J. W. TUDOR.

STARTING DEVICE FOR ENGINES.

APPLICATION FILED AUG. 3, 1908.

974,844.

Patented Nov. 8, 1910.

3 SHEETS—SHEET 1.

FIG. 1.

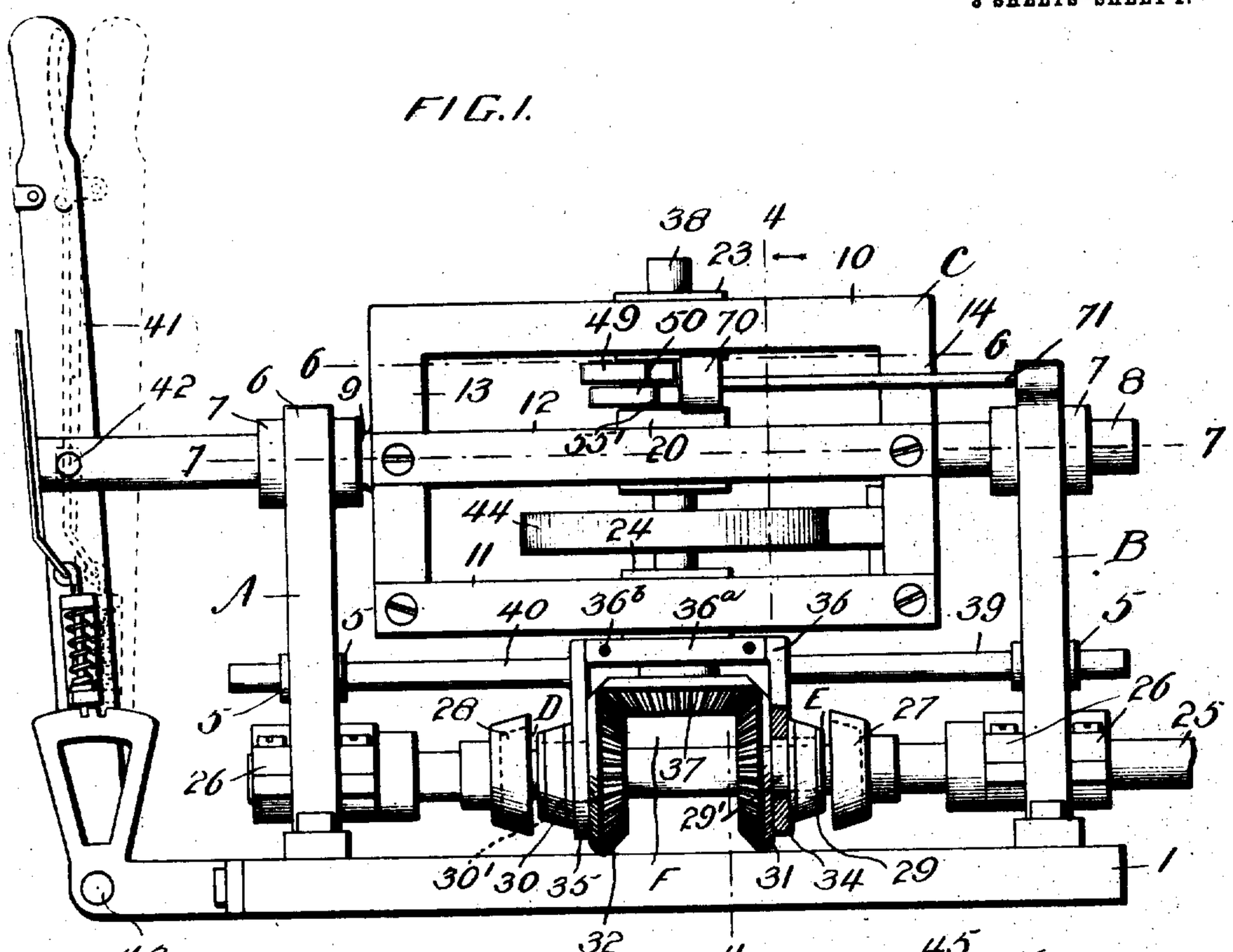

FIG. 2.

