Jan. 15, 1957 H. H. WAGNER 2,777,328

CONTROL FOR STARTER PINION ENGAGING MECHANISM

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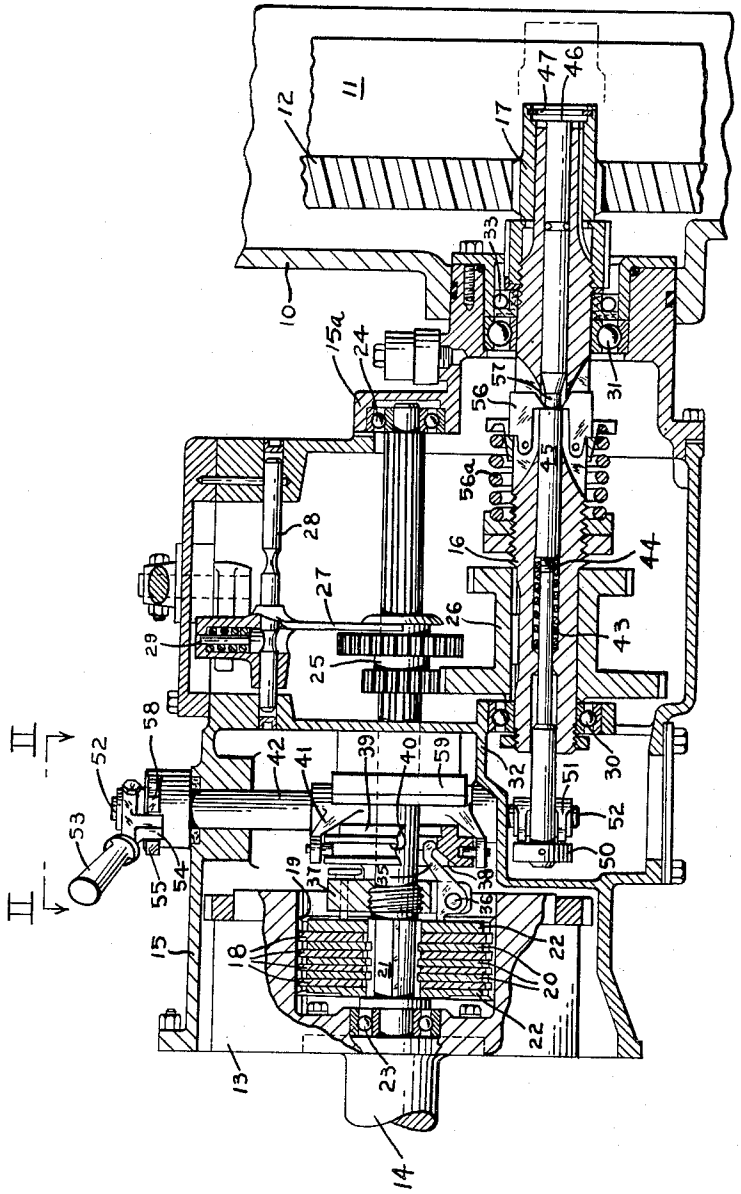


