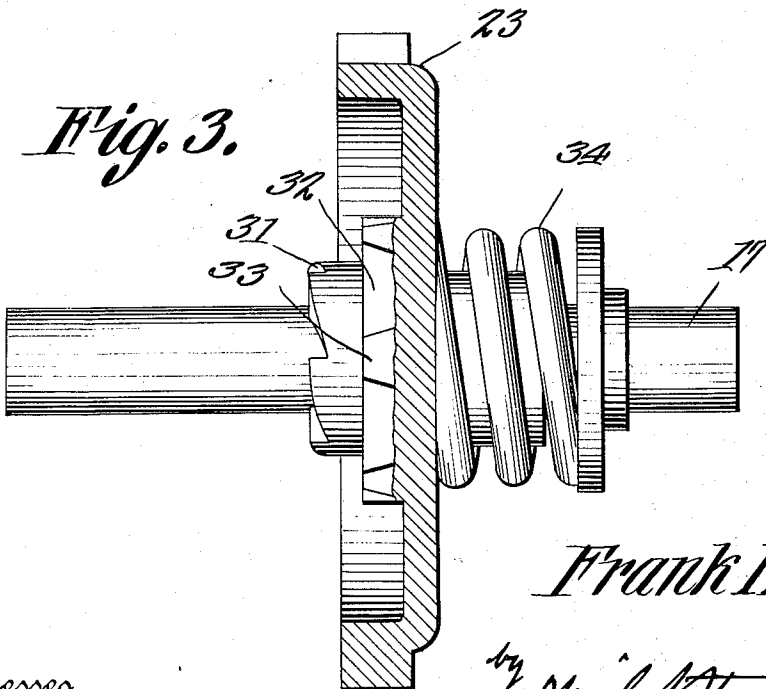


Fig. 3.



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UNITED STATES PATENT OFFICE.

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GEARING.

1,156,869.

Specification of Letters Patent.

Patented Oct. 12, 1915.

Application filed August 29, 1914. Serial No. 859,182.

To all whom it may concern:

Be it known that I, FRANK H. WALKER, a citizen of the United States, residing at Lacon, in the county of Marshall and State of Illinois, have invented certain new and useful Improvements in Gearing, of which the following is a specification.

The gearing which is the subject matter of the present application for patent is designed more particularly for use in connection with starters for internal combustion engines, and its object is to provide a novel and improved gearing for operatively connecting the drive shaft of the starter to the engine shaft when the engine is to be started, after which said drive shaft is driven by the engine shaft to restore or replenish the energy which was expended in starting the engine.

In the accompanying drawing forming a part of this specification, Figure 1 is a central vertical section of the gearing; Fig. 2 is a cross-section on the line 2—2 of Fig. 1, and Fig. 3 is an elevation, partly in section, showing a modified form of clutch employed in connection with the mechanism.

Referring specifically to the drawings, 5 denotes the shaft of the starter of an internal combustion engine, said shaft being driven by an air motor which is convertible into a pump to replenish the air which is expended in starting the engine. The convertible air motor and pump have not been illustrated as they form no part of the present application, and for the same reason the engine has also not been illustrated. The starter shaft 5 is inclosed in a suitable case 6, a fragment of which is shown in Fig. 1, said case also inclosing certain other parts of the mechanism to be presently described, and having a bearing 7 for the starter shaft.

On the shaft 5 is keyed or otherwise made fast a pinion 8, and alongside the latter, a spur gear 9 is loosely and slidably mounted on said shaft. On the hub of the pinion are ratchet teeth 10 which interlock with ratchet teeth 11 on the hub of the spur gear. These ratchet teeth are beveled on one side so that they slip past each other when the shaft 5 is turned, but engage when the gear 9 is driven from the engine. The gear 9 has an elongated hub extension 12 on the side oppo-

site the one provided with the ratchet teeth 11, and to said hub extension is coupled to turn with the gear, a sprocket wheel 13 which is connected by a chain to the shaft of the engine which is to be started. Any other suitable drive connection between the engine shaft and the gear 9 may be provided. A coiled spring 14 between the gear 9 and the adjacent wall of the case 6 tends to normally hold the ratchet teeth 10 and 11 in mesh.

The hub of the gear 9 has an axial bore 15 into which the end of the shaft 5 extends. The case 6 has bearings 16 supporting a counter-shaft 17 which is arranged parallel to the starter shaft 5. On the counter-shaft is a collar 18 which is integral with the shaft or is made fast thereto to turn therewith. One side of this collar has ratchet teeth 19 which are in mesh with ratchet teeth 20 on the hub of a pinion 21, which latter is slidably and loosely mounted on the counter-shaft and is in mesh with the gear 9. The pinion is wide enough to allow the same and the gear 9 to slide without their teeth getting out of mesh. A spring 22 engages the pinion 21 to hold the ratchet teeth 19 and 20 yieldingly in mesh.

The motion of the shaft 5 is transmitted by the pinion 8 to a spur gear 23 on the counter-shaft 17, and the latter derives motion from the spur gear through a friction clutch. This clutch comprises a series of friction disks 24 mounted in a recess in one face of the gear 23. These disks are coupled alternately to the gear and to the counter-shaft. The gear has grooves 25 and the shaft has grooves 26 in which seat lugs on the alternate disks. Back of the disks the gear has pockets 27 in which seat springs 28 which bear against the adjacent disk. The disk at the other end of the series abuts against a disk 29 which latter, in turn, abuts against the collar 18. To the counter-shaft 17 is fastened a collar 30 which abuts against the rear end of the hub of the gear 23. The pressure of the springs 28 frictionally couples the disks 24 together, and as said disks are alternately coupled to the gear 23 and to the counter-shaft 17, the motion of the former is transmitted to the latter.