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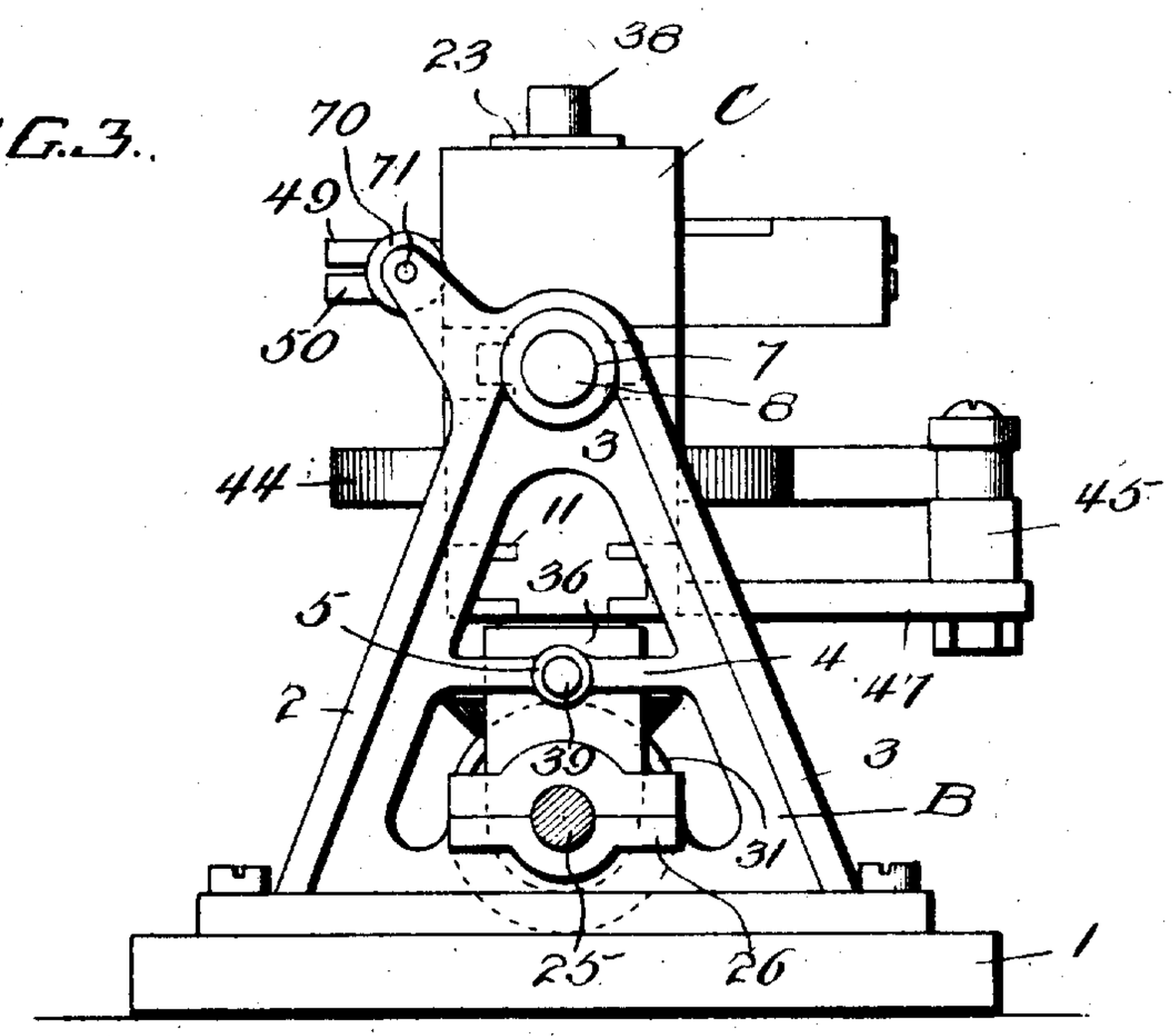
3 SHEETS—SHEET 2.

FIG. 3.



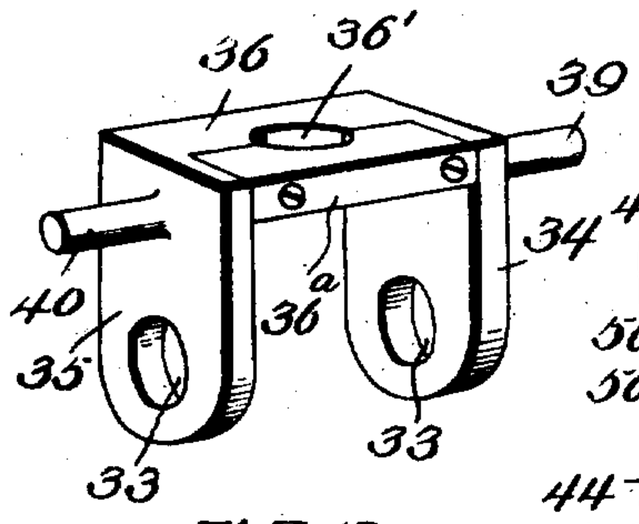


FIG. 5.

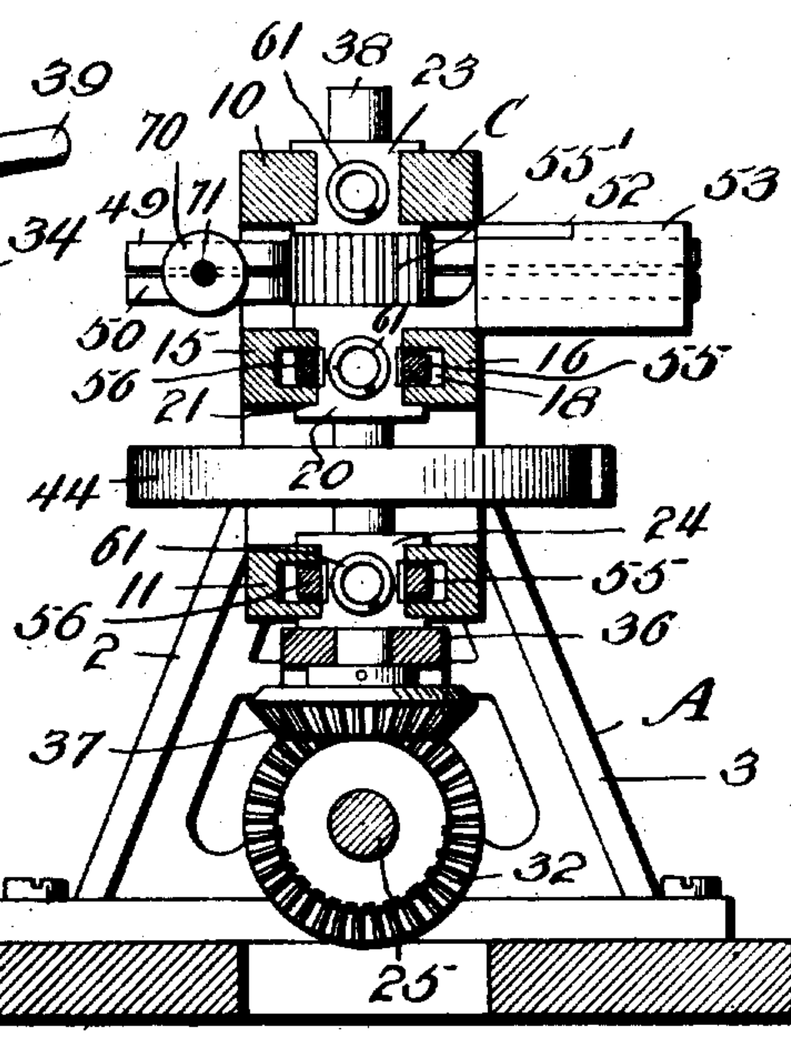


FIG. 4.

