July 11, 1961 J. M. BARR 2,991,779

TOY ENGINE STARTING DEVICE

Filed May 20, 1960 2 Sheets-Sheet 1

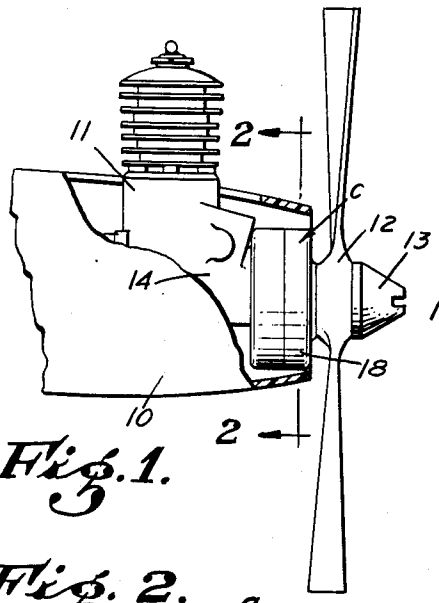


Fig. 1.

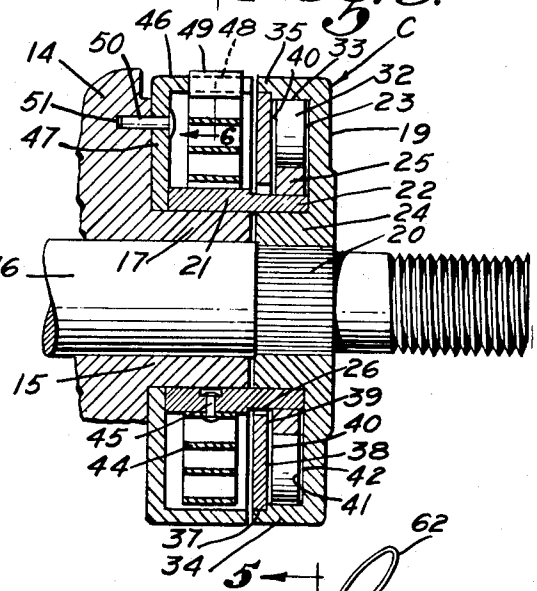


Fig. 3.

Fig. 2.

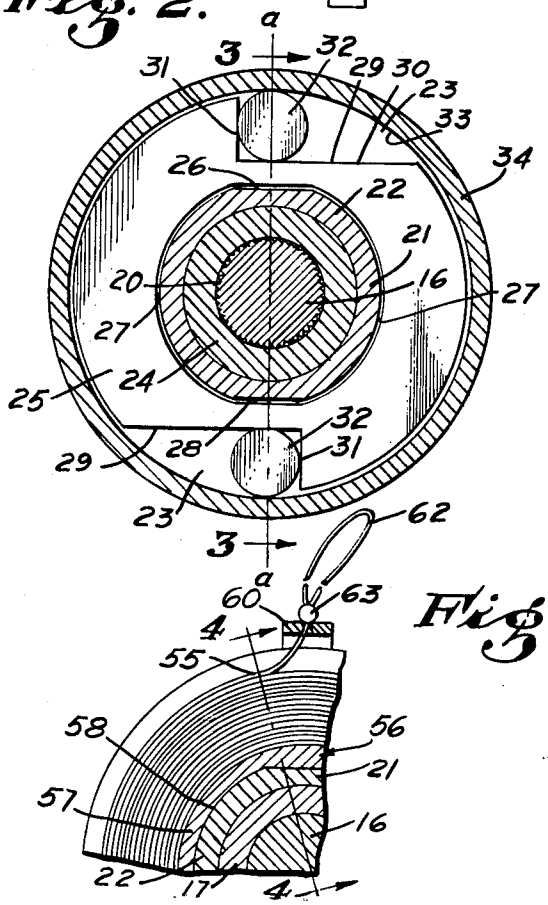


Fig. 5.

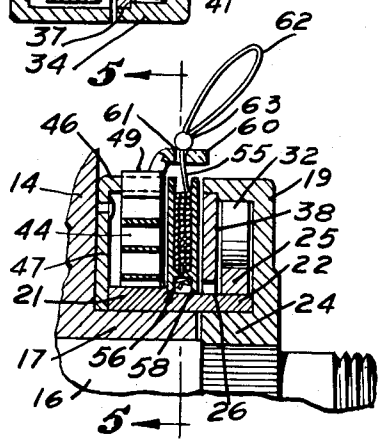


Fig. 4.

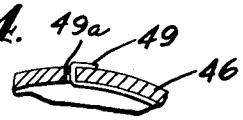


Fig. 6.

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Fig. 7.

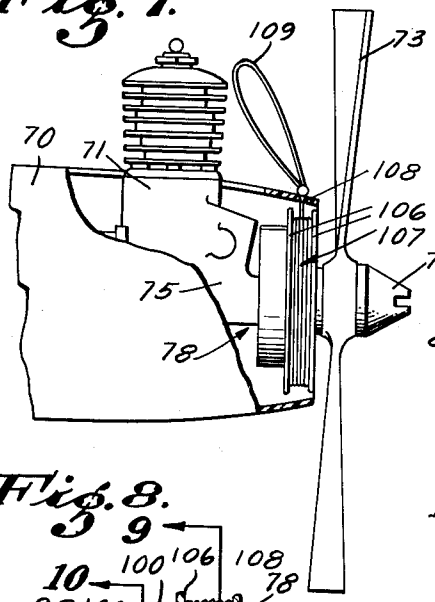


Fig. 9.

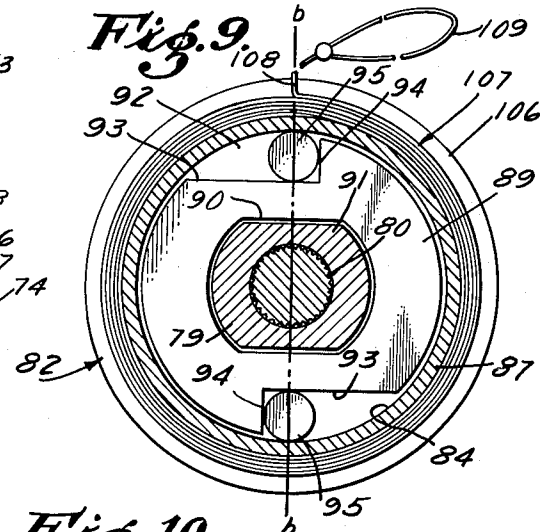


Fig. 8.

