G. J. ANDERSON.

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JAN. 3, 1911.

999,195.

Patented Aug. 1, 1911.

3 SHEETS—SHEET 1.

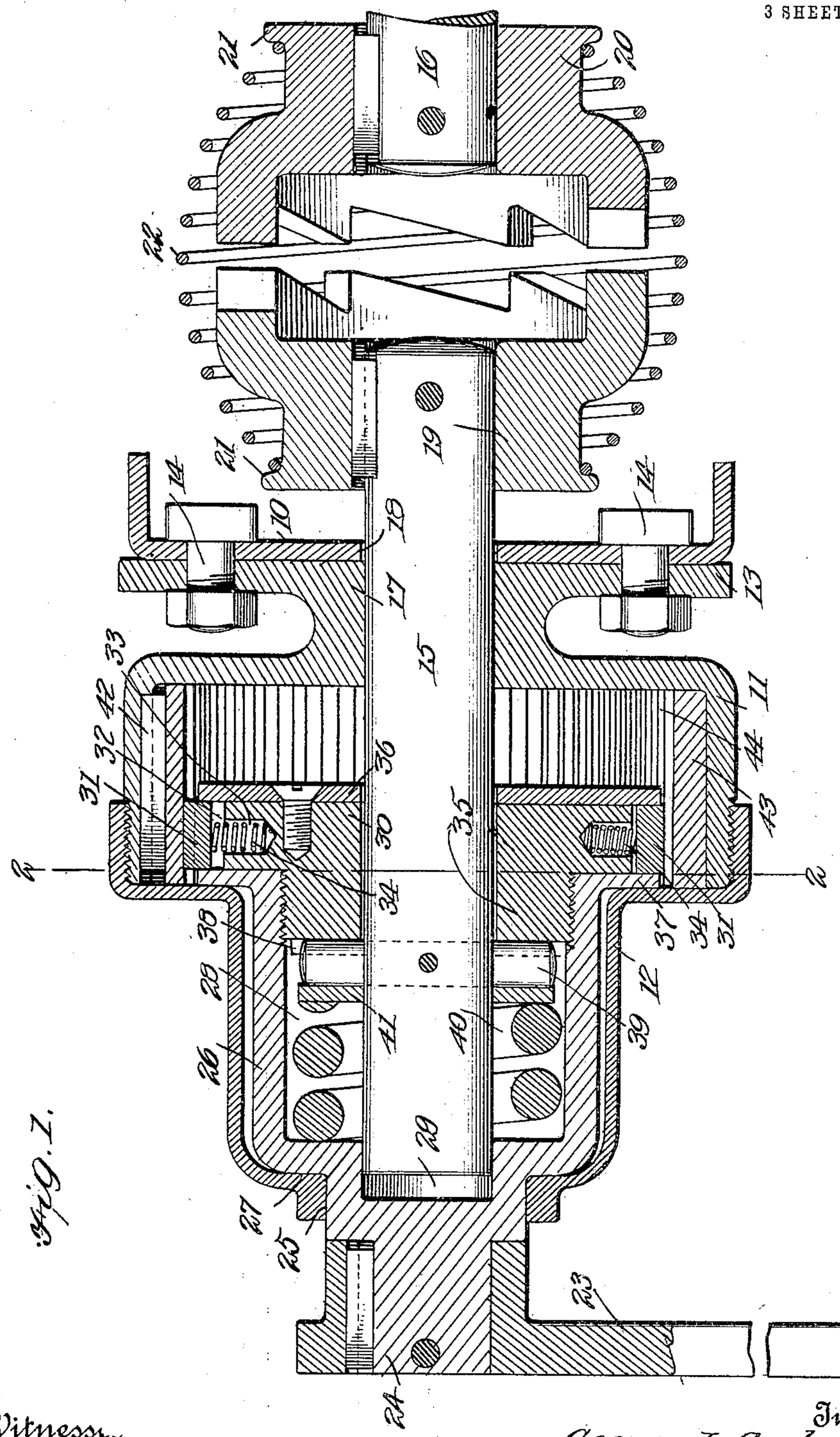

Fig. 1.

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Fig. 3.