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3 SHEETS—SHEET 3.

FIG. 6.

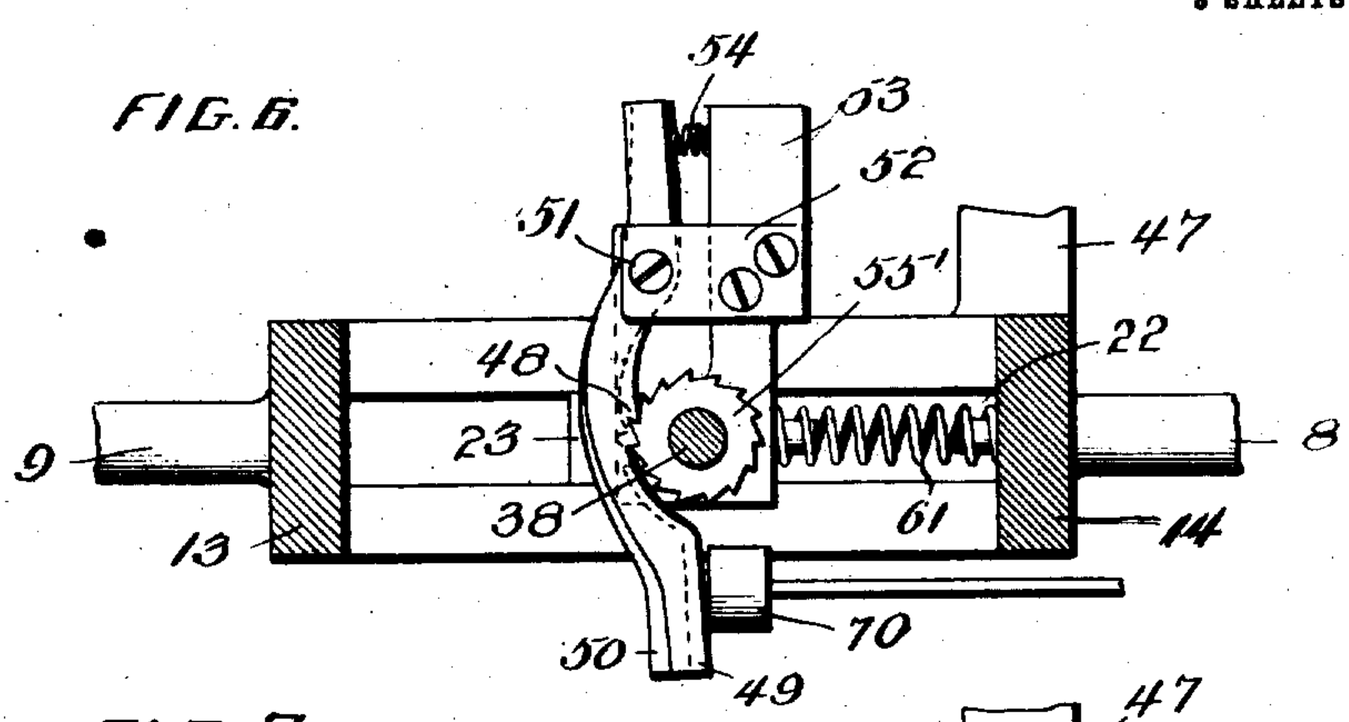


FIG. 7.