Fig. 1

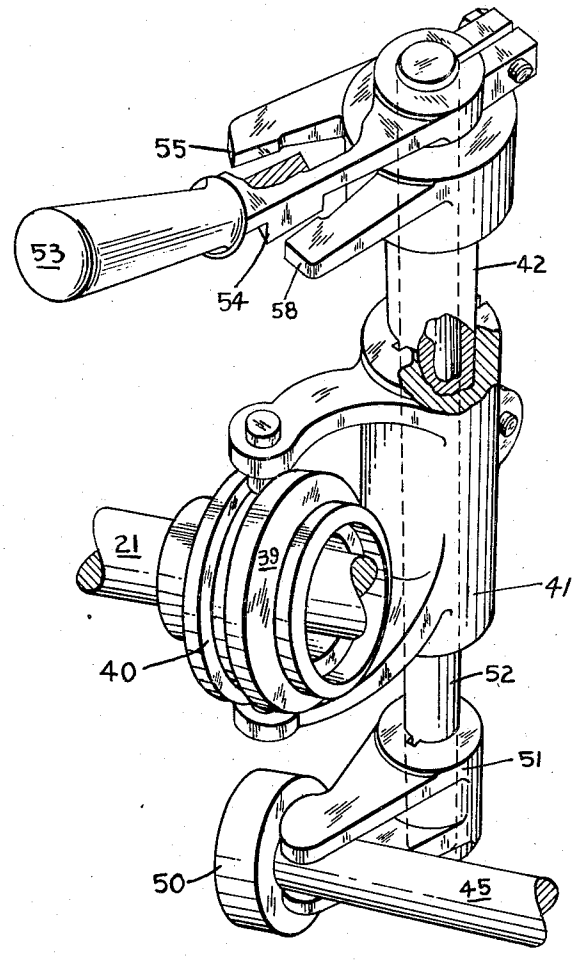
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Fig. 2.



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CONTROL FOR STARTER PINION ENGAGING MECHANISM

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4 Claims. (Cl. 74—6)

This invention relates to the starting mechanism for an internal combustion engine, and more particularly to the starter pinion engaging mechanism therefor.

The invention is particularly adapted for use in connection with starting mechanisms of the type disclosed in Patent No. 2,481,783 to Robinson et al. for "Starting Mechanism for Internal Combustion Engines" which issued on September 13, 1949 and also of the type disclosed in Patent No. 2,621,532 to Robinson et al. for "Starter Pinion Engaging Mechanism" which issued on December 16, 1952.

The former patent discloses a starting engine mounted on the side of a primary engine and a driving connection from the starting engine including a pinion gear adapted to mesh with a ring gear on the flywheel of the primary engine. The control mechanism is disclosed, together with centrifugally actuated latching mechanism for holding the pinion gear in engagement with the ring gear during starting of the primary engine. The latter patent discloses an improvement to the control mechanism whereby none of the latching mechanism extends beyond the end of the pinion. The present invention is concerned with a single lever control and mechanism for engaging the pinion with the ring gear and engaging the starting engine clutch.

The control mechanisms disclosed in the above identified patents utilize one control lever to move the starter pinion into engagement with the ring gear and a separate control lever to engage the friction clutch associated with the starting engine. This arrangement of control levers has been found to have certain disadvantages. One such disadvantage is that the controls must be actuated in a definite sequence to prevent damage to the pinion or the ring gear or both. The clutch brake should first be applied to stop any rotation of the pinion; secondly, the pinion engaging control lever must be actuated to engage the pinion; thirdly, the starting engine clutch must be engaged; and fourthly, the clutch must be disengaged after the primary engine has started and the pinion has been disengaged. It is preferred to include the fourth step in the sequence to prevent the possibility of any seizure of the clutch plates in the event that the clutch had become heated during operation.

It is, therefore, an object of the present invention to provide a single lever control mechanism for the starting engine clutch, as well as the mechanism for engaging the starting pinion gear with the flywheel ring gear, which will insure a sequence of operation of first engaging the starting pinion before engagement of the starting engine clutch and will automatically disengage the starting engine clutch upon disengagement of the pinion. Another object of this invention is to provide a combined mechanism for the sequential engaging of the starter pinion and the starting engine clutch, said mechanism being of compact design and enclosed within a housing to prevent any fouling or malfunction which might occur in exteriorly mounted interconnected lever linkages.

Other objects and advantages of this invention will be made apparent in the following description wherein reference is made to the accompanying drawings.

In the drawings:

Fig. 1 is a fragmentary view in section through a portion of a starting engine and the primary engine showing in detail the clutch parts associated with the starting engine flywheel, the driving mechanism between the starting engine and primary engine disclosing the pinion engaging mechanism, and the single control lever to effect sequential engagement of both the pinion and the starting engine clutch; and

Fig. 2 is an enlarged isometric view of the single control lever with parts broken away to illustrate the details of construction.

