March 29, 1955 A. S. BOSMA 2,705,002

INTERNAL COMBUSTION ENGINES HAVING AUXILIARY DRIVES

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Fig. 1.

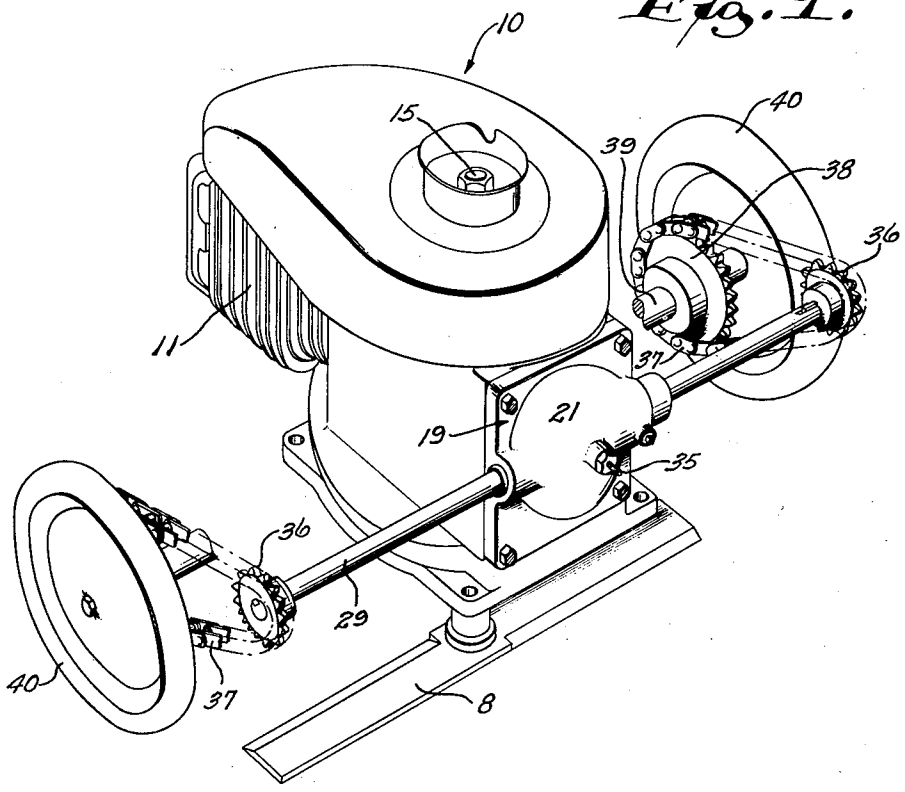
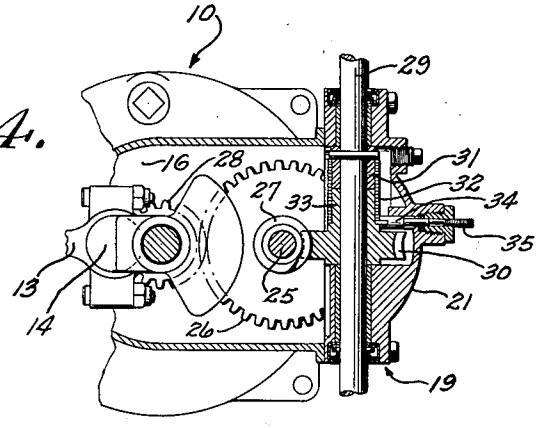



Fig. 4.




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Fig. 2.

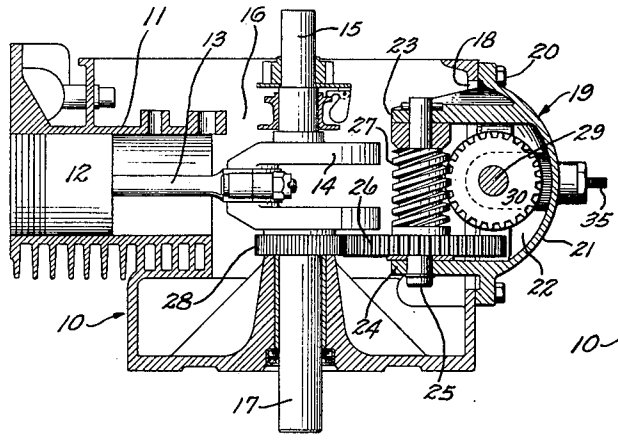



Fig. 5.