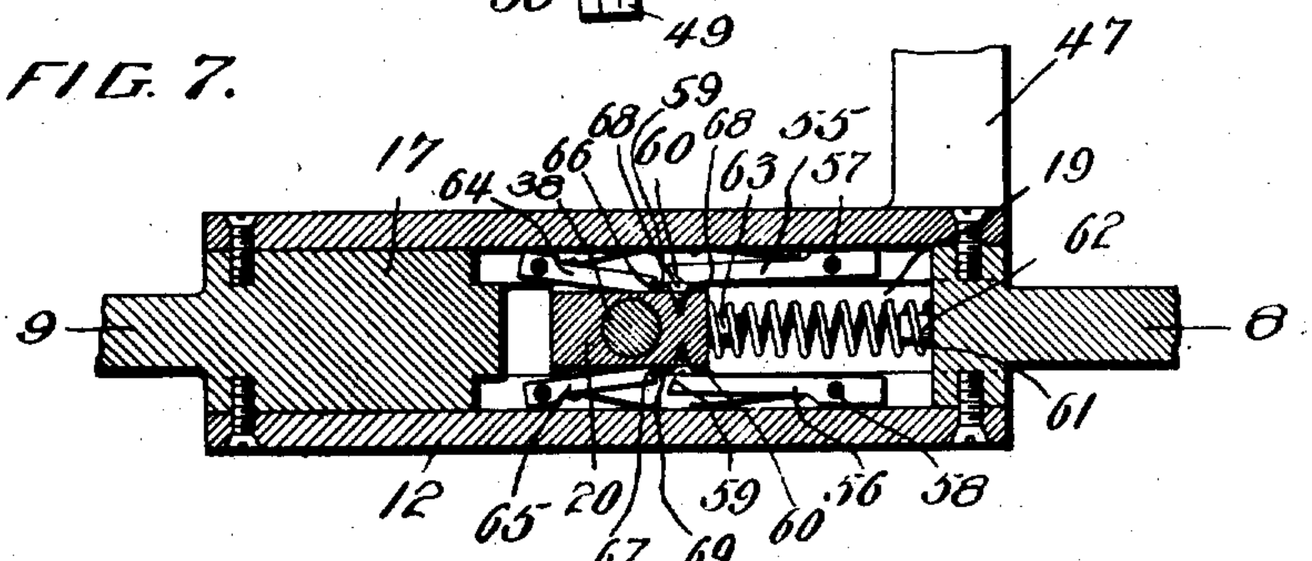
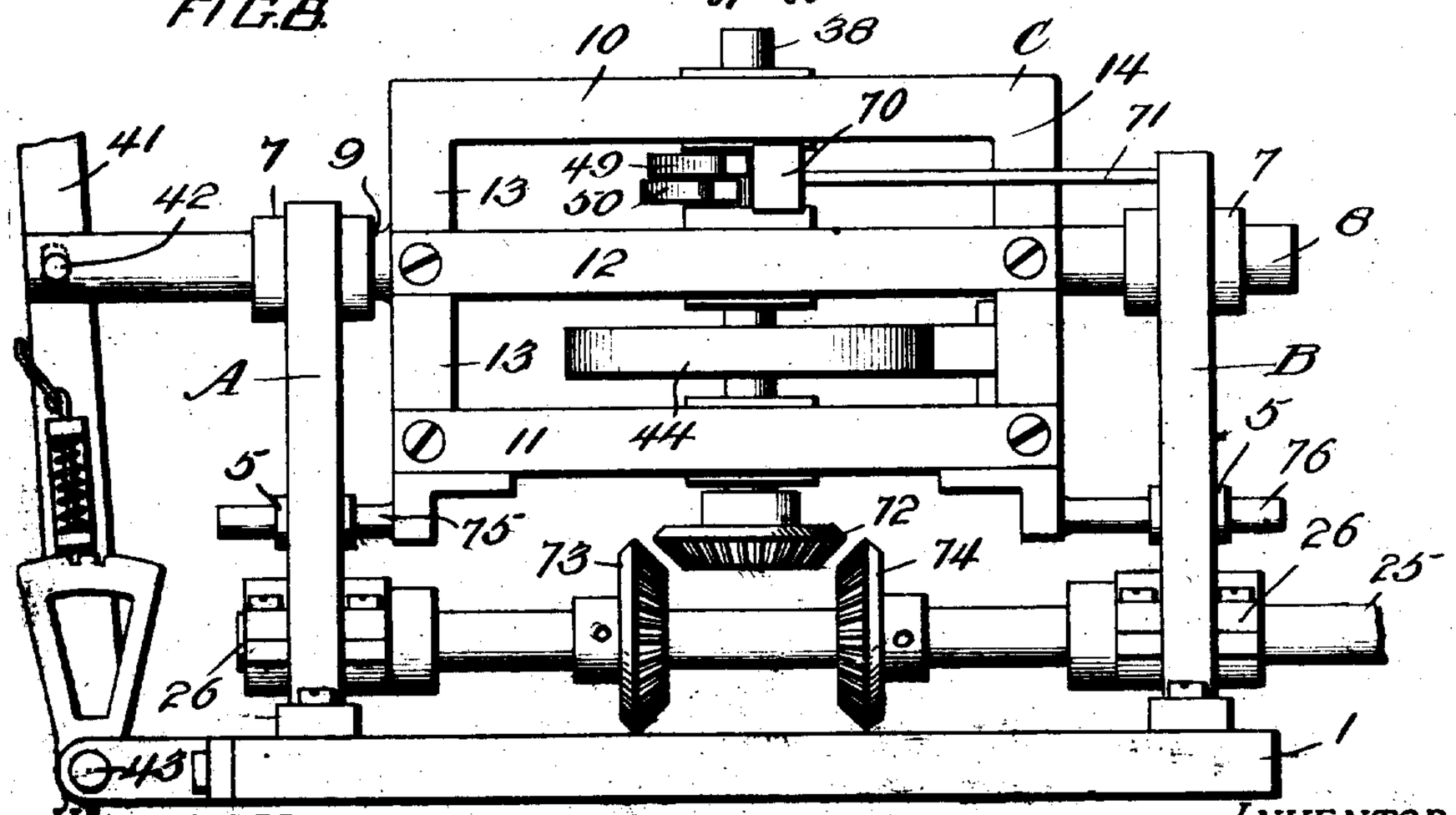


FIG. 8.



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UNITED STATES PATENT OFFICE.

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STARTING DEVICE FOR ENGINES.

974,844. Specification of Letters Patent. Patented Nov. 8, 1910.

Application filed August 3, 1908. Serial No. 446,722.

To all whom it may concern:

Be it known that I, JOHN WILLIAM TUDOR, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Starting Devices for Engines, of which the following is a specification.

This invention relates to starting devices for engines.

One object of my invention is to provide a starting device for automobile or other engines wherein means is provided to store energy of the running engine for a fresh start, by the simple manipulation of a lever in two directions, the first movement of the lever providing for the storage of the energy and the second movement of the lever providing for the starting of the motor by the aid of the stored energy, an essential feature of the device residing in an automatic release of the device after storing the energy and again after starting the engine.