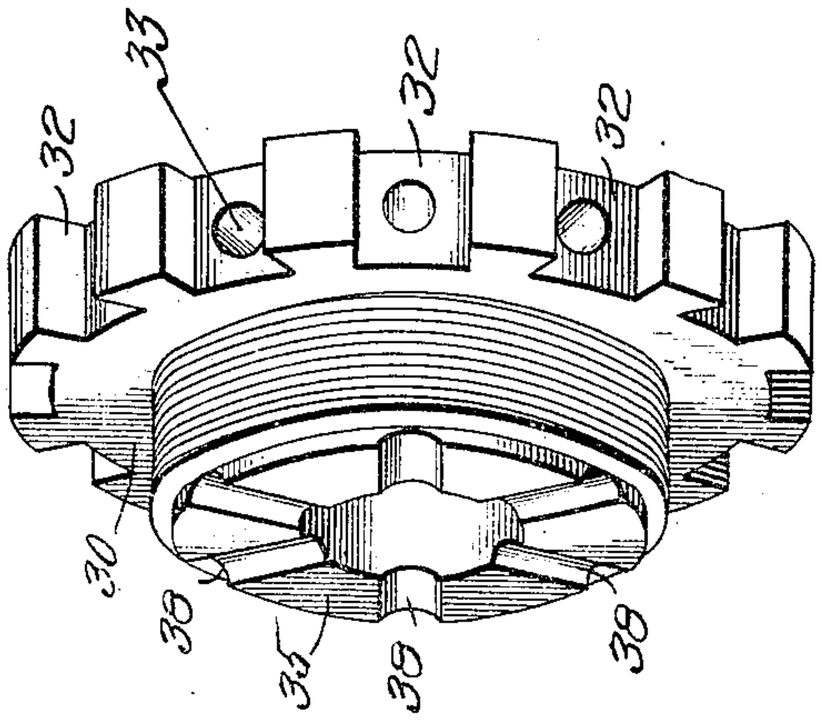

Fig. 2.

