E. B. CALKINS.

SAFETY CRANKING DEVICE.

APPLICATION FILED SEPT. 23, 1910.

1,002,898.

Patented Sept. 12, 1911.

2 SHEETS—SHEET 1.

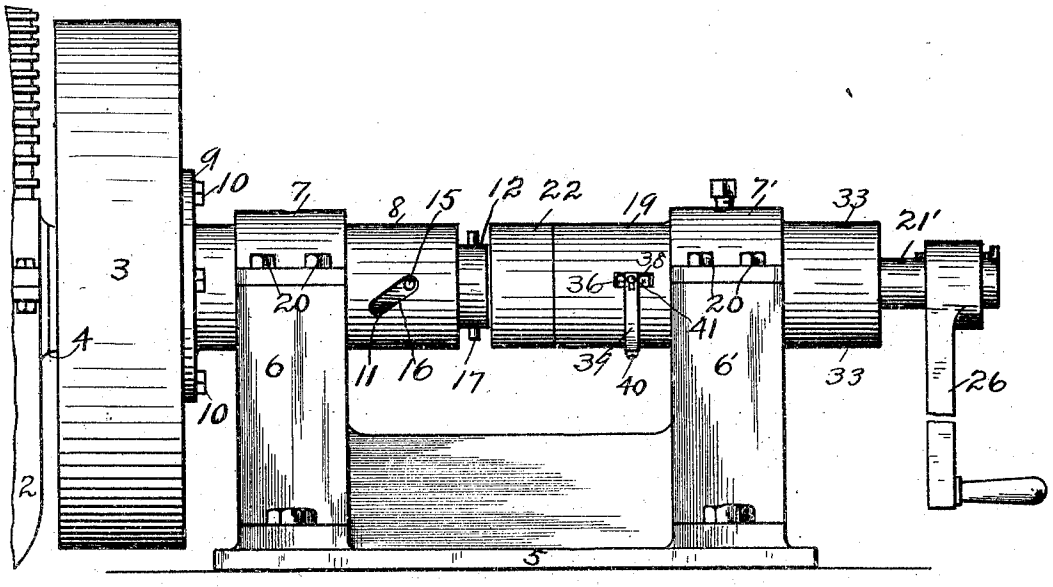

Fig. 1.

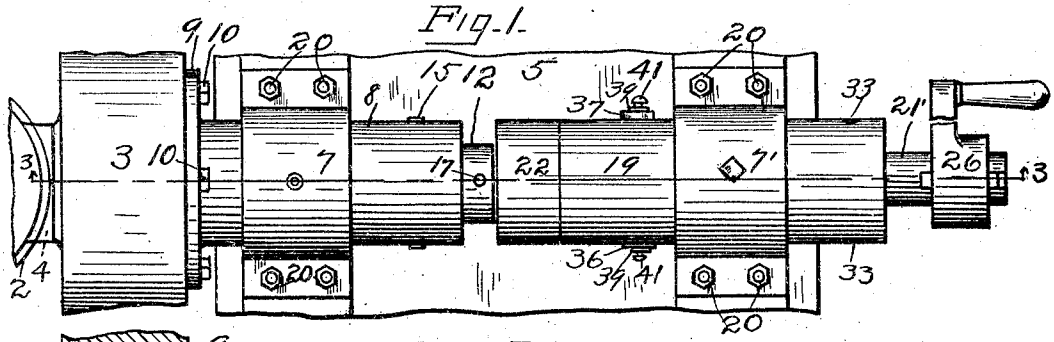

Fig. 2.