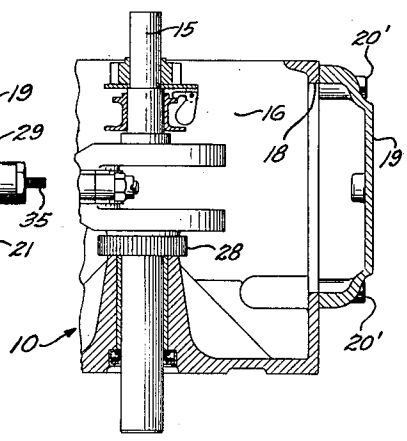
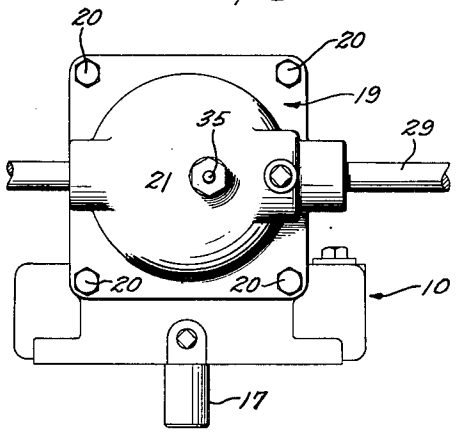



Fig. 3.




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# INTERNAL COMBUSTION ENGINES HAVING AUXILIARY DRIVES

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Application July 2, 1952, Serial No. 296,879

10 Claims. (Cl. 123—195)

This invention relates to improvements in internal combustion engines having auxiliary drives.

In the use of internal combustion engines it is often necessary to have an auxiliary power take-off which is in a plane at right angles to the plane of the main drive shaft from the engine. This requirement is present in power lawn mowers of the type in which the blade is rotatable in a horizontal plane, when it is desired to render such lawn mower self-propelled. Heretofore, in this type of mower it has been customary to have the motor so mounted that its main drive shaft extends vertically, the horizontally rotatable blade being connected directly to the lower end thereof. In order to drive the wheels with the same motor it has heretofore been necessary to use external means for transmitting power from the main drive shaft to another shaft at right angles thereto. This external transmission means is objectionable in a lawn mower because it multiplies the number of exposed parts and does not lend itself to present day requirements for a pleasing external appearance. In addition, these external parts must be separately lubricated, and exposed lubricated parts cause cut grass to adhere with clogging effects.

It is a general object of the present invention to provide an internal combustion engine wherein there is an auxiliary shaft which is in a plane at right angles to the plane of the main drive shaft, said auxiliary shaft being driven by means which is inside of the engine housing.

A further object of the invention is to provide a construction as above described wherein the transmission means for driving the auxiliary shaft is so located in the crankcase as to be lubricated by the splash lubrication system of the engine proper.

A further more specific object of the invention is to provide a construction as above described wherein the crankcase has an opening, there being a cover for said opening which has an externally projecting portion through which the auxiliary drive shaft is journaled, and there being means inside of said cover, which is mounted thereon for removal with the cover, for transmitting power from the crankshaft to the auxiliary shaft when the cover is in place.

A further object of the invention is to provide a specially constructed engine having a crankcase provided with an open end, there being interchangeable covers for said open end whereby the same engine may be adapted to either a single or double drive depending upon which cover is employed.