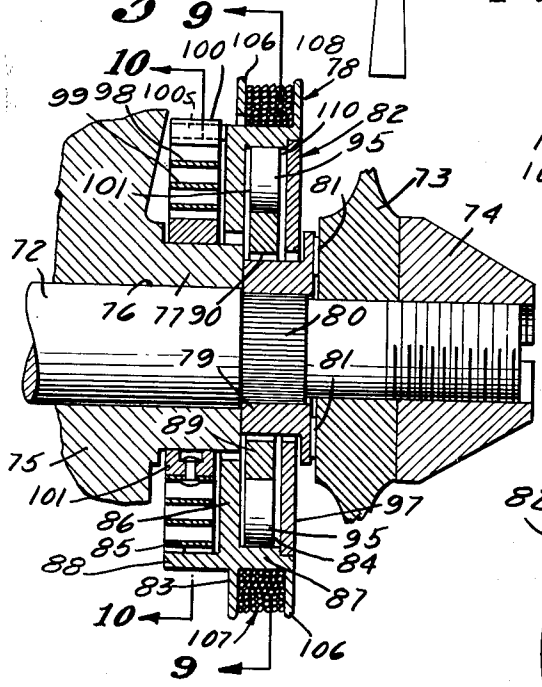


Fig. 10.

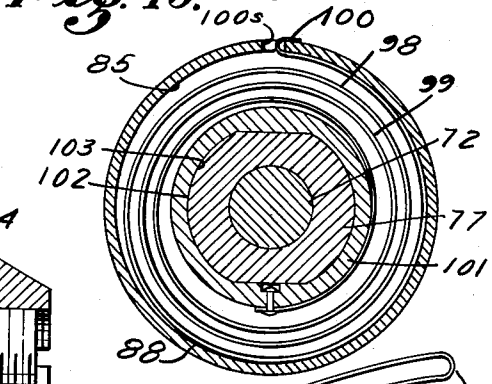


Fig. 11.

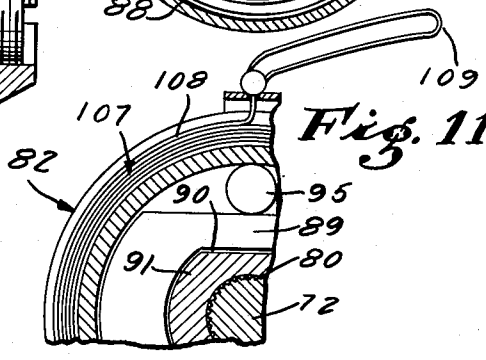
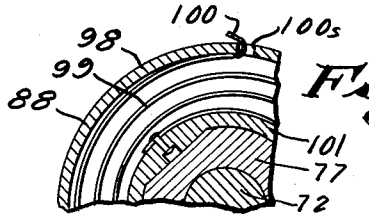


Fig. 12.



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United States Patent Office 2,991,779 Patented July 11, 1961

2,991,779

TOY ENGINE STARTING DEVICE

Josiah Morrison Barr, Manhattan Beach, Calif.

Filed May 20, 1960, Ser. No. 30,516
25 Claims. (Cl. 123—179)

This invention relates to starting devices for toy internal combustion engines of the type which can be adapted to drive toy vehicles, and relates in particular to a toy engine starting device especially suited for use in conjunction with the engines of toy airplanes.

This application is a continuation-in-part of my copending applications entitled Starting Device for Toy Engines, Serial No. 692,924, filed October 28, 1957, now abandoned, and Starter for Toy Engines, Serial No. 694,380, filed November 4, 1957, now abandoned.

It is an object of the invention to provide a toy engine starter having parts related so as to form a starter unit which may be obtained as a self contained assembly and is applied as such to the toy engine and its shaft. Some of the parts of the starter, for example, the clutch discs, are exceedingly small and their assembly into the clutch organization is difficult. They may be readily dropped and lost in the course of normal usage, which means that the clutch is inoperative until the lost parts are replaced. In the present invention the loss of the small clutch parts is avoided for the reason that they are contained within the assembled clutch structure.

It is an object of the invention to provide a toy starting device having a one-way clutch which is positive in its operation and instantaneously effects driving engagement of the drive part and driven part. In the type of starting device to which the invention pertains, failure of the clutch discs to engage is caused by the constant environment of oily and gummy substances. This is overcome in the present invention by a novel arrangement of parts wherein the oily and gummy substances which previously defeated proper and consistent clutch operation are now employed to produce a positive clutching action. In forms of the invention illustrated, the one-way clutch unit of the starter assembly may be removed from the engine separately from the spring and its connecting means, making it possible to quickly and easily install a new one-way clutch which is made as a relatively inexpensive replacement part.

In forms of the invention shown, a cam is connected to one of the relatively rotatable parts and wedge members in the form of small discs are employed to provide a means of clutching engagement between the cam and the other of the relatively rotatable parts. These discs are very small, for example, about one-eighth inch in diameter. The invention provides a simple means for bringing a moving oil film into engagement with the opposite faces of these discs so that they will be almost instantaneously moved into clutching position when a predetermined direction of relative rotation of the cooperating parts is established.

It is a further object of the invention to provide a clutch unit for a starting device of this character wherein a circular clutch body has an annular recess leading in from one face thereof for receiving the cam and the wedge elements of the clutch. The outer face of the recess is then closed by a thin annular plate which is held in operative position by a press fit between its periphery and the peripheral portion of the annular clutch part. Films of oil are maintained in engagement with opposite faces of the wedge members by the inner surfaces of the annular plate and of the radial wall of the annular clutch part. The small parts of the clutch are maintained by the annular plate within the annular cavity of the rotatable clutch member so that they cannot be displaced and lost. Therefore, the clutch device may be

handled by inexperienced and even careless persons without the danger of the starting device being rendered inoperative as the result of the loss of small clutch parts therefrom.