The operation of the gearing is as fol-

lows: When power is applied to the starter shaft 5 by the air motor, the pinion 8 rotates, the ratchet teeth 10 and 11 slipping past each other. The pinion 8 rotates the gear 23 and the latter drives the counter-shaft 17 through the friction disks 24. The pinion 21 is driven by the counter-shaft through the ratchet teeth 19 and 20, and as said pinion is in mesh with the gear 9, the latter is also turned. As the sprocket wheel 13 turns with the gear 9 and is connected to the shaft of the engine to be started, said shaft is turned. A suitable clutch will be provided to connect and disconnect the engine shaft from the starting mechanism. When the engine starts it drives the sprocket wheel 13 and the gear 9, and through the ratchet teeth 10 and 11, the pinion 8 is driven, and as the latter is fast on the starter shaft 5, the latter is driven at the same speed as the engine shaft, and the air motor which drives the starter shaft now acts as a pump to replenish the air supply. As the pinion 21 is in mesh with the gear 9, it is now also driven, but at a greater speed than the gear 23, and hence the ratchet teeth 19 and 20 separate. Thus, it will be seen that when the engine is running, a direct drive is obtained for the starter shaft 5 from the engine shaft and at the same speed as the latter, for the purpose stated, whereas when the engine is to be started, the shaft thereof is turned slowly from the starter shaft 5 with the maximum power through the pinion 8, gear 23, counter-shaft 17, pinion 21, gear 9 and sprocket wheel 13.

With the structure shown in Fig. 1 a slippage between the friction disks 24 takes place whenever there is an overload as in the case of "kicking" back of the engine in starting, thus breaking the driving connection between the gear 23 and the shaft 17. The friction between the disks 24 is able to resist this slippage only in proportion as the springs 27 force the disks together.

Fig. 3 shows a modified form of clutch mechanism between the gear 23 and the counter-shaft 17. In this construction a ratchet collar 31 is fast on the counter-shaft and has clutch teeth 32 which interlock with clutch teeth 33 on the gear. These teeth are tapered so that they may slip past each other, and a spring 34 bearing against the gear is so tensioned that it holds the teeth together firmly enough to couple the gear to the counter-shaft, but allows them to slip when the engine "kicks" back.

I claim:

1. A gearing for internal combustion engine starters, comprising a starter shaft, a pinion fast on the starter shaft, a spur gear loose on the starter shaft, a driving connection between the spur gear and the shaft of the engine to be started, a coupling between the pinion and the spur gear, which

coupling is disconnected when the starter shaft is driven by its motor, a counter-shaft, a spur gear mounted on the counter-shaft and in mesh with the aforesaid pinion, a pinion loose on the counter-shaft and in mesh with the first-mentioned spur gear, a driving connection between the second-mentioned spur gear and the counter-shaft, and a driving connection between the spur gear and the pinion of the counter-shaft, said connection separating when the pinion is driven at a greater speed than the spur gear.

2. A gearing for internal combustion engine starters, comprising a starter shaft, a pinion fast on the starter shaft, a spur gear loose on the starter shaft, a driving connection between the spur gear and the shaft of the engine to be started, interlocking ratchet teeth on the spur gear and on the pinion, said teeth slipping when the starter shaft is driven by its motor, the spur gear being slidable on the starter shaft, a counter-shaft, a spur gear mounted on the counter-shaft and in mesh with the aforesaid pinion, a pinion loose on the counter-shaft and in mesh with the first-mentioned spur gear, a driving connection between the second-mentioned spur gear and the counter-shaft, and a driving connection between the spur gear and the pinion of the counter-shaft, said connection separating when the pinion is driven at a greater speed than the spur gear.

3. A gearing for internal combustion engine starters, comprising a starter shaft, a pinion fast on the starter shaft, a spur gear loose on the starter shaft, a driving connection between the spur gear and the shaft of the engine to be started, a coupling between the pinion and the spur gear, which coupling is disconnected when the starter shaft is driven by its motor, a counter-shaft, a spur gear mounted on the counter-shaft and in mesh with the aforesaid pinion, a pinion loose on the counter-shaft and in mesh with the first-mentioned spur gear, a driving connection between the second-mentioned spur gear and the counter-shaft, a ratchet collar on the counter-shaft, and a ratchet on the second-mentioned pinion interlocking with the ratchet collar, said pinion being slidable on the counter-shaft to effect separation of the ratchets when the pinion of the counter-shaft is driven at a greater speed than the spur gear of the counter-shaft.

4. A gearing for internal combustion engine starters, comprising a starter shaft, a pinion fast on the starter shaft, a spur gear loose on the starter shaft, a driving connection between the spur gear and the shaft of the engine to be started, a coupling between the pinion and the spur gear, which coupling is disconnected when the starter shaft is driven by its motor, a counter-shaft, a spur gear mounted on the counter-shaft

and in mesh with the aforesaid pinion, a
pinion loose on the counter-shaft and in
mesh with the first-mentioned spur gear,
and a driving connection between the sec-
5 ond-mentioned spur gear and the counter-
shaft, said connection disengaging when the
counter-shaft is overloaded.

In testimony whereof I affix my signature
in presence of two witnesses.

FRANK H. WALKER.

Witnesses:

E. D. RICHMOND,
OLIVE LEIGH.