May 5, 1931. V. G. APPLE 1,803,829

ELECTRIC STARTING DEVICE

Filed Jan. 20, 1928

Fig. 2.

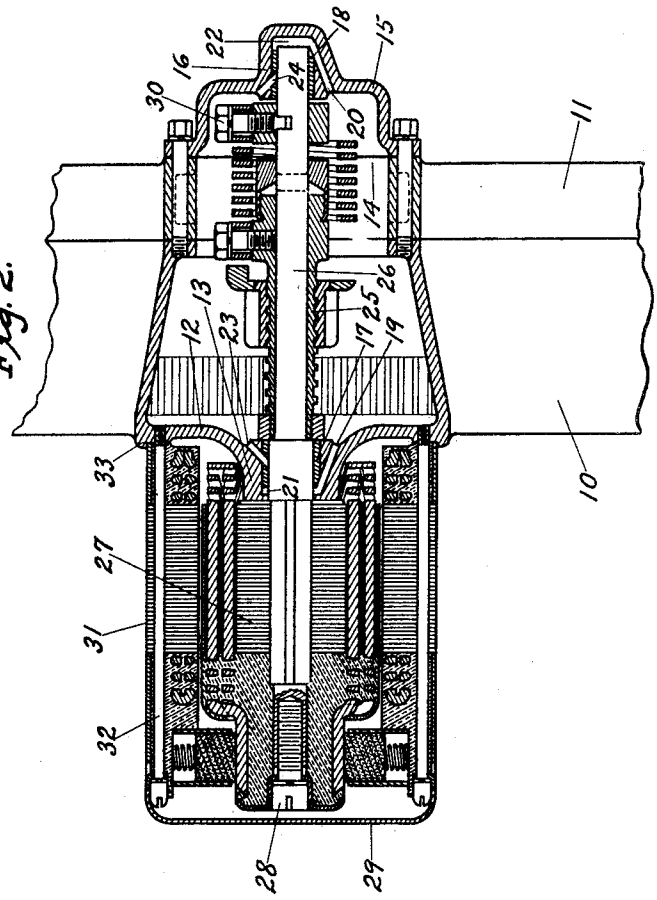
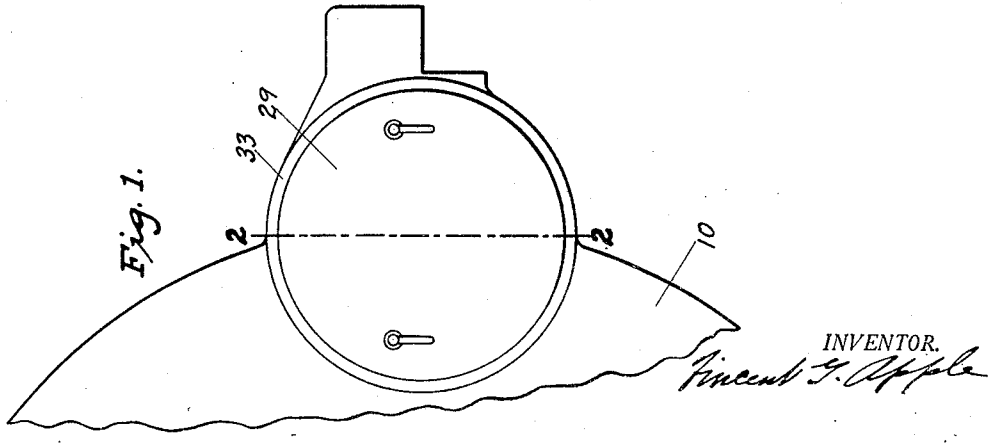


Fig. 1.



INVENTOR.

Vincent G. Apple

Patented May 5, 1931 1,803,829

UNITED STATES PATENT OFFICE

VINCENT G. APPLE, OF DAYTON, OHIO

ELECTRIC STARTING DEVICE

Application filed January 20, 1928. Serial No. 248,232.

My invention relates to electric starting devices of the class used in connection with internal combustion engines, and particularly to that form wherein a motor is normally disconnected from the engine but which has a means associated therewith whereby the motor is connected to the engine during the time of starting, then disconnected therefrom as soon as the engine is running. The embodiment shown employs the well known Bendix drive to connect and disconnect the starting motor and the engine.