It is a further object of the invention to provide a starting device of this character having a rotatable part of annular form adapted to be placed in a position surrounding the engine shaft, this rotatable part having an outwardly faced annular cavity and an inwardly faced annular cavity, one of these cavities containing therein the simple one-way clutch mechanism and the other containing a torsion spring for imparting rotation to the rotatable part. The small clutch parts are held in operative position in their cavity by a thin annular plate which is installed in a position to cover the cavity and the clutch parts contained therein.

It is an object of the invention to provide a starter unit wherein one end of the torsion spring thereof is connected to the rotatable part and the other end of the spring is attached to a connecting member positioned and formed so that it will move into nonrotating engagement with the engine crankcase when the starter is installed on the engine.

Further objects and advantages of the invention may be brought out in the following part of the specification wherein many small details have been described for the purpose of making a complete disclosure, without intending, however, to limit the scope of the invention which is defined by the accompanying claims.

Referring to the accompanying drawings which are for illustrative purposes only:

FIG. 1 is a partly sectioned view showing a form of the invention connected to a toy aircraft engine;

FIG. 2 is a cross section, to enlarged scale, taken as indicated by the line 2—2 of FIGS. 1 and 3;

FIG. 3 is a sectional view taken as indicated by the line 3—3 of FIG. 2;

FIG. 4 is a quarter-section, taken as indicated by the line 4—4 of FIG. 5, showing an alternative form of the invention adapted to be operated by a pull cord;

FIG. 5 is a fragmentary sectional view taken as indicated by the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary cross section, taken as indicated by the line 6—6 of FIG. 3, showing the connecting hook on the spring of the device;

FIG. 7 is a partly sectioned view illustrating another form of the invention connected to a toy aircraft engine;

FIG. 8 is an enlarged fragmentary sectional view of the form of the invention shown in FIG. 7 of the toy engine starting device and engine and propeller parts with which it cooperates;

FIG. 9 is a cross section taken as indicated by the line 9—9 of FIG. 8;

FIG. 10 is a cross section taken as indicated by the line 10—10 of FIG. 8;

FIG. 11 is a quarter section to enlarged scale showing an alternative direction of winding the pull cord of the device shown in FIG. 9; and

FIG. 12 is an enlarged quarter section showing the position of the spring used when the cord is wound as shown in FIG. 11.

FIG. 1 shows the nose end of a toy airplane fuselage 10 in which a toy internal combustion engine 11 is mounted with its shaft projecting forwardly so that a toy propeller 12 may be secured thereon by means such as a cap nut 13. The engine 11, as shown in FIG. 3, has a crankcase 14 with a bearing 15 for the crankshaft 16, this bearing 15 having a projecting tubular portion 17.

The engine 11 is equipped with a toy engine starter 18 having cooperating parts, including a one-way clutch unit C, which are operatively connected to the engine 11 and to the crankshaft 16. The starter includes an annular

rotatable part 19 which is fixed on the portion 20 of the shaft 16 immediately adjacent the forward end of the tubular projection 17 of the toy engine crankcase 14. The rotatable part 19 is a splined or press fit on the portion 20 of the shaft 16. A second rotatable part consists of a sleeve 21 which is rotatably mounted on the projection 17 and has a noncircular portion 22 which extends into an annular cavity 23 in the first rotatable part 19, and surrounds the hub 24 of the part 19. The term "noncircular" has reference to the external configuration of the portion 22 of the rotatable part 21 which is made noncircular so that a cam member 25 which is mounted on the portion 22 of the part 21 within the cavity 23 will not rotate relatively to the part 21. The noncircular portion 22 has diametrally opposed flat faces 26, as best shown in FIG. 2, and the cam member 25 is provided with an opening 27 having flats 28 corresponding to the flat faces 26 of the portion 22.

The cam member 25 is an annular plate having diametrally opposed cam notches 29 each defined by a cam edge or face 30 adapted to meet the inner end of an end wall 31 which extends parallel to a center line *a—a* which intersects the center of rotation of the shaft 16. Clutch wedges 32, consisting of small discs, are disposed in the cam notches 29 adjacent the end walls 31. The cam faces 30, clockwise from the center line 3—3, converge toward the inner surface 33 of the cylindrical peripheral wall 34 of the rotatable part 19 which surrounds the cavity 23. Accordingly, if the member 19 is rotated in clockwise direction, as viewed in FIG. 2, the wedges 32 will become wedged between the cam faces 30 of the cam member 25 and the inner surface 33 of the peripheral wall 34 and the cam mechanism shown will lock the parts 19 and 21 together for simultaneous rotation. Similarly, counterclockwise rotation of the cam member 25 will be transmitted through the wedges 32 to the peripheral wall 34 of the rotatable part 19.

The lip 35 of the cylindrical wall 34 has therein a shallow counterbore 37 to receive the periphery of a thin annular plate 38 which surrounds the rotatable part 21 and closes the otherwise open end of the cavity 23. As seen in FIG. 3, the inner face 39 of the plate 38 lies close to the contiguous face 40 of each disc 32. The depth of the cavity 23 is such that the opposite faces 41 of the discs 32 lie close to the face 42 of the radial wall of the member 19. This cooperative arrangement of parts employs lubricant and gummy substances which enter the clutch mechanism, and which frequently renders inoperative the one-way clutch mechanisms of toy engine starters, as means for improving the action of toy one-way clutch mechanisms with respect to their quick response to relative rotation of clutch parts intended to effect engagement of the wedges or discs with the driving and driven clutch parts. Narrow spaces are provided between the spaces 40 and 41 of the discs 32 and the surfaces 39 and 42. Grease or oil entering these thin spaces form films which tend to resist relative movement between the disc 32 and the surfaces 39 and 42, with the result that when the rotatable part is rotated in clockwise direction, the films will move the discs 32 into tight engagement with the cam faces 30 and the inner surface 33 of the peripheral wall 34. Only a relatively small angular movement of the part 19 is required to bring the discs 32 into clutching position.