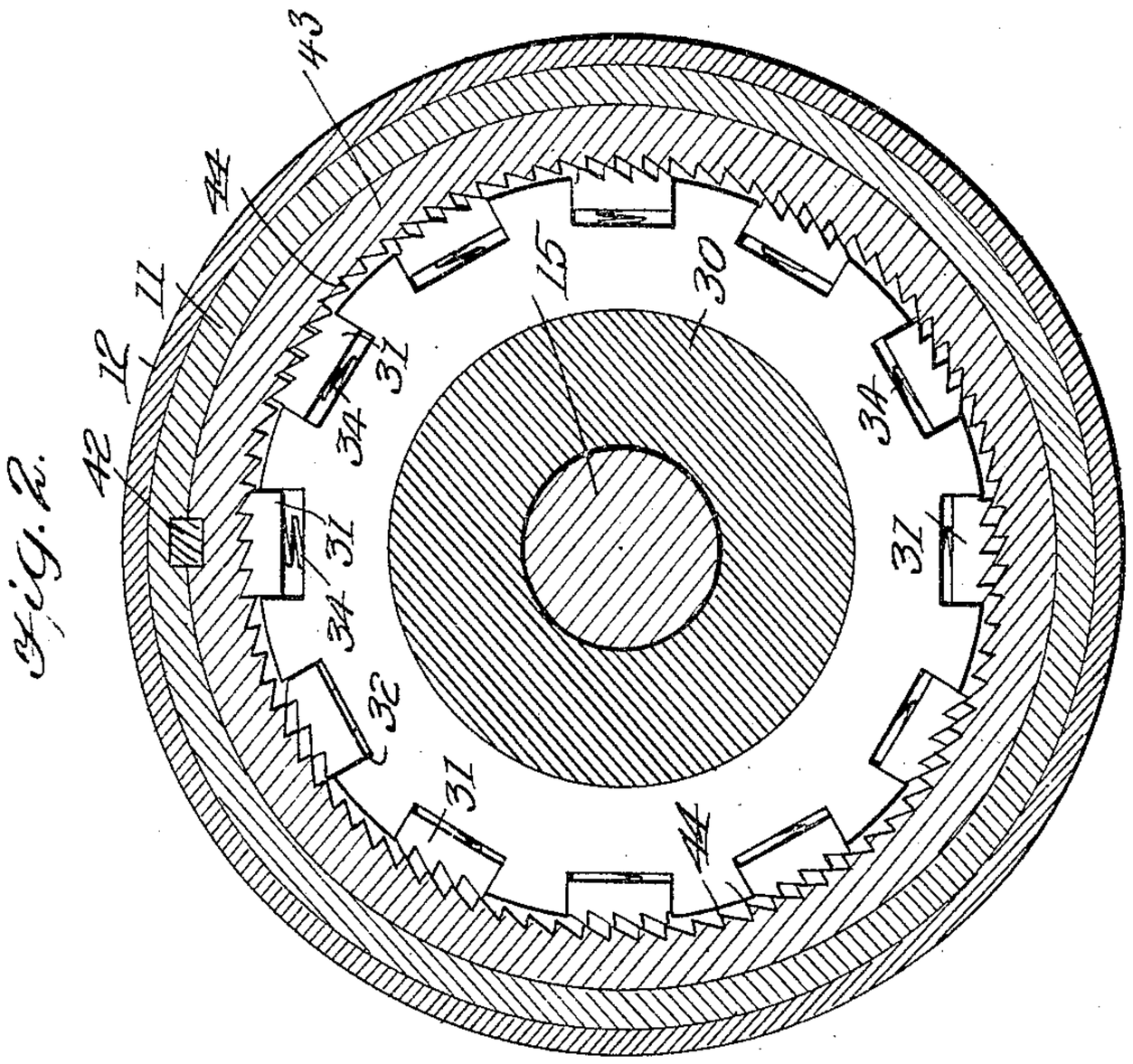

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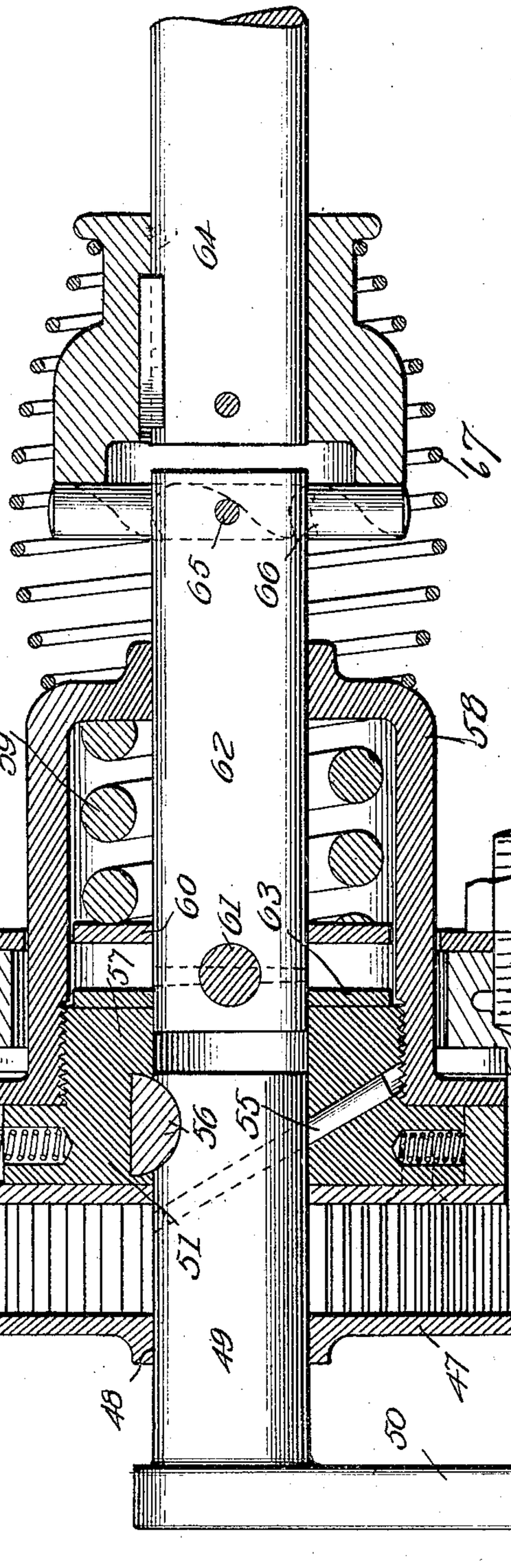
Fig. 4.