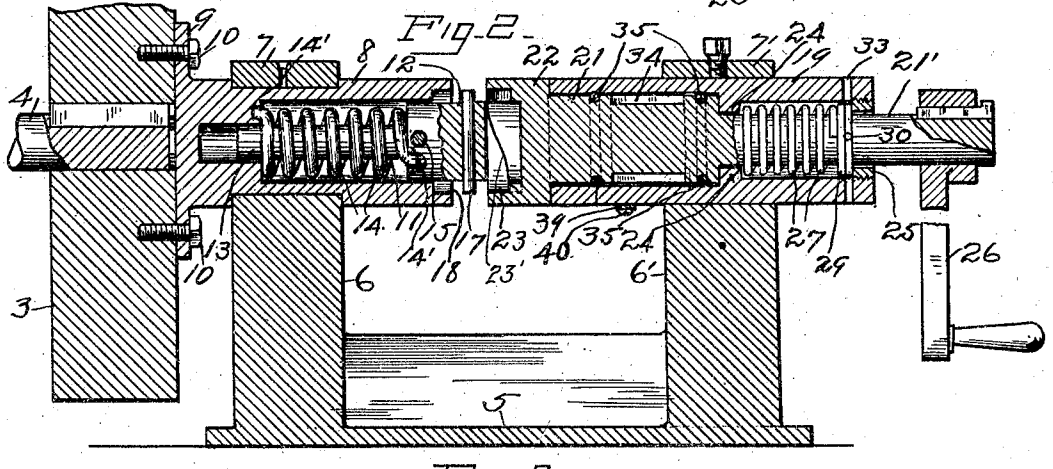

Fig. 3.

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2 SHEETS—SHEET 2.

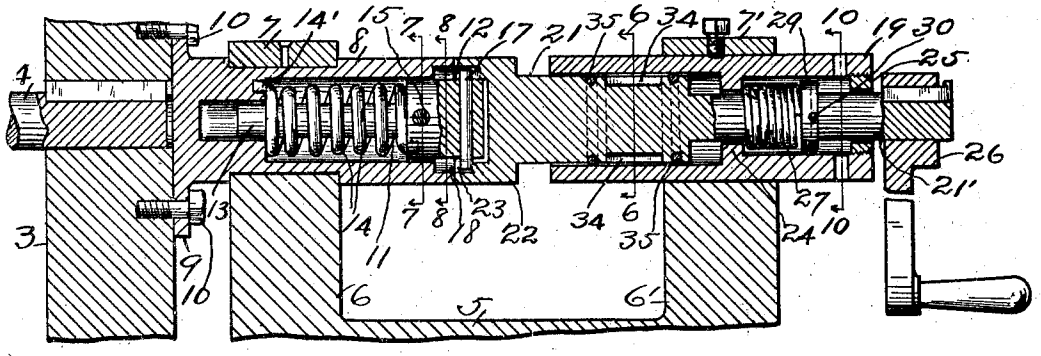

Fig. 4.

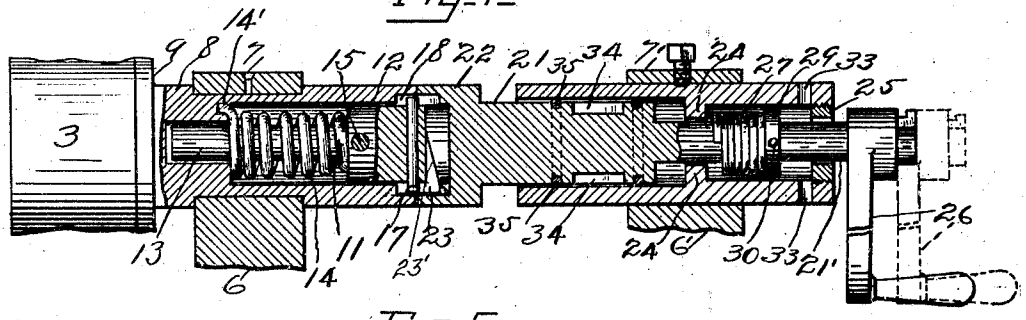

Fig. 5.

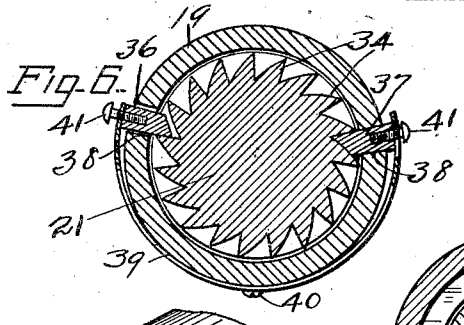

Fig. 6.

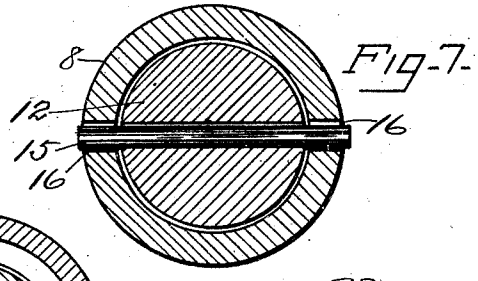

Fig. 7.