The second rotatable part 21 is connected to the engine through spring means comprising a coil spring 44 surrounding a portion of the member 21 and having its inner end connected thereto by suitable means such as a rivet 45. An anchor member 46 connects the outer end of the spring 44 to the engine. This anchor member 46 consists of a cup having a bottom wall 47 which rests against the engine crankcase 14, and a cylindrical wall 48 which surrounds the spring 44 and to which the outer end of the spring 44 is connected by means of a detachable connection consisting of a hook 49 formed on the end of the spring 44 and being adapted to enter a slot 49*a* in the cylindrical wall 48 of the cup member 46.

The spring 44 is oriented so that, as viewed from the right hand portion of FIG. 3, its torque is increased by clockwise rotation of its inner end. Rotation of the anchor member 46 around the tubular part 17 of the engine crankcase is prevented by a pin and socket interengagement. A pin 50 fixed in the wall 47 of the cup 46 projects into an opening 51 in the wall of the crankcase 14.

The operation of the form of the invention shown in FIGS. 1–3, is as follows. The propeller 12 is rotated manually in clockwise direction. This clockwise rotation is imparted to the first rotatable part 19 which is fixed on the shaft. The oil films between the discs 32 and the surfaces 39 and 41 carry the discs 32 in clockwise direction so that they are brought into wedging position between the cam faces 29 and the surface 33. The one-way clutch mechanism then transmits clockwise rotation to the second rotatable part 21 so that the inner end of the spring 44 is rotated in clockwise direction and energy is thereby stored in the spring 44 tending to rotate the rotatable part 21 in counterclockwise direction. The propeller is then released and the torsion spring 44 acting through the rotatable part 21 and the one-way clutch rotates the rotatable part 19 in counterclockwise rotation, so that the shaft 16 will be thereby rotated in counterclockwise direction which is the proper direction of rotation of the engine during its operation. When the energy of the spring 44 has become released and rotation of the rotatable part 21 stops, the one-way clutch will release and the discs 32 will be moved into engagement with the end walls 31 of the notches 29 which are at this time stationary.

In FIGS. 4 and 5, there is shown a form of the invention which employs, in addition to the parts previously described, a pull cord 55 which is wound upon a spool 56 mounted on the second rotatable part 21. In FIGS. 4 and 5, the previously described parts are given the same numerals so that a repetition of the description will not be necessary. The spool 56 is positioned between the plate 38 of the rotatable part 19 and the spring 44. The hub 57 of the spool 56 has therein a noncircular opening 58 corresponding to the opening 27 in the cam so that it will fit the noncircular portion 22 of the rotatable part 21. As will be seen in FIG. 4, the diametrally opposed flat faces 26 of the rotatable part 21 are extended in the direction of the engine 14 so as to accommodate thereon the hub 58 of the spool 56. The cuplike anchor member 46 is provided with an extension 60 lying outside the periphery of the spool 56 and having therein an opening 61 through which the cord 55 extends. The cord 55 is provided with a loop 62 by which it may be manually engaged, and has theron a stop 63, such as a knot, for example, for limiting the rewind movement of the cord 55.

When the cord 55 is pulled outwardly from the position in which it is shown in FIGS. 4 and 5, it will effect rotation of the spool 56, which will in turn rotate the second rotatable part 21 and effect a winding of the spring. The direction in which the clutch mechanism acts is determined by the manner in which the starter is to be operated. For example, if the cord 55 is wound upon the spool 56 in clockwise direction, as shown in FIG. 5, it will rotate the spool 56 and the parts connected thereto in clockwise direction when it is pulled outwardly. In this use of the invention the spring 44 will be placed in the same direction of winding as described with relation to FIG. 3, and the cam 25 will be placed as shown in FIG. 2. Therefore, clockwise rotation of the spool 56 will wind the spring 44 and will rotate the cam 25 in clockwise direction within the cavity of the first rotatable part 19. Then, when the cord has been pulled out to its full extent, it may be released so that the spring 44 will rotate the member 21 and the cam 25 in counterclockwise direction, and this counterclockwise rotation of the cam will

effect actuation of the clutch so that counterclockwise, engine-starting rotation will be transmitted to the part **19**.

The directions in which the spring **44** and the cord **55** are wound may be reversed from those described in the foregoing. The cord **55** will be then wound in counterclockwise direction on the spool **56** instead of in the clockwise direction in which it is shown wound in FIG. 5. Then, when the cord is pulled outwardly, the counterclockwise rotation of the spool by the cord will be transmitted through the part **21** to the cam plate **25** and also to the spring **44**. The clutch mechanism will be actuated to transmit counterclockwise rotation through the rotatable part **19** to the shaft **16** to start the engine, and at the same time the spring **44** will be wound, storing therein energy to rotate the spool **56** in rewind direction when the pulling force is released from the cord **55**, and therefore, as the spring **44** unwinds, the cord **55** will be rewound upon the spool **56** ready for a succeeding operation of the starter mechanism.

In one practice of the invention, the one-way clutch unit C consisting of the parts **19**, **38**, **25** and **32**, may be separated from the remaining parts of the starter which may be left in place on the engine when the one-way clutch is removed. Removal of the clutch unit C, comprises merely sliding it rightwardly from the position in which it is shown in FIG. 3 and thereby sliding the cam member **25** off from the end **22** of member **21** which may remain on the projection **17** of the engine **14**. The replacement clutch slides readily into the position of one removed. If replacement of a broken spring is required, the part **21** which has the inner end of the spring **44** attached thereto may be slid rightwardly from the tubular projection **17** and the spring hook **49** may be readily disengaged from the slot **49***a*, after which the replacement spring unit consisting of the parts **21** and **44** may be quickly installed.

If the pull cord **55** of FIGS. 4 and 5 becomes broken, the spool **56** may be readily slid off from the end **20** of the member **21** to have the cord thereof replaced. The cylindrical wall **48** may be permanently connected to the engine, if desired, for example, the pin **50** may be a press fit in the opening **51** so as to hold the cup member **46** permanently in place, or, if the entire starter mechanism is to be removed as a unit, the pin **50** may be a sliding fit in the opening **51**.

In FIG. 7 there is illustrated another form of the invention in a toy airplane fuselage **70** in which a toy internal combustion engine **71** is mounted. Its crankshaft **72** projects forwardly so that a propeller **73** may be secured thereon by a cap nut **74**. The engine **71** has a crankcase **75** provided with a bearing **76**, as shown in FIG. 8, for the crankshaft **72**, this bearing **76** having a projecting tubular portion **77**.