Another object of the invention resides in the provision of a device of the nature stated, whose parts are so assembled into an aggroupment of coöperative elements that energy may be easily and quickly stored by the machine when running for use to start the motor of the machine after a stop without the liability of breakage of parts or a derangement thereof, and if used to start automobile engines the operator may conveniently and effectively start the engine without leaving his seat, thereby overcoming the serious disadvantages now existing in the method followed in "cranking" the machine.

A still further object is to provide an engine starting device provided with a longitudinally movable member having certain of its coöperative elements of the device movable longitudinally thereof with the aforesaid longitudinally movable member and also capable of moving independently of the aforesaid longitudinally movable member.

With the above and other objects in view, the present invention consists in the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that changes may be made in the form, proportion, size and minor details without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:—Figure 1 is a front elevation of the invention partly in section. Fig. 2 is a top plan view. Fig. 3 is an end view. Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 1. Fig. 5 is a detail perspective view of the second mentioned frame. Fig. 6 is a horizontal sectional view on the line 6—6 of Fig. 1. Fig. 7 is a horizontal sectional view on the line 7—7 of Fig. 1. Fig. 8 is a front elevation of a modified form of the gear mechanism of the invention.

In actual practice any suitable form of supporting means may be employed for the support of the mechanism embodied in my invention, but for purposes of illustration, the reference character 1 indicates a base of any suitable material upon which is mounted spaced standards A and B, each including the downwardly diverging legs 2 and 3 connected intermediate their ends by a cross piece 4, which latter is provided with a bearing 5 for a purpose presently explained. These standards have their heads 6 each provided with a bearing 7 adapted to slidably receive the trunnions 8 and 9 of a suitable longitudinally slidable frame C. The frame C embodies the upper and lower bars 10 and 11 and the intermediate bar 12, all the bars being connected by the end pieces 13 and 14. The intermediate bar 12 is made up in sections including channeled edge sections 15 and 16 and an intermediate section 17 whose opposite longitudinal edges are embraced by the channels 18 of the channeled edge sections 15 and 16 and which is shorter than said channeled sections 15 and 16 to provide a slot 19 in said intermediate bar 12 to slidably receive the movable bearing 20 whose sides may be grooved, as indicated at 21, to embrace the sides of said slot 19 and be guided thereby. The upper bar 10 of the frame C may be formed exactly like the bar 12, but not necessarily so, and therefore, I have shown it not formed in sections but provided with a slot 22 to slidably receive the bearing 23 formed like the aforesaid bearing 20. If preferred, the lower bar 11 may be formed like bar 10, but as shown, it is formed exactly like bar 12 and has the bearing 24 slidably mounted therein.

The character 25 indicates a drive shaft

which may extend from the motor (not shown) or which may be obviously connected to a motor shaft in any suitable manner. In any event, the drive shaft 25 extends through the bearings 26 in the legs of the standards A and B, there being cup shaped driven members 27 and 28 of frictional clutch mechanisms D and E fixedly secured to the drive shaft for engagement with the cone driving members 29 and 30, respectively, carried by the gear mechanism F, the driving members 29 and 30 of said clutch mechanisms D and E being rigidly secured to the sleeves 29′ and 30′ of the respective gears 31 and 32 of said gear mechanism F. These said gears 31 and 32 have their said sleeves rotatably mounted in a suitable bearing 33 in the respective legs 34 and 35 of a second frame 36, each driven clutch member 27 and 28 having a tapering interior conforming to the taper of the respective cone driving members 29 and 30 to effect proper frictional engaging surfaces for the corresponding clutch members D and E to couple the respective clutch mechanisms and consequently their respective gears to the drive shaft 25 when desired, it being understood that the second frame 36, the cone driving members 29 and 30 of the clutch mechanisms and their respective gears are normally loose upon the drive shaft 25. The gears 31 and 32 are always in mesh with an intermediate gear 37 carried at the lower end of a winding shaft 38, which is mounted in the aforesaid slidable bearings 20, 23, and 24 of the main longitudinally movable frame C. The winding shaft 38 is preferably journaled through the bearing 36′ in the back of the second-mentioned frame 36, and in order that said intermediate gear 37 may be fitted to the winding shaft 30 between the gears 31 and 32, the back of the second frame has a removable section 36^a secured against accidental displacement by the screws 36^b, and by virtue of this disposition of the winding shaft 38 with respect to the second mentioned frame 36, the latter may be firmly supported in place upon the drive shaft 25, but in order to further support the second mentioned frame 36 and particularly to hold it against lateral displacement, there are secured to the legs 34 and 35 the supporting arms 39 and 40, respectively, which have slidable movement through the aforesaid bearings 5 in the cross pieces 4 which connect the legs 2 and 3 of the standards A and B.

As already stated, the drive shaft 25 may have connection with the motor, not shown, through the instrumentality of any suitable connections, and the slidable frames hereinbefore referred to may be moved longitudinally between said standards in any suitable manner, one means, however, embodying a manually operated hand lever 41 having a loose pivotal connection at 42 with the aforesaid trunnion 9 of the main frame C and also pivoted at 43 to the base 1.

Connected at one end to the winding shaft 38 between the bars 11 and 12 of the main frame C is an energy storing spring 44 whose opposite end is secured in any suitable manner to the upright 45 adjustably mounted in the slot 46 of the arm 47 which projects from the intermediate bar 12 of the frame C.