The object of my invention is to eliminate the frame used by the conventional starting motor to carry its pinion shaft bearings by a simple modification of the engine housing, whereby it is adapted to carry equivalent bearings, an armature being then supported in overhung fashion on an extended end of the pinion shaft, and a field held concentric with the armature by an annular rib formed in the engine housing, to the end that a low cost structure may be provided wherein the parts requiring oil are segregated from those to which oil is detrimental.

I attain this object by the structure illustrated in the following drawings, wherein—

Fig. 1 is an end elevation of my device and Fig. 2 a longitudinal vertical cross section.

Similar numerals refer to similar parts thruout the several views.

In the drawing 10 is the fly wheel housing of an automotive engine and 11 is the housing cover, which usually forms also a part of the transmission housing.

Ordinarily there is a large opening in the fly wheel housing thru which the frame of the conventional starting motor extends, but in the structure herein shown this opening is replaced by a wall 12 which carries bearing hub 13.

An opening 14 is left in the housing cover, and this is closed by a bearing cap 15 which carries another bearing hub 16.

Bearing hubs 13 and 16 are lined with bearing bushings 17 and 18 respectively, and oil return holes 19 and 20 drain surplus oil which has collected in grooves 21 and 22 back into the housing.

Oil supply holes 23 and 24 carry oil to the bearings when the splash system of oiling is employed, and the same holes may be connected to suitable supply tubes when force feed oiling is desired.

A conventional Bendix drive 25 is mounted on shaft 26 within the housing 10 and between bearings 17 and 18, and an armature 27 is mounted outside the housing on the extending end of shaft 26 with no outboard bearing to support the commutator end. The removal of screw 28 then permits the removal of armature 27 from shaft 26 when brush cover 29 is not in place, and the removal of screw 30 permits the removal of the Bendix drive 25 when cap 15 is removed.

The field element 31 is held against the housing 10 by screws 32 while the annular rib 33 keeps the field concentric with the armature 27.

From the foregoing description and drawing it is obvious that the bearings and gearing to which oil is beneficial are separated by wall 12 from the windings and brush gear to which oil is detrimental, and that this is accomplished in the structure shown with less labor and material than is required in the conventional starting equipment.

While the principles of my invention may find their widest application when used in connection with the Bendix drive as shown, these principles may be equally useful when employed with other drives, whether they include a means of disconnection from the engine or are permanently connected thereto, as in a single unit starter or a charging dynamo.

Believing that by the arrangement herein shown and described I have produced an improved device at reduced cost, I claim—

1. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear situated within said housing and adapted to rotate with said engine, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith, said shaft being within said housing but having an end extending through and beyond one wall of said housing, a bearing for said shaft in said wall, a rotatable member of a dynamo elec-

tric machine secured in overhung fashion outside of said housing to the extending end of said shaft, and a non-rotatable member of said dynamo electric machine secured to the outside of said wall in operative relation with said rotatable element.

2. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear secured to said engine within said housing and adapted to revolve with said engine, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith, said shaft being mostly within said housing but having an end extending through and beyond one wall thereof, a bearing for said shaft in said wall, another bearing for said shaft within said housing, a rotatable element of a dynamo electric machine outside of said housing secured in overhung fashion to the extending end of said shaft, and a stationary element of a dynamo electric machine secured to the outside of said wall in operative relation with said rotatable element.

3. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear secured to said engine within said housing partly immersed in said oil and adapted to revolve with said engine, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith within said housing but having one end extending through and beyond one wall of said housing, a bearing for said shaft in said wall, a dynamo electric machine rotor outside of said housing secured in overhung fashion to the extending end of said shaft, and a dynamo electric machine stator secured to the outside of said wall in operative relation with said rotor.

4. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear secured to said engine within said housing partly immersed in said oil and adapted to revolve with said engine, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith within said housing but having one end extending through and beyond one wall of said housing, a bearing for said shaft in said wall, another bearing for said shaft within said housing, a dynamo electric machine armature outside of said housing secured in overhung fashion to the extending end of said shaft, and a dynamo electric machine field element secured to the outside of said wall in operative relation with said armature.

5. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing to rotate said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and be disengaged therefrom after said engine is started, means to operate said pinion into and out of engagement, a shaft within said housing adapted to support and rotate said pinion, said shaft extending through one wall of said housing, a bearing for said shaft in said housing wall, a rotatable element of an electric motor secured in overhung fashion to the extending end of said shaft and adapted to drive said shaft, and a stationary element of an electric motor secured to the outside of said housing wall in operative relation with said rotatable element.

6. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing to rotate said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and be disengaged therefrom after said engine is started, means to operate said pinion into and out of engagement, a shaft within said housing adapted to support and rotate said pinion, said shaft extending through one wall of said housing, a bearing for said shaft in said housing wall, another bearing for said shaft within said housing, a rotatable element of an electric motor secured in overhung fashion to the extending end of said shaft and adapted to drive said shaft, and a stationary element of an electric motor secured to the outside of said housing wall in operative relation with said rotatable element.

7. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing partly immersed in said oil and adapted to drive said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and to be disengaged therefrom after said engine is started, means within said housing to shift said pinion into and out of engagement, a shaft, adapted to support and rotate said pinion, within said housing but having one end extending through one wall of said housing, a bearing for said shaft in said housing wall, an electric motor rotor secured in overhung fashion to the extending end of said shaft to rotate said shaft, and an electric motor stator secured to the outside of said housing wall in operative relation with said rotor.

8. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing partly immersed in said oil and adapted to drive said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to

start said engine and be disengaged therefrom after said engine is started, means within said housing to shift said pinion into and out of engagement, a shaft adapted to support and rotate said pinion, said shaft being mostly within said housing but having one end extending through one wall of said housing, a bearing for said shaft in said housing wall, another bearing for said shaft within said housing, an electric motor armature secured in overhung fashion to the extending end of said shaft to rotate said shaft, and an electric motor field element secured to the outside of said housing wall in operative relation with said armature.

9. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear situated within said housing secured to said engine to rotate therewith, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith within said housing but having one extending end through and beyond one wall of said housing, a bearing for said shaft in said housing wall, an annular rib formed on the outside of said housing wall concentrically surrounding said bearing, a stationary element of a dynamo electric machine held in concentric relation to said shaft by said rib, and a rotatable element of a dynamo electric machine secured in overhung fashion to the extending end of said shaft in operative relation with said stationary element.

10. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear within said housing secured to said engine to rotate therewith, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith within said housing but having one end extending through and beyond one wall of said housing, a bearing for said shaft in said housing wall, an annular rib formed on the outside of said housing wall concentrically surrounding said bearing, another bearing for said shaft within said housing, a stationary element of a dynamo electric machine held in concentric relation to said shaft by said rib, and a rotatable element of a dynamo electric machine secured in overhung fashion to the extending end of said shaft in operative relation with said stationary element.

11. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear secured to said engine within said housing partly immersed in said oil and adapted to revolve with said engine, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith within said housing but having one end extending through and beyond one wall of said housing, a bearing for said shaft within said wall, an annular rib formed on said wall on the outside of said housing concentric with said shaft, a dynamo electric machine stator element held in concentric relation to said shaft by said rib, and a dynamo electric machine rotor secured in overhung fashion to the extending end of said shaft in operative relation with said stator.

12. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear secured to said engine within said housing partly immersed in said oil and adapted to revolve with said engine, a pinion within said housing adapted to mesh with said gear, a shaft secured to said pinion for rotation therewith within said housing but having one end extending through and beyond one wall of said housing, a bearing for said shaft in said wall, another bearing for said shaft within said housing, an annular rib formed on said wall on the outside of said housing concentric with said shaft, a dynamo electric machine field element held in concentric relation to said shaft by said rib, and a dynamo electric machine armature secured in overhung fashion to the extending end of said shaft in operative relation with said field element.

13. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing to rotate said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and be disengaged therefrom after said engine is started, means to operate said pinion into and out of engagement, a shaft within said housing adapted to support and rotate said pinion, said shaft extending through one wall of said housing, a bearing for said shaft in said housing wall, an annular rib formed on the outside of said housing wall concentrically surrounding said bearing, a stationary element of an electric motor held concentric with said shaft by said rib, and a rotatable element of an electric motor within said field element secured in overhung fashion to the extending end of said shaft to rotate said shaft.

14. The combination of an internal combustion engine having a housing surrounding its movable parts, with a gear of relatively large diameter secured to said engine within said housing to rotate said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and be disengaged therefrom after said engine is started, means to operate said pinion into and out of engagement, a shaft within said housing adapted to support and rotate said pinion, said shaft extending through one wall of said housing, a bearing for said shaft in said housing wall, a second

bearing for said shaft within said housing, an annular rib formed on the outside of said housing wall concentrically surrounding the first said bearing, a stationary element of a dynamo electric machine held concentric with said shaft by said rib, and a rotatable element of a dynamo electric machine within said stationary element secured in overhung fashion to the extending end of said shaft to rotate said shaft.