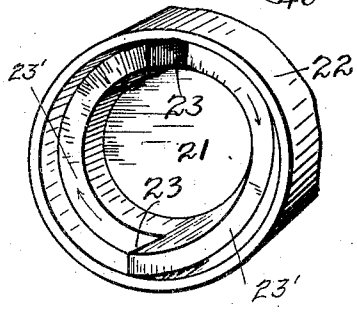

Fig. 9.

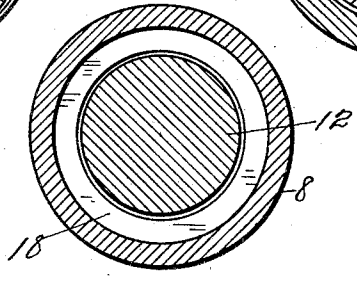

Fig. 8.

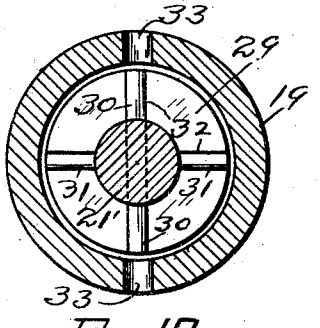

Fig. 10.

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SAFETY CRANKING DEVICE.

1,002,898. Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed September 23, 1910. Serial No. 583,333.

To all whom it may concern:

Be it known that I, EDMUND B. CALKINS, a citizen of the United States, residing at Watertown, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Safety Cranking Devices, of which the following is a specification.

This invention relates to improvements in safety cranking devices, designed for use in connection with the starting cranks of gas and other internal combustion or explosion engines, such as are employed for propelling automobiles, boats and the like.

The object of the invention is to provide a safety device to be applied between the usual starting crank and the fly wheel of an engine, and arranged to operatively connect with each of these parts, for the purpose of cranking the engine and for preventing injury to the engineer or operator due to the back firing and sudden reversing or starting of the engine.

It is characteristic of gas and other explosion or internal combustion engines, that they must be cranked, or in other words, the fly wheel and related parts of the engine must be started by some power other than that derived from the engine itself. The usual practice, especially with automobiles is, for the driver to take hold of and operate a hand-crank which is arranged for temporarily connecting with the fly wheel or crank-shaft of the engine, in order to artificially start the firing or sparking of the cylinders. Frequently when cranking an engine as described, the engine back fires, or, in other words, the explosion occurs at a time and point which effects the sudden starting of the engine in the backward direction. This sudden back firing or turning of the engine, if it occurs while the starting crank is held in positive engagement with the fly wheel or crank shaft, invariably wrests the crank from the grasp of the engineer, and quite often the crank when thus reversed under great power and speed, strikes the engineer on the hand or arm, inflicts serious injury, and sometimes breaks his arm.

It is a particular object of this invention to provide a mechanism for safe-guarding against all such trouble, accidents and injuries, and to this end I provide a safety appliance which is self-releasing whenever the engine back fires, and which is also self-releasing in case the engine starts in the right direction, before the engineer releases the crank.

The features and parts of the invention will be understood from the detailed description which follows, and by reference to the accompanying drawings which form a part of this specification, and in which—

Figure 1 is an elevational view showing the safety cranking device applied to an engine. Fig. 2 is a top plan view of the device. Fig. 3 is a longitudinal section substantially on line 3—3 of Fig. 2; showing the construction and arrangement of the parts of the device; also showing the cranking clutch disengaged. Fig. 4 is a similar view showing the clutch in operative position ready for cranking the engine. Fig. 5 is still another similar view; showing the manner in which the male member of the clutch is forced out of engagement with the other member, against the tension of its spring by the back firing, recoiling or starting of the engine. Fig. 6 is an enlarged cross-section taken on line 6—6 of Fig. 4. Fig. 7 is a similar cross-section taken on line 7—7 of Fig. 4. Fig. 8 is a similar sectional view taken on line 8—8 of Fig. 4. Fig. 9 is a perspective view looking into the female clutch member. Fig. 10 is a cross-section on line 10—10 of Fig. 4.