The winding shaft 38 and the second mentioned frame 36, and consequently the gear mechanism, are disposed normally intermediate the friction clutch driven members 27 and 28 and these parts are caused to assume this intermediate position automatically regardless of whether the friction clutch cone driving members 29 and 30 are in coöperative relation with either the friction clutch driven members 27 or 28. Therefore, assuming that the winding shaft 38, the second mentioned frame 36 and the gear mechanism are in their normal intermediate position, and it is desired to wind the spring 44, the longitudinally movable frame C is moved longitudinally to the left by throwing the operating lever 41 one stroke to the left. This movement of said lever 41 also causes the winding shaft 38, the second mentioned frame 36 and the gear mechanism to be thrown from their normal position, resulting in the cone 30 being thrown into clutch with the driven clutch member 28, thereby locking the gear mechanism to the drive shaft 25, and, owing to the operation of the drive shaft 25, the spring 44 will be consequently wound upon the winding shaft 38. When the mechanism is thus thrown to wind the spring 44, the teeth 48 of one or the other of the upper and lower pawls 49 and 50 pivoted at 51 in the bracket 52 secured to the arm 53 and which are spring pressed by the springs 54, engage the teeth of the ratchet 55′ on the winding shaft 38 between the bars 10 and 12 of the frame C to prevent backward movement of the shaft 38, during the time the spring is being wound or after it has been wound until it is desired to use the energy stored by the spring to start the motor. The teeth of one pawl are preferably arranged alternately with respect to the teeth of the other pawl, so that if the teeth of one pawl should fail to enter between the teeth of the ratchet 55′, the teeth of the other pawl would be so disposed as to positively enter between the teeth of said ratchet to prevent backward turning of the winding shaft. Arm 53 is formed with and sides with bearing 23. (See Figs. 4 and 6.) When the spring 44 has been wound, the clutch D is automatically thrown out of operation to release the gear mechanism from the drive shaft so that continued operation of the latter will not continue to

wind the spring 44, all as will be explained in detail hereinafter. The winding operation may take place to store up energy in the spring 44 while the machine is in motion, so that after a stop of the machine, the energy may be utilized to start the motor, (not shown.) To start the motor, subsequently to the winding up of the spring 44, the lever 41 is thrown one stroke to the right, as shown in dotted lines in Fig. 1, causing the longitudinally movable frame C, the second mentioned frame 36, and the gear mechanism to be thrown to the right, when the driving cone 29 of the clutch mechanism E will be thrown into coöperative relation with the driven clutch member 27 of the clutch mechanism E to bind the gear mechanism to the drive shaft 25 and cause a rapid unwinding of the spring 44 to start the motor.

To effect the aforesaid automatic shifting of the secondary frame and gear mechanism to their normal intermediate position, I provide the aforesaid slidable bearings 20, 23 and 24. These bearings will remain normally in their initial positions, that is, at the inner end of their respective guide slots, unless the spring 44 be wound beyond a certain degree of tension. When said spring 44 has reached its normal highest tension, the driving cone 30 will separate from the driven clutch member 28 of the clutch mechanism D, releasing the latter automatically from the drive shaft and resulting in the slidable bearings 20, 23 and 24, the winding shaft 38, and consequently, the secondary frame 36 and gear mechanism F being pulled automatically to their normal position, incident to the pull exerted upon the winding shaft by the spring 44, and by reason of which the tension of the spring 44 is released automatically prior to its reaching a "breaking stress". However, before the aforesaid elements are thus shifted automatically, the spring 44 must reach such a tension as to overcome the tension of the spring pressed pawls 55 and 56 pivotally mounted at 57 and 58, respectively, in the channels of the aforesaid side sections 15 and 16 of the intermediate bar 12 of the frame C. The outward movement of each bearing 20, 23 and 24 is limited by a stop *a* projecting into each of the guide-slots of the bars 10, 11 and 12. The pawls 55 and 56 each has its free end beveled, as indicated at 59 for engagement normally with the beveled shoulders 60 on the slidable bearing 20, so that when the bearing 20 has a tendency to slide in its slot 19 incident to the pulling action exerted thereupon by the increasing tension of the spring as the latter is being wound, the movement of said bearing is resisted by these pawls 55 and 56, because of the fact that these pawls are bearing against the said beveled shoulders 60. Thus the spring 44 must reach such a tension as to overcome the frictional resistance offered by these pawls 55 and 56 before the slidable bearing 20 can move from its normal position at the inner end of its guide 19 to that position shown in Fig. 7, wherein it will be seen that the winding shaft 38 has been moved to its normal intermediate position, although the main frame C has remained in the position toward the left where it has been moved by the hand operated lever 41 in a manner hereinbefore explained. There is a spring 61 mounted in the guide-slot 19 upon the studs 62 and 63 possessing such strength as to not force the bearing 20 back to the inner end of the slot 19 of the intermediate bar 12, after the clutch mechanism D has been separated until the energy of the wound spring 44 has been spent incident to an unwinding of the spring 44 in the manner hereinbefore explained, because of another set of pawls 64 and 65 pivoted in alinement with the aforesaid pawls 55 and 56 in said channels of the side sections of the intermediate bar 12 and which have their free beveled ends 66 and 67, respectively, bearing against the beveled shoulders 68 and 69, respectively, of the slidable bearing 20. This second set of pawls 64 and 65, however, are smaller than the pawls 55 and 56 and have not the resistance against the return movement of the bearing 20, against the action of the spring 61 as has the resistance of the pawls 55 and 56 against outward movement of the bearing 20. Hence, while the tension of the spring 44 may be sufficient when completely wound to effect an automatic release of the clutch D for the purpose already stated, the spring 61 has not such strength as to act against the spring 44 until the latter has lost its tension.