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UNITED STATES PATENT OFFICE.

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STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

999,195. Specification of Letters Patent. Patented Aug. 1, 1911.

Application filed January 3, 1911. Serial No. 600,583.

To all whom it may concern:

Be it known that I, GEORGE J. ANDERSON, citizen of the United States, residing at West Chazy, in the county of Clinton and State of New York, have invented certain new and useful Improvements in Starting Devices for Internal-Combustion Engines, of which the following is a specification.

This invention relates to manually operated starting devices for internal combustion engines; and it is the object of the invention to provide an improved mechanism of this kind which will be automatically disconnected from the starting shaft in case the engine should start backward, or "kick back", as it is commonly termed.

Another object of the invention is to provide a starting mechanism which can be readily applied to any ordinary internal combustion engine, either automobile, marine, or stationary, without altering or modifying the structure thereof.

The invention comprises a starting shaft, means for coupling the same to the engine crank shaft, and a pawl-and-ratchet mechanism between the starting shaft and a housing, said pawl-and-ratchet mechanism being arranged so as to permit a forward, but not a reverse motion of the hand crank. A yielding connection between the hand crank and the starting shaft is also provided, which connection is so arranged that these two elements operate together as one for turning the crank shaft against the highest compression, but when the engine "kicks back", the starting shaft is disconnected from the hand crank, so that the reverse motion will not be communicated to the latter.

The invention also consists in a novel construction and arrangement of parts to be hereinafter described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a longitudinal section of the starting mechanism which is the subject of the present invention. Fig. 2 is a cross-section on the line 2—2 of Fig. 1. Fig. 3 is a perspective view of the pawl-carrying member, removed. Fig. 4 is a longitudinal section of a modification.

In the drawings, 10 denotes a portion of the engine frame or other suitable support to which is firmly secured a housing which carries the starting mechanism. This housing is in two parts connected by a screw joint or other suitable means, as shown in Fig. 1, said parts being indicated at 11 and 12, respectively. The part 11 has a base flange 13 and is secured to the frame 10 by means of bolts or other suitable fastening means 14 passing through the frame and the flange.

The housing herein described incloses a starting shaft 15 which is in axial alinement with the engine crank shaft, a fragment of the latter being shown at 16. The housing is formed at its base with a bearing portion 17 which supports the starting shaft, and the latter passes loosely through an opening 18 in the frame 10, and extends into close proximity to the crank shaft. The opposi' ends of the two shafts carry clutch members 19 and 20, respectively. The starting shaft is movable in the direction of its length to bring its clutch member 19 into locking engagement with the clutch member 20 of the crank shaft, whereby said shafts are coupled together, and the motion of one will be transmitted to the other. The two clutch members have circumferential flanges 21 between which is interposed a coiled releasing spring 22, the function of which latter is to normally hold the clutch members separated and thus disconnect the shafts. Upon pushing the starting shaft forwardly in the direction of the crank shaft to interlock the clutch members, the spring 22 is compressed, and when the starting shaft is released, it is moved back, by the spring, in the opposite direction, to disengage its clutch member from the clutch member of the crank shaft.

At 23 is indicated an ordinary hand crank which is located on the outside of the housing, and is made fast to a short shaft 24 which is supported in an opening 25 in the part 12 of the housing, and has an enlarged and tubular portion 26 located in said portion of the housing. The shoulder 27 formed by the enlargement of the shaft 24 engages the end wall of the portion 12 of the housing, and thus limits the outward movement of the shaft. The shaft 24 is in axial alinement with the starting shaft 15, and the latter extends into the bore 28 of the tubular portion 26 of the former, and also into an axial opening 29 in the shaft 24 at the inner end of said bore, said opening thus providing a support for the end of the starting shaft.