Similar characters of reference designate corresponding parts throughout the several views.

In the drawings, 2 represents the cylinder of a gas or other explosion engine, 3 the fly-wheel, and 4 the crank-shaft of the engine which supports and drives the fly-wheel.

My safety cranking mechanism comprises a number of parts, some stationary, others movable, which I will now describe.

5 represents a base for supporting the safety cranking mechanism having standards 6 and 6′, all of which may be made of metal and constructed and joined together in any suitable form. The top of standard 6 is formed into a pillow-block, and is provided with a cap 7, for forming a journal-bearing for an auxiliary shaft 8, which is connected to the side of the fly-wheel by a flange 9, and a series of bolts or screws 10. Shaft 8 may be connected directly to the crank-shaft, as well as, to the fly-wheel and serve the same purpose. Shaft 8 is bored out to different diameters, for the greater part of its length, as indicated in the sec-

tional views, 3, 4 and 5, into which is inserted a cylindrical plunger or part 11 having an enlarged outer end 12 which conforms to the larger bore of the shaft 8, its inner end 13 being reduced to operatively fit the smaller bore of said shaft. The plunger 11 is rendered yieldable longitudinally within the shaft 8, by means of a coil spring 14, which normally exerts its tension for holding the plunger so that its enlarged end 12 projects slightly beyond the free end of shaft 8. The plunger 11 is driven with the hollow shaft 8, by means of a pin 15, which pierces the plunger, and its opposite projecting ends are disposed in like obliquely arranged slots 16 which are cut in the opposite sides of the shaft 8. The arrangement of the slots 16 is such that when the plunger 11 is forced into shaft 8 against spring 14, it is given a spiral movement or twist, which, owing to the arrangement of the ends of the spring, which are inserted and held in sockets 14′ tends to increase the tension for assisting the spring to recoil for restoring the plunger to normal position after each compression. The outer end 12 of the plunger comprises the male member of a clutch, which is employed for making and breaking the connection between the parts employed for cranking the engine, and a pin 17 driven through the head 12 of the plunger is provided for interlocking with jaw portions of the female member of the clutch. The free end of shaft 8 is recessed, as at 18, in order to receive the pin 17, when the plunger is forced into the shaft. Shaft 8 and also plunger 11 constantly rotate with the fly-wheel of the engine.

Upon the standard or pillow block 6′ is mounted a hollow cylindrical member or part 19, which is disposed in line and concentric to the shaft 8, and which is spaced from shaft 8, and is held stationary or rigid by means of a cap 7′ and the usual set-screw. Both of the caps 7 and 7′ are secured to the standards by bolts or screws 20. The stationary cylinder 19 supports within it a revolving and reciprocating shaft 21, which passes through and projects beyond the opposite ends of said cylinder. The inner end 22 of shaft 21 is preferably formed to the same diameter as shaft 8 and the cylinder 19. This enlarged end 22 is made partly hollow, or recessed, and within this hollow portion is formed oppositely facing clutch jaws 23 and between the jaws are formed spiral cam faces 23′, all of which comprise the female member of the clutch. The opposite end 21′ of shaft 21 is reduced, and has bearings in a contracted portion 24 of the hollow member 19 and also in a bushing 25 which is screwed into the outer end of the part 19. The intermediate portion of shaft 21 operatively fits the larger bore of the part 19. The protruding end 21′ of shaft 21 is fitted with a crank 26, which is employed for manually operating shafts 21 and 8 through the connection with the clutch members 12 and 22. Shaft 21 is capable of movement endwise, for the temporary interlocking of the clutch members, when sufficient force is applied against the crank 26 and the said shaft by the operator. The shaft 21 is normally held in its outer or resting position (see Figs. 1, 2 and 3), out of engagement with the clutch member 12 of shaft 8, by means of a coil spring 27, which is positioned between the bearing 24 of part 19 and a collar or stop 29, which is loosely fitted to the shaft 21, the said collar being held in place and prevented from outward movement toward the crank 26 by means of pins 30 and 31. The pin 30 passes through the shaft, while the pins 31 which are arranged at right angles to pin 30 only pass part way through the shaft. The outer ends of the pins 30 and 31 lie in notches or grooves 32, which are cut in the outer face of the collar 29, and by means of this arrangement the collar is held from rotating on shaft 21 under the force or twist of the spring 27. The pins 30 and 31 are inserted and removed by means of perforations 33 arranged in the part 19. Shaft 21, as stated, is rotatable, but in order to carry out the objects of the invention, this shaft may only be rotated by means of the hand-crank 26 in one direction, that is to say, in the direction for turning the fly wheel for properly starting the engine. Shaft 21 is held from rotation in the opposite direction, for preventing the crank 26 from being affected by the back-firing or back-kicking of the engine, by a series of ratchet teeth 34, which are formed upon the intermediate portion of shaft 21 between the clutch 22 and the spring 27. The ratchet teeth 34 are preferably what is known as "shrouded teeth", and they completely encircle the said shaft. Near each end of the ratchet 34 is disposed the usual ball-bearings 35, for reducing the friction of the shaft 21.