With the above and other objects in view, the invention consists of the improved internal combustion engine, and all of its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating one complete embodiment of the preferred form of the invention in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is a perspective view showing the improved engine as used in a self-propelled power lawn mower of the type having a horizontally rotatable blade, parts of the lawn mower being omitted;

Fig. 2 is a vertical sectional view through the main portion of the engine showing use of the cover which provides the auxiliary drive, the upper portion of the engine being removed;

Fig. 3 is an end elevational view of the structure of



Fig. 2, the ends of the auxiliary drive shaft being broken away;

Fig. 4 is a horizontal sectional view through part of the structure of Fig. 2; and

Fig. 5 is a fragmentary vertical sectional view taken similarly to Fig. 2 showing a plain cover for the crankcase opening instead of the cover which provides the auxiliary drive.

Referring more particularly to the drawings, the internal combustion engine is designated generally by the numeral **10** and includes a cylinder **11** having a piston **12** movable therein, and a connecting rod **13** connecting the piston to the crank **14** of a crankshaft **15**, said crank being movable in a crankcase **16** as is customary. The lower end of the crankshaft projects from the bottom of the engine as at **17**, and when the engine is used for driving a power lawn mower of the type shown in Fig. 1, the horizontally rotating blade **8** may be connected directly to the lower end of the shaft **17** below the portion of the lawn mower (not shown) which covers the rotating blade and supports the engine.

At the end of the crankcase which is opposite the cylinder **11**, there is an opening **18**. This opening may be closed either by the cover **19** or by the cover **19'** (Fig. 5), these covers being removably held in position by bolts **20** or **20'**.

The cover **19** forms one of the important features of the present invention. It includes a hollow outwardly projecting portion **21** to form a chamber **22** therewithin. Projecting into the crankcase through the opening from the interior of the cover are spaced wall portions **23** and **24**. Journaled at its ends to extend between said wall portions is a short shaft **25**. Fixedly mounted on said shaft is a gear **26** and a worm **27**. Part of the gear **26** projects into the chamber **22** formed by the hollow interior of the cover **19**. The gear **26** is so positioned, when the cover **19** is in place, that it meshes with a gear **28** which is rigidly mounted on the crankshaft **15**.

Journaled in the projecting portion **21** of the cover with its axis in a plane at right angles to the plane of the axis of the crankshaft is an auxiliary drive shaft **29**. The latter has ends which project laterally from the engine as shown in Figs. 1 and 4. Mounted loosely on the auxiliary shaft within the chamber **22** formed by the hollow interior of the cover is a worm wheel **30** which meshes with the worm **27** (see Fig. 4). Pinned to the auxiliary drive shaft within the interior of the cover is a clutch sleeve **31** to which one end of a clutch spring **32** is connected. The other end of the spring embraces a hub **33** on the worm wheel. A clutch controlling member **34** which may be operated by an external Bowdin wire **35** is adapted to cause temporary wrapping of the spring around the worm wheel hub **33** so that rotation of the worm wheel will cause a clutching engagement with resulting drive of the auxiliary drive shaft when desired. This type of wrap-around clutch is well known in the art and its details have therefore not been shown.

It is to be noted that the gear **26**, worm **27**, and worm wheel **30** are all supported within the margin of the opening **18**, with the length of the short shaft **25** less than the diameter of the opening. Thus, when the cover **19** is removed, all of the parts which transmit power to the auxiliary shaft **29**, with the exception of the gear **28** on the crankshaft and including the auxiliary drive shaft **29** itself, are removed with the cover **19**. When the cover is in place with the bolts **20** tightened, the gear **26** is caused to automatically engage the pinion **28** on the crankshaft.

When the improved engine equipped with the cover **19** is employed in a lawn mower of the type shown in Fig. 1, sprocket wheels **36** may be mounted directly on the projecting ends of the auxiliary drive shaft **29** and connected by means of endless chains **37** with sprocket wheels **38** which are on the lawn mower shaft **39** carrying the traction wheels **40**. Thus, when the engine is equipped with the improved cover **19** and associated parts, the engine may be made to propel the wheels **40** as well as rotate the cutting blade **8**.