The shaft 24 carries a disk 30 which latter

carries a series of pawls 31, the periphery of the disk having notches 32 in which the pawls seat, said pawls being blocks which fit in the notches and have their outward surface toothed. At the inner ends of the notches are pockets 33 in which seat coiled springs 34 which engage the inner ends of the pawl blocks, and serve to force the same outwardly from the notches sufficiently to bring their teeth into engagement with the teeth of the ratchet ring to be presently described.

The disk 30 has a hub 35 which is externally screw-threaded and screws into the bore 28, whereby the connection between the disk and the shaft 24 is made. The disk and its hub have a central opening through which the starting shaft 15 loosely passes. To one face of the disk is secured a circular plate 36, and on the portion 26 of the shaft 24 is an outstanding circular end flange 37 which engages the other face of the disk. This plate and the flange close up the notches 32 at the ends thereof, and serve to prevent displacement of the pawls 31.

A yielding coupling between the disk 30 and the starting shaft 15 is provided. This coupling comprises the following means: The face of the hub 35 is located in the bore 28, and has a series of uniformly spaced radial notches 38, any two diametrically opposite ones of which are adapted to be entered by a transverse pin 39 carried by the starting shaft, and projecting from diametrically opposite sides thereof, said pin being made fast to the shaft by any suitable means. Behind the pin is located a strong coiled spring 40, a washer 41 being interposed between the pin and one end of the spring. The other end of the spring abuts against the inner end of the bore 28. The spring serves to yieldingly hold the pin in the notches.

In the portion 11 of the housing is secured, by means of a key or any other suitable device, 42, a ratchet ring 43, the teeth 44 of which are on its inner periphery. This ring encircles the disk 30, and its teeth are adapted to be engaged by the teeth of the pawls 31. The width of the ring 43 and its teeth is such that the pawls will remain in engagement with the teeth when the starting shaft is in advanced, as well as in retracted, position.

In operation, to start the engine, the entire mechanism herein described, except the housing, is pushed forwardly by taking hold of the hand crank 23, whereupon the starting shaft 15 is advanced in the direction of the crank shaft 16, and the clutch members 19 and 20 are engaged with each other, thereby coupling the two shafts together. The hand crank is now given a turn to rotate the crank shaft in the proper direction to start the engine, and after the engine starts, the clutch members automatically disengage, the inclined contiguous surfaces of the teeth of the members causing the starting shaft to back away from the crank shaft, whereupon the starting shaft is disconnected from the crank shaft. The motion of the hand crank to start the engine is transmitted to the disk 30 by reason of the connection of the latter with the portion 26 of the shaft 24, and the motion of the disk is transmitted to the starting shaft by reason of the engagement of the pin 39 with the notches 38. The pawl and ratchet teeth are arranged to permit the parts to turn freely in a direction to start the engine, the pawls slipping over the ratchet teeth during this movement of the parts. If the engine should "kick back", the pawls at once take hold, and lock the disk 30 against the reverse rotation, and the pin 39 slips back one or more notches against the pressure of the spring 40.

The average lifting effort necessary in cranking an automobile is from one hundred to two hundred pounds, and for a large, high-compression engine, a lifting effort of as much as four hundred pounds is required. The force of the "back kick" is almost illimitable—ranging around a ton pressure. For average motor cars, therefore, the spring 40 and the parts coöperating therewith are so designed that a lift of from six hundred to eight hundred pounds on the hand crank is transmitted without back slip, but when the "back kick" reaches, say, one thousand pounds pressure, a back slip does occur, and the hand crank is safely held by the pawl-and-ratchet mechanism.

The notches 38 govern the synchronism of the device—that is, the hand crank is always in a predetermined advantageous position of its swing when the engine passes the point of highest compression, no matter in which notch the pin 39 seats. The number of these notches, therefore, depends on the engine to which the device is attached. For example, if the clutch members 19 and 20 have six teeth, as shown, then six notches 38 must be provided. But if the clutch members have only four teeth, then four notches should be provided.