36 and 37 represent pawls for engaging the ratchet teeth 34. These pawls are disposed in perforations 38 which are formed in the opposite sides of the cylinder 19. The two pawls are exactly alike in construction, but when applying them, one is inverted as compared with the other, so that they may engage in the same positive manner the ratchet teeth 34, and thereby positively hold the shaft 21 from turning except in the direction in which the engine and crank 26 should be turned. The pawls are held in the perforations 38 and in engagement with the ratchet 34, by means of a tension spring 39, which partially encircles the member 19, and which is held in place by a screw 40. The opposite ends of the spring 39 are perforated to receive screws 41 employed for securing the spring to the pawls.

When the device is at rest or idle, as shown in Figs. 1, 2 and 3, the shaft 21, is positioned so that its head comprising the clutch member 22 is normally held tightly against the inner end of the part 19 by the tension of the spring 27. When in this position, the adjacent ends of shafts 8 and 21 are spaced far enough apart to allow the complete breaking of the connection between the clutch members 12 and 22, as best seen in Figs. 1, 2 and 3.

When it is desired to crank an engine having my safety device applied, the engineer or operator takes hold of the crank 26, and forces the shaft 21 inwardly against the tension of spring 27, which may be a comparatively light spring, until the clutch member 22 contacts with the end of shaft 8 and telescopes the outer end of plunger 11 (see Figs. 4 and 5), at which time the pin 17 of clutch member 12 becomes interlocked with the jaws 23 of the clutch member 22. Then by turning the crank in the direction permitted by the ratchet 34 and pawls 36 and 37, the fly-wheel 3 may be rotated in the direction for starting the engine. During the interval of cranking the engine, it is necessary for the operator to maintain enough pressure against the outer end of shaft 21 to hold it in the position shown in full lines in Figs. 4 and 5. As soon as he releases his pressure on shaft 21, spring 27 will instantly restore said shaft to the position shown in Figs. 1, 2 and 3 and in dotted lines in Fig. 5. In case the engine should accidentally back fire while the operator is in the act of cranking, as last described, and the engine and fly wheel are suddenly reversed, the pawls 36 and 37, one or both of which always engage with the ratchet 34, will hold shaft 21 and crank 26 from being rotated in the direction opposite to that which the operator is turning. When the engine back fires or reverses as described, the pin 17 is engaged by the clutch jaws 23. At this time the shaft 21 is held by the pawls and the ratchet gear from rotating in the reverse direction, so that the plunger 11 cannot rotate. As the hollow shaft 8 rotates backward under the power of the engine, the inclined slots 16 engage the pin 15 and force the plunger 11 to the left, the pin 17 sliding on the jaws 23, until it passes the point of the jaws and becomes free from the clutch member 22. As long as the engineer continues to hold the shaft 21 in the interlocking or compressed position shown in Figs. 4 and 5 while the engine is turning backward due to back-firing, the plunger 11 will reciprocate back and forth in the shaft 8 to the extent of the length of clutch jaws 23. Under this construction and arrangement of the parts of the device, it is impossible for the engine when driven in the wrong direction by reason of its back-firing, to effect the reversal of the shaft 21 and crank 26, and thereby inflict any injury upon the person engaged in cranking the same. If, on the other hand, the engine starts up in the right direction under the cranking operation without back-firing before the operator releases his pressure against the shaft 21, and also while he holds the crank rigidly, the plunger 11 will reciprocate in the hollow shaft 8, owing to the yielding of the said part through its connection with the spring 14. In the latter case, however, the pin 17, instead of sliding lengthwise on the jaws 23 will slide or travel over the spiral cam faces 23′ in the direction indicated by the arrows in Fig. 9. In either case, the interlocking and driving connection between the clutch members 12 and 22 will be broken without effecting the reversing of the shaft 21. As soon as the engine is started in the running direction, the operator should let go of the crank 26, whereupon the spring 27 will instantly shift the shaft 21 from the operative position shown in Figs. 4 and 5 to the normal or released position shown in Figs. 1, 2 and 3.