For starting the toy engine **71**, a toy engine starter **78** is provided and positioned between the crankcase **75** and the propeller **73**. The toy engine starter **78** includes a driven member consisting of an annular rotatable part **79**, shown in FIGS. 8 and 9, which is fixed on the stepped portion **80** of the shaft **72** contiguous to the end of the projection **77** of the crankcase **75**. The rotatable part **79** is a splined or press fit on the portion **80** of the shaft **72** and is held on the shaft portion **80** by the propeller **73** which is in turn held in place by the cap nut **74**, rotation of the propeller **73** relatively to the shaft **72** being prevented by radial ridges **81** arranged in a circle on the outer radial face of the driven member **79** for engagement with the contiguous portion of the impeller **73**.

A driving member **82** is positioned so as to surround adjacent portions of the tubular extension **77** and the driven member **79**. It comprises a circular body **83** having therein an annular outwardly faced recess or cavity **84** and an inwardly faced annular recess or cavity **85**, these cavities **84** and **85** being separated by an annular radial wall **86**. The annular body **83** has a cylindrical wall portion **87** forming a peripheral wall around the cavity **84** and also a cylindrical wall portion **88** which surrounds the inwardly faced annular cavity **85**.

Within the outwardly faced cavity **84** there is an annular cam plate **89** having a noncircular opening **90** to receive the contiguous portion **91** of the driven member **79** which is of corresponding noncircular form so that relative rotation of the cam plate **89** and the driven member **79** is prevented, and therefore, simultaneous rotation of the parts **89** and **79** is effected. The cam plate **89** has therein diametrically opposed notches **92** defined by cam faces **93** and end faces **94**, the latter being parallel to a diametral center line *b*—*b* which is perpendicular to the cam faces **93**. Clutch wedge elements **95** are disposed in the notches **92**, consisting of small discs of such diameter that when appropriate relative rotation of the cam plate **89** and the driving member **88** occurs, the discs **95** will be tightly wedged against the peripheral wall **87**, thereby clutching the driving and driven members **88** and **79** together.

An annular outer cover plate **97** extends radially inwardly from the peripheral wall **87** in a position to conceal the discs **95** and at least a portion of the cam plate **89**. The driving member **82** is connected to the engine by torsion spring means **98** consisting of a spiral spring **99**, the outer end of which is connected to the circumferential wall **88** of the annular body **83** by a hook **100** which is bent on the end of the spring **99** and is adapted to be received by a slot **100***s* in the wall **88**, and a ring member **101** which is attached to the inner end of the spring and connects it to the projecting tubular portion **77** of the crankcase **75**. As shown in FIG. 10, the external surface **102** of the projecting tubular portion **77**, the annular body **82**, the one-way clutch parts **89** and **95**, the spring **99** and the ring **101** comprise a unit which may be readily moved into the position in which it is shown in the drawing. The ring member **101** will slide readily onto the tubular portion **77** as the unit is brought into its operative position. Then, the driven member **79** may be moved along the projecting portion of the shaft **72** into its operative position upon the shaft portion **80**. If the cam plate **89** is fixed on the driven member **79** all of the parts of the toy starting device **78** will form a single unit which may be installed upon or removed from the crankcase and shaft parts **77** and **80**. The annular body **83** of the driving member **82** has thereon parallel radially directed annular flanges **106** so as to form a spool **107** on which a pull cord **108** may be wound.

The cover plate **97** has, in addition to the valuable function of holding the small clutch parts **89** and **95** in the cavity **84**, the utility of holding a film of oil, grease or gummy substances in contact with the outer faces **100** of the discs **95** to cooperate with the film of oil, grease or gummy substance which exists between the surface of the radial wall **86** of the driving member **82** and the leftward or inner faces **101** of the discs **95**, to cause immediate movement of the discs **95** in clockwise direction, FIG. 9, from the positions in which they are shown, when the driving member **82** is rotated in clockwise direction, thereby causing immediate wedging or clutching engagement of the discs **95** with the wedge faces **93** and the peripheral wall **87**.

In the form of the invention shown in the FIGS. 7–9, the pull cord **108** is wound on the spool **107** in such direction that when the pull cord is pulled outwardly by force applied to the loop **109** on its outer end, the driving member **82** will be thereby rotated in counterclockwise direction. Counterclockwise rotation of the driving member **82**, effected by pulling out the pull cord **108** is transmitted through the clutch parts **95** and **89** to the driven member **79**, thereby rotating the shaft **72** in the proper direction, counterclockwise to start the engine. The spring **99**, as shown in FIG. 10, is wound in counterclockwise direction so that when the driving member **82** is rotated in counterclockwise direction winding of and

storage of energy in the spring **99** will take place. When pulling force is released from the pull cord **108**, the spring **99** will unwind and return the driving member **82** to its original position, rewinding the pull cord **108** on the spool **107** so that it will be ready for a subsequent operation.

In the foregoing, I have described a method of operation of the invention wherein the force applied to the pull cord is transmitted instantly through the clutch means to the engine shaft, the spring being used to rewind the pull cord when the pulling force thereon has been released. The invention may be used in such a manner that the force applied in pulling out the pull cord is used in winding the spring so as to store energy therein, the release of the pull cord then permitting the spring to unwind and transmit its energy through the clutch mechanism to the engine shaft to rotate it in proper direction to start the engine. In FIGS. 11 and 12, I show that the pull cord **108** is wound on the drum **107** in clockwise direction and that the spring **99** is placed so that clockwise rotation of the member **82** will wind the spring **99**.

Referring to FIG. 11, outward pull upon the cord **108** will rotate the member **82** in clockwise direction. The clutch mechanism will be at this time inactive for the reason that the cam faces **93** of the cam plate **89** are disposed so that actuation of the clutch is effected by counterclockwise rotation of the driving member **82**. Therefore, the shaft **72** will not be driven, but the rotation of the driving member **82** will wind the spring. When the pull cord is released the spring **99** will unwind and rotate the driving member **82** in counterclockwise direction, effecting actuation of the clutch mechanism and rotating the engine shaft **80** in counterclockwise direction to start the engine and also rewind the pull cord **108**.