Inasmuch as there is a substantial demand for smaller lawn mowers of this type in which the wheels are not

self-propelled, but in which the same internal combustion engine is used, by substituting the cover 19' of Fig. 5 for the cover 19 of Fig. 2 the engine may be readily adapted for the single drive purpose.

Inasmuch as the gear 26, worm 27, and worm wheel 30 are all located close to the crank 14 on the crankshaft, these parts are all lubricated by the usual splash lubrication system in the crankcase.

The worm 27 may be readily interchanged with a worm having reverse threading when it is desired to have the auxiliary shaft driven in a reverse direction.

Various changes and modifications may be made without departing from the spirit of the invention, and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In an internal combustion engine having a crankcase provided with an opening at one end and having a cylinder at its opposite end and said engine having a crankshaft journalled in said crankcase intermediate said opening and cylinder and extending transversely of the axis of said opening and cylinder, a cover for said crankcase opening, an auxiliary shaft supported for rotation on said cover and having an externally projecting portion and having its axis extending transversely of the axis of said crankshaft, and means for transmitting power from said crankshaft to said auxiliary shaft when said cover is in place, said means including transmission parts on said crankshaft and on said cover positioned for automatic engagement when the cover is in position.

2. In an internal combustion engine having a crankcase provided with an opening at one end and having a cylinder at its opposite end and said engine having a crankshaft journalled in said crankcase intermediate said opening and cylinder and extending transversely of the axis of said opening and cylinder, a removable cover for said crankcase opening, said cover having a hollow outwardly projecting portion to provide a chamber therewithin, an auxiliary drive shaft journaled in the projecting portion of said cover and having its axis extending transversely of the axis of said crankshaft, and means including parts mounted on said cover and projecting into said cover chamber for transmitting power from said crankshaft to said auxiliary shaft when said cover is in place, said parts being readily removable with the cover without affecting the support for the crankshaft.

3. In an internal combustion engine having a crankcase provided with a cylinder at one end and having an opening at the opposite end, there being a crankshaft having a crank intermediate said cylinder and opening and said crankshaft extending transversely of the axis of said cylinder and opening, a gear on said crankshaft, a cover closing said opening and having a hollow outwardly projecting portion to provide a chamber therewithin, an auxiliary drive shaft journaled in the projecting portion of said cover and having its axis extending transversely of the axis of the crankshaft, a gear rotatably supported on said cover and positioned to mesh with the gear on the crankshaft when the cover is in position, and worm and worm wheel means carried by the cover for transmitting power from said cover gear to said auxiliary shaft.

4. In an internal combustion engine having a crankcase provided with a cylinder at one end and having an opening at the opposite end, there being a crankshaft having a crank intermediate said cylinder and opening and said crankshaft extending transversely of the axis of said cylinder and opening, a gear on said crankshaft, a cover closing said opening and having a hollow outwardly projecting portion to provide a chamber therewithin, an auxiliary drive shaft journaled in the projecting portion of said cover and having its axis extending transversely of the axis of the crankshaft, a gear rotatably supported on said cover and positioned to mesh with the gear on the crankshaft when the cover is in position, a worm rotatable with said cover gear and supported on the cover, a worm wheel mounted on said auxiliary drive shaft and driven by said worm, and externally controllable clutch means for transmitting rotation from said worm wheel to said auxiliary shaft.

5. In an internal combustion engine having a crankcase provided with a cylinder at one end and having an opening at the opposite end, there being a crankshaft having a crank intermediate said cylinder and opening and said crankshaft extending transversely of the axis of said cylinder and opening, a gear on said crankshaft, a cover closing said opening and having a hollow outwardly projecting portion to provide a chamber therewithin, an auxiliary drive shaft journaled in the projecting portion of said cover and having its axis extending transversely of the axis of the crankshaft, a gear rotatably supported on said cover and positioned to mesh with the gear on the crankshaft when the cover is in position, a worm rotatable with said cover gear and supported on the cover, a worm wheel mounted on said auxiliary drive shaft and driven by said worm, and externally controllable clutch means for transmitting rotation from said worm wheel to said auxiliary shaft, said cover gear, worm, worm wheel and auxiliary shaft being readily removable with said cover without affecting the support for the crankshaft.