15. The combination of an internal combustion engine having an oil containing housing surrounding its movable parts, with a gear of relatively large diameter secured to said engine within said housing partly immersed in said oil and adapted to drive said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and be disengaged therefrom after said engine is started, means within said housing to shift said pinion into and out of engagement, a shaft adapted to support and rotate said pinion, mostly within said housing but having an end extending through one wall of said housing, a bearing for said shaft in said housing wall, an annular rib formed on said wall on the outside of said housing concentric with said bearing, an electric motor stator element held concentric with said shaft by said rib, and an electric motor rotor within said field element secured in overhung fashion to the extending end of said shaft to drive said shaft.

16. The combination of an internal combustion engine having an oil containing housing, surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing partly immersed in said oil and adapted to drive said engine, a pinion of relatively small diameter within said housing adapted to engage said gear to start said engine and be disengaged therefrom after said engine is started, means within said housing to shift said pinion into and out of engagement, a shaft, adapted to support and rotate said pinion, mostly within said housing but having an end extending through one wall of said housing, a bearing for said shaft in said housing wall, another bearing for said shaft within the said housing, an annular rib formed on said wall on the outside of said housing concentric with the first said bearing, an electric motor field element held concentric with said shaft by said rib, and an electric motor armature within said field element secured in overhung fashion to the extending end of said shaft to drive said shaft.

17. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear situated within said housing and adapted to rotate with said engine, a shaft within said housing but having one end extending through and beyond one wall thereof, a bearing for said shaft within said wall, another bearing spaced apart from the first said bearing within said housing, a pinion secured to said shaft to rotate therewith between said bearings within said housing, said pinion being adapted to mesh with said gear, a dynamo electric machine rotor secured in overhung fashion outside of said housing to the extending end of said shaft and a dynamo electric machine stator secured to the outside of said wall concentrically surrounding said rotor.

18. The combination of an internal combustion engine having a housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing to rotate said engine, a shaft within said housing but having one end extending through and beyond one wall thereof, a bearing for said shaft in said wall, another bearing spaced apart from the first said bearing within said housing, a pinion of relatively small diameter together with means for operating said pinion into and out of engagement with said gear situated within said housing between said bearings on said shaft and adapted to be driven thereby, an electric motor rotor secured in overhung fashion to the extending end of said shaft to drive said shaft, and an electric motor stator secured to the outside of said housing wall in concentric relation to said rotor.

19. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear secured to said engine within said housing partly immersed in said oil and adapted to rotate with said engine, a shaft within said housing but having one end extending through and beyond one wall thereof, a bearing hub for said shaft in said wall, another bearing hub spaced apart from the first said bearing hub within said housing, said hubs both having one opening in the upper side to convey oil to said shaft from said housing and another opening in the lower side to return oil from the outer ends of said hubs to said housing, a pinion secured to said shaft for rotation therewith between said bearings within said housing, said pinion being adapted to mesh with said gear, a dynamo electric machine rotor secured in overhung fashion outside of said housing to the extending end of said shaft, and a dynamo electric machine stator secured to the outside of said wall concentrically surrounding said rotor.

20. The combination of an internal combustion engine having an oil containing housing surrounding its rotatable parts, with a gear of relatively large diameter secured to said engine within said housing partly immersed in said oil and adapted to rotate said engine, a shaft within said housing but having one end extending through and beyond one wall thereof, a bearing hub for said shaft in said wall, another bearing hub spaced

apart from the first said bearing hub within said housing, said hubs both having one opening in the upper side connecting the interior of said housing to points on the shaft journals midway of their length and another opening in the lower side connecting the interior of said housing to points on the shaft journals near their outer ends, an axially movable pinion within said housing between said bearing hubs adapted to engage said gear to start said engine and be disengaged therefrom when said engine is started, means within said housing between said bearing hubs to move said pinion axially into and out of engagement, an electric motor rotor secured in overhung fashion to the extending end of said shaft, and an electric motor stator secured to the outside of said housing wall in concentric relation to said shaft.

In testimony whereof I hereunto sign my name.

VINCENT G. APPLE.