Referring to FIGS. 9, 11 and 12, the winding of the spring **99**, positioned as shown in FIG. 12, may be accomplished by rotating the propeller **73** by hand in clockwise direction. The clockwise rotation of the propeller **73** will be transmitted to the driven member **79**, which will rotate the clutch plate **89** in clockwise direction, causing the cam faces **93** thereof to force the wedge elements **95** into engagement with the peripheral wall **87** of the member **82** so that it will rotate in clockwise direction and wind the spring **99**. When the propeller **73** is released, the unwinding of the spring **99** will rotate the remaining parts of the starter mechanism in counterclockwise direction so as to rotate the shaft **72** in counterclockwise, engine-starting direction. In this use of the invention the pull cord **108** and the flanges **106** are omitted.

I claim:

1. In a starting device for a toy engine or the like having a shaft connected to the crank of the engine: a first rotary part comprising an annular body having an annular cavity in one face thereof providing a radial wall surrounded by a peripheral wall; a second rotary part having a portion thereof projecting into said cavity; one-way clutch means in said cavity comprising a cam member and a wedge member, one of said members engaging said peripheral wall and the other of said members engaging the portion of said second rotary part which projects into said cavity; an annular plate connected to the periphery of said annular body of said first rotary part and extending across the outer part of said cavity to provide a covering wall overlying said wedge member, said radial wall and said covering wall being spaced to provide, in the presence of oily and gummy substances, adhering contact between at least one of said radial and covering walls with said wedge member which will effect, upon relative movement between said walls and said cam member, movement of said wedge member into driving engagement between said cam member and said peripheral wall; means for connecting one of said rotary parts to said shaft; and torsion spring means for connecting the other of said rotary parts to said engine.

2. In a starting device for a toy engine or the like having a shaft connected to the crank of the engine: a first rotary part comprising an annular body having an annular cavity in one face thereof providing a radial wall surrounded by a peripheral wall; a second rotary part contiguous to said first rotary part; a cam member in said cavity connected to said second rotary part; drive wedge means between said cam member and said peripheral wall; an annular plate connected to the periphery of said annular body of said first rotary part and extending across the outer part of said cavity to provide a covering wall overlying said wedge means, said radial wall and said covering wall being spaced to provide, in the presence of oily and gummy substances, adhering contact between at least one of said radial and covering walls with said wedge means which will effect, upon relative movement between said walls and said cam member, movement of said wedge means into driving engagement between said cam member and said peripheral wall; hub means on said first rotary part for connecting it to said shaft; and spring means for connecting said second rotary part to said engine, comprising an annular wall surrounding a portion of said second rotary part, and a torsion spring having one end connected to said second rotary part and the other end connected to said engine.

3. In a starting device for a toy engine or the like having a shaft connected to the crank of the engine: a first rotary part comprising an annular body having an annular cavity in one face thereof providing a radial wall surrounded by a peripheral wall; a second rotary part contiguous to said first rotary part; a cam member in said cavity connected to said second rotary part; drive wedge means between said cam member and said peripheral wall; an annular plate connected to the periphery of said annular body of said first rotary part and extending across the outer part of said cavity to provide a covering wall overlying said wedge means, said radial wall and said covering wall being spaced to provide, in the presence of oily and gummy substances, adhering contact between at least one of said radial and covering walls with said wedge means which will effect, upon relative movement between said walls and said cam member, movement of said wedge means into driving engagement between said cam member and said peripheral wall; means for connecting one of said rotary parts to said shaft; and torsion springs means for connecting the other of said rotary parts to said engine.

4. In a starting device for a toy engine or the like having a shaft connected to the crank of an engine: a first rotary part comprising an annular body having a radial wall and an axial wall defining a cavity in one face thereof; a second rotary part; one-way clutch means in said cavity comprising a cam member and a wedge member, one of said members engaging said axial wall and the other of said members operatively connected to said second rotary part; an annular plate associated with said first rotary part so as to rotate therewith and extending across the outer part of said cavity to provide a covering wall overlying said wedge member, said radial wall and said covering wall being spaced to provide, in the presence of oily and gummy substances, adhering contact between at least one of said radial and covering walls with said wedge member which will effect, upon relative movement between said walls and said cam member, movement of said wedge member into driving engagement between said cam member and said axial wall; means for connecting one of said rotary parts to said shaft; and torsion spring means for connecting the other of said rotary parts to said engine.

5. In a toy clutch device adapted to connect a rotatable member to a second member: a first plate element having a cylindrical wall on one face thereof; a second plate element connected to the periphery of said cylindrical wall and providing a cavity between said plate elements; a cam member in said cavity; drive disc means in

said cavity between said cam member and said cylindrical wall, said plate elements being in overlying relationship to said disc means and being spaced to permit free movement of said disc means into engagement between said cam member and said cylindrical wall, said spaced overlying relationship between said plate elements and said disc means providing, in the presence of oily and gummy substances, adhering contact between at least one of said plate elements and said disc means which will effect, upon relative movement between said plate elements and said cam member, movement of said disc means into engagement between said cam member and said cylindrical wall; means for connecting at least one of said plate elements to said rotatable member; and means for connecting said cam member to said second member.

6. In a toy clutch device adapted to connect a rotatable member to a second member: a first plate element having a cylindrical wall providing a cavity on one face of said first plate element; a cam member in said cavity; drive disc means in said cavity between said cam member and said cylindrical wall; a second plate element connected to the periphery of said cylindrical wall and extending across the outer part of said cavity in overlying relationship to said disc means and being spaced to permit free movement of said disc means into engagement between said cam member and said cylindrical wall, said spaced overlying relationship between said plate elements and said disc means providing, in the presence of oily and gummy substances, adhering contact between at least one of said plate elements and said disc means which will effect, upon relative movement between said plate elements and said cam member, movement of said disc means into engagement between said cam member and said cylindrical wall; means for connecting at least one of said plate elements to said rotatable member; and means for connecting said cam member to said second member.