If preferred, I may have only the single slidable bearing 20, and may dispense with the slidable bearings 23 and 24, using only the one bar 12, but generally, the complete frame C and its three bars and three bearings are preferred because of a more substantial mounting for the winding shaft 38. Further, although I may use all three of the slidable bearings, I may provide only one of them with the aforesaid resisting means, including the pivoted pawls 55, 56, 64 and 65 and their adjunctive parts. However, in the accompanying drawings, I disclose this resisting means associated with both bearings 20 and 24, and not associated with the bearing 23, although the same may be used in connection with the latter, if desired, the springs 61 being mounted for coöperation with each bearing.

When the energy of the spring is to be utilized to start the motor, that is, when the mechanism is thrown to present the driving cone 29 to operative position with relation to the driven clutch member 27, by shifting

the longitudinally movable frame, through the instrumentality of a single stroke of the operating lever 41 toward the right to the dotted line position shown in Fig. 1, the operation of the clutch mechanism E will bind the mechanism to the drive shaft and effect a quick starting of the motor incident to the unwinding of the spring 44 which will effect a rapid rotation of the winding shaft 38 to unwind the spring. As the main frame C is thus shifted to the right, and when the clutch faces 27 and 29 meet for operation, the pawls 49 and 50 contact with the headed end 70 of the arm 71 fitted in the upper end of the standard B to disengage said pawls from the teeth of the ratchet 55′ to permit of rotation of the winding shaft 38 to unwind the spring 44. After the spring has been unwound, it has lost its tension, and is not pulling upon the winding shaft. The springs 61 then overcome the frictional resistance of the lighter pawls 64 and 65 and force the bearings and consequently the winding shaft and the gear mechanism back automatically to their normal intermediate position without shifting the longitudinally movable frame C, such operation throwing the clutch mechanism E out of operation automatically.

The modified form of invention illustrated in Fig. 8 is the same as the preferred form of device, except that I eliminate the second mentioned frame 36 and the clutch mechanism D and E, and have the intermediate gear 72 movable with the drive shaft 38 into interchangeable engagement with the gears 73 and 74 keyed on the drive shaft 25. The only other difference between the two structures resides in securing the arms 75 and 76 to the main frame C for sliding movement through the bearings 5 of the standards A and B. As these are the only differences between the two devices, the operation of the modified form of invention will be readily understood.

What is claimed is:—

1. In an engine starting device, the combination with a drive shaft, a gear mechanism slidable upon the drive shaft and carrying at opposite sides a driving member of a clutch mechanism, two independent driven clutch members on the drive shaft for cooperation with the respective aforesaid driving members of the clutch mechanisms, a spring, means whereby the gear mechanism may be shifted upon the drive shaft to present one of the driving members of one of the clutch mechanisms to the corresponding driven clutch member to effect a winding of said spring, means for automatically throwing said clutch mechanism out of operation and shifting the gear mechanism to a point intermediate the aforesaid driven members of said clutch mechanisms, said shifting means being operable to throw the gear mechanism in the opposite direction to present the other driving member of the other clutch mechanism to the corresponding driven member to effect an unwinding of said spring, and means to automatically shift the gear mechanism out of coöperative relation with said second clutch mechanism to a point intermediate said driven members of the clutch mechanisms after the spring has been unwound.

2. In a starting device for engines, the combination with a drive shaft, spaced driven clutch members on the drive shaft, a frame, a spring having connection with the frame, means movable in one direction and including a driving clutch member for engagement with one of the aforesaid driven clutch members to effect a winding of said spring, means to effect a release of the winding means when the spring has reached a certain tension, said movable means also including a second driving clutch member for coöperation with the other of said driven clutch members to effect an unwinding of said spring when said movable means is again operated, and means to effect an automatic release of the unwinding means when the spring has been unwound.

3. In a starting device for engines, the combination with a drive shaft, a movable frame, a spring having connection with the frame, a gear mechanism between the frame and said shaft, means whereby the frame may be moved in one direction, a clutch mechanism thrown into operation upon said movement of the frame to connect the gear mechanism and the drive shaft together to effect a winding of said spring, means to effect an automatic release of said clutch mechanism to disconnect the gear mechanism from the shaft when the spring has reached a certain tension, a second clutch mechanism thrown into operation when the frame is again moved to effect an unwinding of said spring, and means to effect an automatic release of the second clutch mechanism to disconnect the gear mechanism from the driving shaft when the spring has been unwound.

4. In a starting device for engines, the combination with a drive shaft, a movable frame, a spring having connection with the frame, a gear mechanism between the frame and said shaft, means whereby the frame may be moved in one direction, a clutch mechanism thrown into operation upon said movement of the frame to connect the gear mechanism and the winding shaft together to effect a winding of said spring, means to effect an automatic release of said clutch mechanism to disconnect the gear mechanism from the shaft when the spring has reached a certain tension, and a second

clutch mechanism thrown into operation when the frame is again moved to effect an unwinding of said spring.

5. In an engine starting device, the combination with a drive shaft, a gear mechanism upon the drive shaft, a slidable frame mounted for longitudinal movement, a shaft carried by the frame and connected with said gear mechanism, and a spring having connection with the second mentioned shaft and the frame.

6. In an engine starting device, the combination with a drive shaft, a gear mechanism upon the drive shaft, a longitudinally slidable frame, a shaft carried by the frame and connected with said gear mechanism, all of the gears of the gear mechanism being constantly in mesh a spring having connection with the second mentioned shaft and the frame, and means for shifting the gear mechanism independently of the movement of said frame.