It will be noted that the ratchet ring 43 has eighty-five teeth, and that twelve pawl blocks 31 are provided. However, any reasonable number, more or less, may be used, provided the number of ratchet teeth divided by the number of pawl blocks leaves a remainder of one tooth. Thus—eighty-five divided by twelve equals seven and one remainder. This means that only one block will engage at a time, and the distance from one block to the next, center to center, is seven and one-twelfth teeth. Therefore, the greatest drop back is one-twelfth of a tooth. The release of the hand crank when the engine "kicks back" is, therefore, practically

instantaneous, and all danger of injury to the operator is eliminated. The number of teeth which each pawl block embraces depends merely upon the strength required to insure against breakage. The drawings show the blocks dimensioned to engage four of the ratchet teeth. This arrangement may vary according to the nature of the material used in the construction of the pawl blocks and the ratchet ring. Preferably special steel, heat treated, will be employed.

The mechanism herein described can be readily fitted to any internal combustion engines, since it is entirely outside the frame 10.

Fig. 4 discloses a slightly modified structure designed to be employed where many engines of the same kind are to be fitted with the invention, and where space allows a portion of the housing to be located inside the engine frame. Referring specifically to Fig. 4, 45 denotes a part of the engine frame to which the housing 46, inclosing the mechanism, is bolted or otherwise rigidly secured. The outer end of this housing is closed by a screw-cap 47 having a central opening 48 which serves as a bearing for a shaft 49 fitted at its outer end with a hand crank 50. On that portion of the shaft 49 which extends into the housing is mounted a disk 51 carrying pawls 52, similar to the pawls already described, and adapted to engage ratchet teeth on the inner periphery of a ring 53, also similar to the ratchet ring heretofore described, said ring being mounted in the housing, and fastened thereto by a key or other suitable means 54. The disk 51 is made fast to the shaft 49 by a pin 55 and a key 56, or any other suitable means. The disk 51 is provided with a hub 57, similar to the hub 35, and said hub 57 screws into a housing 58 which passes loosely through an opening in the housing 46, as well as through an opening in the frame 45. The housing 58 incloses a spring 59 engaging at one of its ends a washer 60 which latter engages a pin 61 carried by a starting shaft 62, said pin corresponding to the pin 39, and engaging notches 63 in the face of the hub 57, similar to the notches 38. The starting shaft 62 is in axial alinement with the shaft 49, and extends for a short distance at its inner end into the bore of the hub 57. The other end of the shaft extends through an opening in the housing 58, and is located in close proximity to the crank shaft 64. That end of the starting shaft 62 which is opposite the end of the crank shaft 64 carries a transverse pin 65 which is adapted to engage the notches of a clutch head 66 fitted to the end of the crank shaft, when the starting device is pushed forwardly to lock the two shafts together. This clutch mechanism automatically disengages in the same manner as the clutch members 19 and 20 already described, when the engine starts, a release spring 67 being also provided.

The operation of the modified mechanism is the same as that of the first described mechanism, the starting shaft being clutched to the engine crank shaft by pushing forwardly on the hand crank 50. The automatic release when the engine "kicks back" is also effected in the manner already described.

I claim:

1. In a starting device for internal combustion engines, a stationary housing, a ratchet ring secured in the housing, the teeth of the ring being on its inner periphery, a hand crank, a shaft on which the hand crank is mounted, said shaft having a tubular portion extending into the housing and supported by one end thereof, a starting shaft supported by the other end of the housing and extending thereinto, and also into the bore of the tubular portion of the first-mentioned shaft, a disk encircled by the ratchet ring and having a hub portion secured in the bore of the tubular portion of the first-mentioned shaft, the face of the hub having radial notches, a coupling member carried by the starting shaft within the aforesaid bore, yielding means for normally engaging said coupling member with the aforesaid notches, and radially slidable pawls carried by the disk and engageable with the aforesaid ratchet ring for locking the disk against reverse motion.

2. In a starting device for internal combustion engines, a stationary housing, a ratchet ring secured in the housing, the teeth of the ring being on its inner periphery, a hand crank, a shaft carrying said hand crank, said shaft extending into the housing, a coupling member mounted on the shaft within the housing and encircled by the ratchet ring, a starting shaft extending into the housing, yielding means for coupling the starting shaft to the coupling member, and radially slidable pawls carried by the coupling member and engageable with the aforesaid ratchet ring for locking the member against reverse motion.

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

GEORGE J. ANDERSON.

Witnesses:

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