7. In a toy starting device for a toy engine having a shaft, the combination of: a first rotary part adapted to be drivably secured to said shaft and having a cavity formed by a side wall and a cylindrical wall, a second rotary part positioned adjacent to said first rotary part on the side of said cavity, said second rotary part being axially aligned with said first rotary part and being rotatable relative to said first rotary part and said shaft; spring means connected to said second rotary part for rotating the same in one direction; overrunning clutch means for drivably connecting said first rotary part and said second rotary part in one direction, said overrunning clutch means having cooperating cam means and wedge means positioned in said cavity, said cam means being secured to one of said rotary parts and said wedge means being positioned between said cam means and the other of said rotary parts; and a radial wall secured to said cylindrical wall of said first rotary part and projecting across a portion of said cavity so as to cover said wedge means.

8. In a toy starting device for a toy engine having a shaft, the combination of: a first rotary part adapted to be drivably secured to said shaft and having a cavity formed by a side wall and a cylindrical wall; a second rotary part positioned adjacent to said first rotary part on the side of said cavity, said second rotary part being axially aligned with said first rotary part and being rotatable relative to said first rotary part and said shaft; spring means connected to said second rotary part for rotating the same in one direction; overrunning clutch means for drivably connecting said first rotary part and said second rotary part in one direction, said overrunning clutch means having cooperating cam means and wedge means positioned in said cavity, said cam means being secured to one of said rotary parts and said wedge means being positioned between said cam means and the other of said rotary parts; and a radial wall secured to said cylindrical wall of said first rotary part and projecting across a portion of said cavity so as to cover said wedge means, whereby in the presence of oil and gummy substances in said cavity said wedge means will have adhering contact between either said side wall or said radial wall causing said wedge means upon relative rotation between said cam means and said cylindrical wall to have driving engagement between said first and second rotary parts.

9. In a toy starting device for a toy engine having a shaft, the combination of: a first rotary part adapted to be drivably secured to said shaft and having a cavity formed by a side wall and a cylindrical peripheral wall; a second rotary part positioned adjacent to said first rotary part on the side of said cavity, said second rotary part being axially aligned with said first rotary part and being rotatable relative to said first rotary part and said shaft; spring means connected to said second rotary part for rotating the same in one direction; overrunning clutch means for drivably connecting said first rotary part and said second rotary part in one direction, said overrunning clutch means having cam means positioned in said cavity inside said peripheral cylindrical wall and secured to said second rotary part and wedge means positioned between said cam means and said cylindrical peripheral wall; and a radial wall secured to said cylindrical peripheral wall of said first rotary part and extending inwardly between said first rotary part and said second rotary part and forming a closed cavity in which said wedge means is contained.

10. In a toy engine starting device for a toy engine having a shaft connected to the piston of the engine: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; a cam plate connected to said driven member and lying within said cavity; wedge clutching elements disposed between said cam plate and said peripheral wall of said driving member; an annular wall connected to said peripheral wall and extending radially inwardly to cover said clutching elements and hold a film of oil in contact therewith; and torsion spring means connecting said driving member to the crankcase of said engine.

11. In a toy engine starting device for a toy engine having a shaft connected to the piston of the engine: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; a cam plate connected to said driven member and lying within said cavity; wedge clutching elements disposed between said cam plate and said peripheral wall of said driving member; an annular wall connected to said peripheral wall and extending radially inwardly to cover said clutching elements and hold a film of oil in contact therewith; and torsion spring means connecting said driving member to the crankcase of said engine, said spring means comprising a coil spring having one end thereof connected to said driving member, and means connected to the other end of said spring and being adapted for nonrotative engagement with said engine when said driving member is moved into its operative position surrounding said axis of said shaft.

12. In a toy engine starting device for a toy engine having a crankcase and a shaft connected to the piston of the engine: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; one-way clutch means in said cavity for connecting said driving and driven members; and an annular wall extending radially from the peripheral wall of said driving member to retain said clutch means in said cavity; and torsion spring means connecting said driving member to the crankcase of said engine.

13. In a toy engine starting device for a toy engine having a crankcase and a shaft connected to the piston of the engine: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected

to said shaft; one-way clutch means in said cavity for connecting said driving and driven members; an annular wall extending radially from the peripheral wall of said driving member to retain said clutch means in said cavity; and torsion spring means connecting said driving member to the crankcase of said engine, said spring means comprising a coil spring having one end thereof connected to said driving member, and means connected to the other end of said spring and being adapted for nonrotative engagement with said engine when said driving member is moved into its operative position surrounding said axis of said shaft.

14. In a toy engine starting device for a toy engine having a crankcase and a shaft connected to the piston of the engine and a tubular extension projecting from the engine crankcase and surrounding a portion of said shaft; a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; a cam plate connected to said driven member and lying within said cavity; wedge clutching elements disposed between said cam plate and said peripheral wall of said driving member; an annular wall connected to said peripheral wall and extending radially inwardly to cover said clutching elements and hold a film of oil in contact therewith; and torsion spring means connecting said driving member to the crankcase of said engine, said spring means comprising a coil spring having one end thereof connected to said driving member, and a ring member connected to the other end of said spring and being positioned so that it will slide onto said tubular extension of said engine crankcase and make nonrotative engagement therewith when said toy engine started is installed in operative position.

15. In a toy engine starting device for a toy engine having a crankcase and a shaft connected to the piston of the engine and a tubular extension projecting from the engine crankcase and surrounding a portion of said shaft: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; one-way clutch means in said cavity for connecting said driving and driven members; an annular wall extending radially from the peripheral wall of said driving member to retain said clutch means in said cavity; and torsion spring means connecting said driving member to the crankcase of said engine, said spring means comprising a coil spring having one end thereof connected to said driving member, and a ring member connected to the other end of said spring and being positioned so that it will slide onto said tubular extension of said engine crankcase and make nonrotative engagement therewith when said toy engine starter is installed in operative position.

16. In a toy engine starting device for a toy engine having a crankcase and a shaft connected to the piston of the engine: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; a cam plate connected to said driven member and lying within said cavity; wedge clutching elements disposed between said cam plate and said peripheral wall of said driving member; an annular wall connected to said peripheral wall and extending radially inwardly to cover said clutching elements and hold a film of oil in contact therewith; torsion spring means connecting said driving member to the crankcase of said engine; and a spool connected to said driving member to receive a pull cord for imparting rotation to the driving member.