In Fig. 1 of the drawings, a part of a conventional internal combustion engine is illustrated as comprising a housing **10** enclosing a flywheel **11** having a ring gear **12** which may be formed integrally therewith. The primary engine carries a separate starting engine, only part of which is shown as comprising a flywheel **13** carried on a crankshaft, part of which is shown at **14** and a housing **15** enclosing the flywheel. Power from the starting engine is transmitted through a drive shaft **16** to a pinion gear **17**, which is adapted to be brought into engagement with the ring gear **12** to crank the primary engine.

The drive shaft **16** is driven from the starting engine flywheel through a conventional clutch comprising a series of clutch plates **18** having splined connections with the interior of a recess **19** provided in the flywheel **13** and a series of cooperating clutch plates **20** alternately arranged with the plates **18** and having splined connections with a driven shaft **21**. The clutch plates are adapted to be compressed between pressure plates **22** also having splined connections with shaft **21**, which is supported for rotation in bearings **23** and **24** carried in the starting engine flywheel **13** and an extension **15***a* of the housing **15** respectively. The clutch driven shaft **21** carries a cluster gear **25** splined to the shaft **21** and meshing with a second gear **26** splined to the drive shaft **16**. The cluster gear **25** is adapted for axial movement on shaft **21** so that either end of the gear may be selectively positioned to mesh with the mating end of gear **26** to effect a high or a low speed ratio between the starting engine and the drive shaft **16**. The gear **25** is shifted by means of a shifter fork **27** mounted on a conventional shift rail **28** and provided with a well-known spring-loaded detent-type locking mechanism, generally indicated at **29**, to resist axial movement of gear **25** while in mesh with gear **26**. The drive shaft is supported for rotation in bearings **30** and **31** carried in an internal wall **32** of the housing **15** and the extension **15***a* respectively. The enclosure formed by wall **32** and extension **15***a* which contains the speed change gears and the drive shaft **16** is adapted to contain lubricating oil for the lubrication of moving parts, and is provided with a seal **33** to prevent leakage of oil into the adjacent housing **10**.

Engagement of the clutch to transmit the drive from the flywheel to the driven shaft is accomplished by compressing the clutch plates through a plurality of cam levers, only one of which is illustrated at **35** as supported for rocking movement about a pin **36** carried in a spider **37** having a threaded connection with the periphery of the driven shaft. The ends of the cam levers are received within rearwardly converging recesses **38** provided in a collar **39** carried for sliding movement on the driven shaft so that axial movement of the collar effects engagement or release of the clutch. The periphery of the sliding collar **39** is provided with a groove **40** for the reception of the inwardly extending ends of a yoke **41** secured to a

sleeve 42 extending into and supported for rotation in the housing 15.

The starter pinion engaging mechanism is very similar to that disclosed in Patent No. 2,621,532. This mechanism comprises a drive shaft 16 carrying the pinion 17 which is splined to the shaft and is adapted for sliding movement thereon to effect engagement or disengagement with the ring gear 12. The pinion gear is normally urged toward its disengaged position illustrated in broken lines in Fig. 1 by a spring 43 carried in an axial bore provided in the drive shaft. The spring bears against a reduced section of the axial bore and a shoulder 44 formed on a control rod 45 carried in the axial bore of shaft 16. A collar 46 formed on the end of the control rod is received within an enlarged bore in the pinion gear and is retained by a shoulder at the end of the bore enlargement and an internal snap ring 47. The control rod is provided with a thrust plate 50 (also see Fig. 2) which is contacted by a yoke 51 secured to an engaging shaft 52 rotatably supported within and concentric with the sleeve 42. As shown in Fig. 2, a control handle 53 is secured to the rock shaft 52 and the handle is moved in a clockwise direction to effect engagement of the pinion. Further movement in a clockwise direction will cause a lug 54, integral with the handle, to contact an ear 55 provided on the sleeve and turn the sleeve in a clockwise direction to effect engagement of the starting engine clutch.