In practice the spring 14 carried by plunger 11, should be strong enough to withstand the force necessary to be applied by the crank-operator, for starting a heavy engine, or one in which the parts do not rotate freely. Ratchet 34 and pawls 36 and 37 should be of stout enough construction to resist the power of the engine and prevent the latter from turning shaft 21 and crank 26 in the wrong direction. Spring 27 needs only to be strong enough to properly and quickly withdraw shaft 21 from engagement with plunger 11 after each manipulation of crank 26 by the operator.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is—

1. The combination with an engine and a fly-wheel, of a hollow shaft rigidly connected to the fly wheel and driven thereby, a male clutch member carried by said hollow shaft, a stationary cylinder arranged in line with said hollow shaft and concentric to said male clutch member, a female clutch member carried by said cylinder adapted for reciprocal movements for engaging and disengaging with said male member, a spring for normally holding said female clutch member out of engagement with said male member, a ratchet and a number of pawls for holding the female clutch member from rotation by the back-firing of the engine, and means for manually operating said clutch members for starting the engine.

2. A cranking device for engines, comprising a clutch, one member of said clutch connected to the engine and capable of reciprocal movement toward or away from the engine, the second clutch member disposed concentric

to the first member and normally idle, means for holding the idle clutch member out of engagement with the first member, a hand crank for operating the idle clutch member in the direction for starting the engine, means for preventing the operation of the idle clutch member and said crank in the opposite direction either by the power of the engine or manually, and means for forcing the first clutch member away from the idle member upon the starting of the engine.

3. The combination with an engine and a clutch member resiliently connected to the engine, of a normally idle clutch member disposed concentric to said first clutch member, means for holding the idle clutch member out of engagement with the first clutch member, a hand crank for operating the idle member in the direction for starting the engine, means for preventing the operation of the idle clutch member and said crank in the opposite direction either by the power of the engine or manually, and means for shifting the first clutch member out of engagement with the idle clutch member when the engine is reversed by the back firing thereof.

4. A safety cranking device, comprising a clutch member capable of being connected to the fly-wheel or crank-shaft of an engine, a normally idle clutch member supported near the engine and adapted for interlocking with said first clutch member only when manually shifted and held under longitudinal pressure, a crank for operating said clutch members in the direction for starting the fly-wheel of the engine, a ratchet and a pawl for holding one of said clutch members from rotation in the opposite direction, resilient means connected to the other clutch member adapted for permitting the disconnecting of the clutch members by the power of the engine after the same has been started in the reverse direction by reason of back-firing, and means for disengaging the clutch members.

5. The combination with an engine and a fly-wheel, of a hollow shaft rigidly connected to the fly-wheel and driven thereby, a male clutch member caried by said hollow shaft, a stationary cylinder arranged in line with said hollow shaft and concentric to said male clutch member, a female clutch member carried by said cylinder adapted for reciprocal movements for engaging and disengaging with said male member, a spring for normally holding said female clutch member out of engagement with said male member, a ratchet and a pair of pawls for holding the female clutch member from rotation by the back-firing of the engine, a hand crank for operating said clutch members and said fly-wheel in the direction for starting the engine, and means for breaking the connection between said clutch members when the engine starts in either direction, without rotating said female member or said hand crank.