17. In a toy engine starting device for a toy engine having a shaft connected to the piston of the engine: a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; a cam plate connected to said driven member and lying within said cavity; wedge clutching elements disposed between said cam plate and said peripheral wall of said driving member; an annular wall connected to said peripheral wall and extending radially inwardly to cover said clutching elements and hold a film of oil in contact therewith; torsion spring means connecting said driving member to the crankcase of said engine, said spring means comprising a coil spring having one end thereof connected to said driving member, and means connected to the other end of said spring and being adapted for nonrotative engagement with said engine when said driving member is moved into its operative position surrounding said axis of said shaft; and a spool connected to said driving member to receive a pull cord for imparting rotation to the driving member.

18. In a toy engine starting device for a toy engine having a shaft connected to the piston of the engine and a tubular extension projecting from the engine crankcase and surrounding a portion of said shaft; a driving member surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a driven member connected to said shaft; one-way clutch means in said cavity for connecting said driving and driven members; an annular wall extending radially from the peripheral wall of said driving member to retain said clutch means in said cavity; torsion spring means connecting said driving member to the crankcase of said engine, said spring means comprising a coil spring having one end thereof connected to said driving member, and a ring member connected to the other end of said spring and being positioned so that it will slide onto said tubular extension of said engine crankcase and make nonrotative engagement therewith when said toy engine starter is installed in operative position; and a spool connected to said driving member to receive a pull cord for imparting rotation to the driving member.

19. In a starting device for an engine having a shaft connected to the piston of the engine: a driving member having a central opening and being adapted to surround a portion of said shaft, said member having an outwardly faced annular cavity and an inwardly faced annular cavity; a driven member adapted to be connected to said shaft; one-way clutch means in said outwardly faced cavity for connecting said driving and driven members; means for holding said one-way clutch in said outwardly faced cavity; a torsion spring in said inwardly faced cavity having one end thereof connected to said driving member; and connecting means attached to the other end of said spring adapted to make nonrotative engagement with said engine when said starting device is installed.

20. In a starting device for an engine having a shaft connected to the piston of the engine and a tubular extension projecting from the engine crankcase and surrounding a portion of said shaft: a driving member having a central opening and being adapted to surround a portion of said shaft, said member having an outwardly faced annular cavity and an inwardly faced annular cavity; a driven member adapted to be connected to said shaft; one-way clutch means in said outwardly faced cavity for connecting said driving and driven members; means for holding said one-way clutch in said outwardly faced cavity; a spiral spring in said inwardly faced cavity having its outer end connected to said driving member; and a ring member connected to the inner end of said spring and being adapted to slide onto and make nonrotative engagement with said extension of said engine crankcase when said starting device is installed in operative position.

21. In a starting device for an engine having a shaft connected to the piston of the engine: a driving member having a central opening and being adapted to surround a portion of said shaft, said member having an outwardly faced annular cavity and an inwardly faced annular cavity; a driven member adapted to be connected to said shaft and having a portion projecting within the central part of said outwardly faced cavity; a cam plate in said

outwardly faced cavity having an opening to receive said portion of said driven member, said cam plate and said driven member having engagement for preventing relative rotation thereof; wedge elements between said cam plate and the peripheral wall of said cavity; an annular radial wall connected to the outer face of said driving member so as to hold said cam plate and said wedge elements in said outwardly faced cavity; a torsion spring in said inwardly faced cavity having one end thereof connected to said driving member; and connecting means attached to the other end of said spring adapted to make nonrotative engagement with said engine when said starting device is installed.

22. In a starting device for an engine having a shaft connected to the piston of the engine and a tubular extension projecting from the engine crankcase and surrounding a portion of said shaft; a driving member having a central opening and being adapted to surround a portion of said shaft, said member having an outwardly faced annular cavity and an inwardly faced annular cavity; a driven member adapted to be connected to said shaft and having a portion projecting within the central part of said outwardly faced cavity; a cam plate in said outwardly faced cavity having an opening to receive said portion of said driven member, said cam plate and said driven member having engagement for preventing relative rotation thereof; wedge elements between said cam plate and the peripheral wall of said cavity; an annular radial wall connected to the outer face of said driving member so as to hold said cam plate and said wedge elements in said outwardly faced cavity; a spiral spring in said inwardly faced cavity having its outer end connected to said driving member; and a ring member connected to the inner end of said spring and being adapted to slide onto and make nonrotative engagement with said extension of said engine crankcase when said starting device is installed in operative position.

23. In a toy engine starting device for a toy engine having a crankcase and a shaft connected to the piston of the engine: a first rotatable part surrounding the axis of said shaft, having an annular cavity defined by a radial wall and a peripheral wall; a second rotatable part connected to said shaft; a cam plate connected to said second rotatable part and lying within said cavity; wedge clutching elements disposed between said cam plate and said peripheral wall of said driving member; an annular wall connected to said peripheral wall and extending radially inwardly to cover said clutching elements and hold a film of oil in contact therewith; and torsion spring means connecting said first rotatable part to the crankcase of said engine.

24. In a starting device for an engine having a shaft connected to the piston of the engine: a first rotatable part having a central opening and being adapted to surround a portion of said shaft, said part having an outwardly faced annular cavity and an inwardly faced annular cavity; a second rotatable part adapted to be connected to said shaft; one-way clutch means in said outwardly faced cavity for connecting said first and second rotatable parts; means for holding said one-way clutch in said outwardly faced cavity; a torsion spring in said inwardly faced cavity having one end thereof connected to said first rotatable part; and connecting means attached to the other end of said spring adapted to make nonrotative engagement with said engine when said starting device is installed.

25. In a clutch device for connecting a shaft to another member: a first rotatable part having a central opening and being adapted to surround a portion of said shaft, said part having an outwardly faced annular cavity and an inwardly faced annular cavity; a second rotatable part adapted to be connected to said shaft; one-way clutch means in said outwardly faced cavity for connecting said first and second rotatable parts; means for holding said one-way clutch in said outwardly faced cavity; and means in said inwardly faced cavity for connecting said first rotatable part to said other member.

No references cited.