During starting of the primary engine it is desirable that the pinion gear remain in mesh with ring gear 12 until the primary engine is brought up to sufficient speed to assure its continued operation. A latching mechanism comprising a pair of pawls 56 biased by a spring 56*a* to engage in a peripheral groove 57 in the control rod 45 is provided for this purpose. As soon as a predetermined rotational speed is reached by the pinion 17, centrifugal force causes the pawls to swing outwardly to release the control rod. The spring 43 then urges the control rod to the right, as viewed in Fig. 1, which disengages the pinion from the ring gear. As the control rod moves in this direction during disengagement, the thrust plate 50 bears on the yoke 51 to rotate the engaging rock shaft 52 in a counter-clockwise direction. The control handle 53 moving with rock shaft 52 contacts a second ear 58 extending from sleeve 42 to rotate said sleeve in a counter-clockwise direction and disengage the starting engine clutch.

To insure that the pinion is not rotating before attempting to engage it with the ring gear, the control handle may be moved in a counter-clockwise direction to fully disengage the clutch and to move the clutch collar 39 into contact with a braking disc 59. The control handle is then rocked in a clockwise direction for the sequential operation of first engaging the pinion with the ring gear followed by engagement of the starting engine clutch. As described above, as soon as the primary engine starts and a predetermined rotational speed is reached by the pinion 17, it is automatically disengaged; at the same time, the starting engine clutch is disengaged to prevent any adherence of the clutch plates 18 and 20 in the event that they had become heated during engagement.

I claim:

1. In a starting mechanism for an engine having a ring gear, a starter driven pinion gear wherein the pinion gear is slidably supported on a hollow shaft for movement to and away from the ring gear, and a friction clutch interposed between the starter and the pinion gear, control means for sequential operation of first, engaging the pinion gear with the ring gear, and second, engagement of the friction clutch, said control means comprising a rod slidable in the hollow shaft, a yoke engaging the rod and secured to a rock shaft, a control lever extending from the rock shaft, said lever being provided with a projecting lug to contact an ear extending from a sleeve surrounding said rock shaft and carrying a yoke to effect engagement of the clutch.

2. In a starting mechanism for an engine having a ring gear, a starter driven pinion gear wherein the pinion gear is slidably supported on a hollow shaft for movement to and away from the ring gear, and a friction clutch interposed between the starter and the pinion gear, control means for sequential operation of first, disengaging the pinion gear from the ring gear, and second, disengagement of the clutch, said control means comprising a spring associated with a control rod to urge the pinion out of engagement with the ring gear upon release of latch means which hold the pinion in engagement until a predetermined rotational speed is reached, a yoke engaging the control rod, a rock shaft supporting said yoke, a lever secured to said rock shaft, said lever being provided with a projecting lug to contact an ear extending from a sleeve surrounding said rock shaft and carrying a yoke to effect disengagement of the clutch.

3. In a starting mechanism for an engine having a ring gear and a pinion on a sliding shaft for engagement with the ring gear, and a transmission shaft and clutch parallel to but spaced from the pinion shaft for driving the pinion, means including a yoke on a rockable shaft to effect engagement of the pinion, means including a yoke on a second rockable shaft to effect engagement of the clutch, and a single lever to actuate both said rockable shafts in sequence to insure engagement of the pinion with the ring gear before engagement of the clutch.

4. In a starting mechanism for an engine having a ring gear and a pinion on a sliding shaft for engagement with the ring gear, and a transmission shaft and clutch parallel to but spaced from the pinion shaft for driving the pinion, means including a yoke on a rockable shaft disposed transversely of the pinion and transmission shaft to effect engagement of the pinion, means including a yoke on a hollow rockable shaft which embraces the first rockable shaft to effect engagement of the clutch, a lever on the first rockable shaft to rock it and engage the pinion, and a part on said lever engageable with a part on the hollow rockable shaft to rock it and cause engagement of the clutch only after the pinion is engaged.

References Cited in the file of this patent

UNITED STATES PATENTS

2,621,532	Robinson et al.	Dec. 16, 1952

FOREIGN PATENTS

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891,685	France	Dec. 17, 1943