6. In an internal combustion engine having a crankcase provided with a cylinder at one end and having an opening at the opposite end, there being a crankshaft having a crank intermediate said cylinder and opening and said crankshaft extending transversely of the axis of said cylinder and opening, a gear on said crankshaft, a cover closing said opening and having a hollow outwardly projecting portion to provide a chamber therewithin, there being spaced wall portions projecting into the crankcase from the cover chamber, an auxiliary drive shaft journaled in the projecting portion of said cover and having its axis extending transversely of the axis of the crankshaft, a short shaft journaled between said spaced wall portions of the cover, a gear rotatably supported on said short shaft and positioned to mesh with the gear on the crankshaft when the cover is in position, a worm on said short shaft, and a worm wheel within the cover on said auxiliary shaft and driven by said worm for transmitting power to said auxiliary shaft.

7. In an internal combustion engine having a crankcase provided with an end opening which lies in an upright plane and having a crankshaft journalled vertically in said crankcase to lie in a plane which extends in the same general direction as the plane of said opening but which is spaced inwardly therefrom, a cover for said crankcase opening, an auxiliary shaft supported for rotation on said cover and having an externally projecting horizontally disposed portion with its axis extending transversely of the axis of the crankshaft, and means for transmitting power from said vertical crankshaft to said horizontal auxiliary shaft when said cover is in place, said means including transmission parts on said crankshaft and on said cover which are positioned for automatic engagement when the cover is in place.

8. A power take-off unit for use in an internal combustion engine having a crankcase provided with an opening located in a given plane and having a crankshaft journalled in said crankcase inwardly of said opening in a plane which extends in the same general direction as the plane of said opening, there being a gear on said crankshaft, comprising a cover of a size to close said opening, an auxiliary shaft supported for rotation on said cover and having an externally projecting portion whose axis extends transversely of the axis of the crankshaft, when the cover is in place, and transmission means for said auxiliary shaft carried by said cover and including a transmission member which is located for automatic engagement with said gear on the crankshaft when the cover is in position.

9. A power take-off unit for use in an internal combustion engine having a crankcase provided with an opening located in a given plane and having a crankshaft journalled in said crankcase inwardly of said opening in a plane which extends in the same general direction as the plane of said opening, there being a gear on said crankshaft, comprising a cover of a size to close said opening, an auxiliary shaft supported for rotation on said cover and having an externally projecting portion whose axis extends transversely of the axis of the crankshaft when the cover is in place, a gear rotatably supported on said cover and positioned to mesh with the gear on the crankshaft when the cover is in position, and worm and worm wheel means carried by the cover for transmitting power from said cover gear to said auxiliary shaft.

10. A power take-off unit for use in an internal com-

bustion engine having a crankcase provided with an opening located in a given plane and having a crankshaft journalled in said crankcase inwardly of said opening in a plane which extends in the same general direction as the plane of said opening, there being a gear on said crankshaft, comprising a cover of a size to close said opening, spaced wall portions projecting from the inner side of said cover, an auxiliary shaft supported for rotation on said cover and having an externally projecting portion whose axis extends transversely of the axis of the crankshaft when the cover is in place, a short shaft journalled between said spaced wall portions of the cover, a gear rotatably supported on said short shaft



and positioned to mesh with the gear on the crankshaft when the cover is in position, a worm on said short shaft, and a worm wheel within the cover on said auxiliary shaft and driven by said worm for transmitting power to said auxiliary shaft.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,377,378 | White | May 10, 1921 |
| 1,957,221 | McCray | May 1, 1934 |
| 2,256,601 | West | Sept. 23, 1941 |