6. A safety cranking device for engines, comprising a clutch, the male member of said clutch connected to a rotatable part of an engine and adapted for reciprocal movement toward or away from the engine and also the second clutch member, the said male clutch member normally held in extended position away from the engine, the second clutch member supported near the engine and adapted for reciprocal movement toward or away from the male clutch member, said second clutch member normally held out of engagement with said male clutch member, a crank for rotating said clutch members and said rotatable part of the engine in one direction, means associated with the second clutch member for preventing said member from being rotated in the opposite direction when the engine back fires, and means for breaking the operative connection between said clutch members for permitting the engine and the male clutch member to operate without rotating said second clutch member or said crank.

7. The combination with an engine and its fly-wheel, of an auxiliary shaft connected to the fly-wheel, a portion of said shaft being hollow, a bearing for supporting said shaft, a plunger within the hollow portion of said shaft, said plunger connected to said shaft for movement therewith, said plunger adapted for longitudinal as well as spiral movement in said shaft, resilient means for holding said plunger partially extended beyond the free end of said shaft, a clutch member formed on the extended end of said plunger, a second clutch member supported by an independent bearing concentric to said plunger, a hand-crank operatively connected to the second clutch member adapted for rotating said member in one direction and for operating both of said clutch members and also the fly-wheel in said direction for starting the engine, means for preventing the rotation of the second clutch member in the opposite direction by the power of the engine when back-firing occurs, and means for breaking the engagement of said clutch members when said hollow shaft is rotated by the power of the engine.

8. The combination with an engine and its fly-wheel, of an auxiliary shaft connected to the fly-wheel, a reciprocating plunger having one end formed into a clutch member disposed concentrically in said shaft, a spring for normally holding the clutch portion of said plunger extended from said shaft, a hollow cylinder supported concentric to said auxiliary shaft, the adjacent ends of said shaft and said cylinder spaced apart, a reciprocating shaft journaled in said cylinder, a clutch member carried by said re-

ciprocating shaft and disposed in the space between said cylinder and said auxiliary shaft, a spring for normally holding said reciprocating shaft and its clutch portion from engagement with said auxiliary shaft and said plunger, said reciprocating shaft capable of movement endwise for interlocking said clutch members, a crank carried by said reciprocating shaft, for rotating said shaft in the direction for starting the engine, and means for preventing the rotation of said reciprocating shaft in the opposite direction.

9. In a cranking device, the combination with the fly-wheel and crank-shaft of an engine, of a hollow shaft capable of being attached to the fly-wheel, a clutch member carried by said hollow shaft, a spring carried by said shaft for rendering said clutch member yieldable and for normally holding said member extended in operative position, a stationary hollow cylinder disposed in line with and spaced from said hollow shaft, a rotatable and reciprocating shaft journaled in said cylinder, a clutch member formed on one end of said shaft adapted for interlocking with the first clutch member for rotating said fly-wheel for starting the engine, a hand-crank for operating said clutch members, a spring carried by said cylinder adapted for normally holding said second clutch member in released position, a ratchet formed on the shaft in said cylinder, and a pair of pawls carried by said cylinder for preventing said shaft from being rotated in the reverse direction by the back-firing of the engine.

10. A safety cranking device, comprising a clutch member capable of being connected to the crank-shaft of an engine, a normally idle clutch member supported near the engine and adapted for interlocking with said first clutch member only when manually shifted and held under longitudinal pressure, a hand-crank for operating said clutch members in the direction for starting the crank-shaft of the engine, a ratchet and a plurality of pawls for holding the idle clutch member from rotation in the opposite direction, resilient means connected to the first clutch member adapted for permitting the disengaging of the clutch by the power of the engine immediately after the engine has been started in either direction, and means for disengaging the clutch members.

11. The combination with an engine and a fly-wheel, of a hollow shaft rigidly connected to the fly-wheel and driven thereby, a male clutch member carried by said hollow shaft, a stationary cylinder arranged in line with said hollow shaft and concentric to said male clutch member, a female clutch member carried by said cylinder adapted for reciprocal movements for engaging and disengaging with said male member, a spring for normally holding said female clutch member out of engagement with said male member, a hand-crank for operating said clutch members and said fly-wheel in the direction for starting the engine, said crank rigidly connected with the female clutch member, and a ratchet and a pair of pawls for holding the female clutch member and said crank from rotation in the opposite direction by the back-firing of the engine.

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

EDMUND B. CALKINS.

Witnesses:
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ROBERT L. WALLACE.