7. In an engine starting device, the combination with a drive shaft, a slidable frame, a second frame connected to the first mentioned frame, a gear mechanism slidably mounted upon the drive shaft within the second mentioned frame, a shaft extending through both frames and connected to said gear mechanism, and a spring having connection with the second mentioned shaft and one of the frames.

8. In an engine starting device, the combination with a drive shaft, spaced driven members of a clutch mechanism upon the drive shaft, a slidable frame, a second frame slidably mounted upon the drive shaft, a gear mechanism mounted within the second frame and having driving clutch members for coöperation with the aforesaid driven clutch members, a shaft journaled through both frames and connected to the gear mechanism, a spring having connection with the second mentioned shaft and the first mentioned frame, means whereby both frames may be moved in one direction and one of the driving clutch members thrown into cooperation with one of the driven members to effect a winding of said spring, means to automatically release said coöperating clutch members and shift the second frame and gear mechanism to a point intermediate the aforesaid driven clutch members when said spring reaches a certain tension, said means for moving said frames being movable to throw the other of said driving clutch members into coöperative relation with the other of said driven clutch members to effect an unwinding of the spring, and means to automatically release the second mentioned cooperating clutch members when the spring has been unwound and to shift the second frame and the gear mechanism to a point intermediate said driven clutch members when the spring is unwound.

9. In an engine starting device, the combination with a drive shaft, spaced driven members of a clutch mechanism upon the drive shaft, a slidable frame, a second frame slidably mounted upon the driven shaft, a gear mechanism mounted within the second frame and having driving clutch members for coöperation with the aforesaid driven clutch members, a shaft journaled through both frames and connected to the gear mechanism, a spring having connection with the second mentioned shaft and the first mentioned frame, means whereby both frames may be moved in one direction and one of the driving clutch members thrown into cooperation with one of the driven clutch members to effect a winding of said spring, means to automatically release said coöperating clutch members and shift the second frame and gear mechanism to a point intermediate the aforesaid driven clutch members when said spring reaches a certain tension, said means for moving said frames being movable to throw the other of said driving clutch members into coöperative relation with the other of said driven clutch members to effect an unwinding of the spring, and means to automatically release the second mentioned coöperating clutch members when the spring has been unwound and to shift the second frame and the gear mechanism to a point intermediate said driven clutch members when the spring is unwound, said movements of said second mentioned frame and gear mechanism being made independently of the movement of the first mentioned frame.

10. An engine starting device comprising standards, a frame mounted for sliding movement in the standards, a second frame, a shaft journaled through both frames and movable therewith, and means constructed and arranged to permit of movement of said shaft and the second mentioned frame longitudinally of the first mentioned frame independently of the movement of the latter, and a spring operable by said shaft.

11. In an engine starting device, the combination with a longitudinally movable frame, a second frame, a drive shaft, a second shaft journaled through said frames, a gear mechanism between said shafts, and means to automatically shift said second frame and the gear mechanism in either direction and independently of the movement of said first frame.

12. In an engine starting device, the combination with a drive shaft, a movable frame, a second frame disposed beneath the aforesaid frame and movable therewith, connections between the second frame and the drive shaft, a winding shaft journaled through both frames and connected with the connections between the second frame and the drive shaft, means whereby said frames

and the second mentioned shaft may be moved together, and means whereby the second mentioned frame and the second mentioned shaft may be moved independently of the movement of the first frame.

13. In an engine starting device, the combination with a drive shaft, a movable frame, a second frame disposed beneath the first frame and movable therewith, connections between the second frame and the drive shaft, a winding shaft journaled through both frames and connected with the connections between the second frame and the drive shaft, means whereby said frames and the second mentioned shaft may be moved together, and means whereby the second mentioned frame and second mentioned shaft may be moved automatically and independently of the movement of the first frame.

14. In an engine starting device, the combination with a longitudinally movable frame, a second movable frame, a drive shaft, a gear mechanism between the drive shaft and the second frame, a second shaft journaled through both frames, a spring having connection with the second shaft, a clutch mechanism thrown into operation upon movement of said frames to effect a winding of said spring, means to automatically release the clutch mechanism and shift said second frame and the second shaft and also the gear mechanism independently of movement of the first frame, a clutch mechanism operable when the first mentioned movable frame is shifted to another position to effect an unwinding of said spring, and means to automatically release the second clutch mechanism and shift the second frame and the second shaft and the gear mechanism independently of the movement of the first frame.

15. In an engine starting device, the combination with a supporting means, a drive shaft rotatably mounted in the supporting means, a frame, a shaft journaled through the frame and disposed at a right angle to the drive shaft, a gear on said second shaft, gears carried by said frame and slidably mounted on said drive shaft, all of said gears being constantly in mesh, and clutch mechanisms for effecting a rotative connection of the frame gears upon the drive shaft.

16. In an engine starting device, the combination with a drive shaft, a frame slidably mounted upon the drive shaft, gears loosely mounted upon the drive shaft within said frame, a second shaft journaled through said frame, a gear on the second shaft constantly in mesh with the aforesaid gears, spaced clutch members on the drive shaft between which members the aforesaid frame and gears are normally disposed, and clutch members carried by the first mentioned gears for coöperation with the first mentioned clutch members alternately to effect a binding engagement of the first mentioned gears alternately with the drive shaft.

17. In an engine starting device, the combination with a supporting means, a drive shaft rotatably mounted in the supporting means, a frame slidably mounted upon the drive shaft and provided with arms slidably mounted in the supporting means, gears loosely mounted upon the drive shaft within said frame, a shaft disposed at a right angle to the drive shaft and journaled through said frame, a gear fixed on the second shaft for mesh constantly with the aforesaid gears, an energy storing means having connection with the second shaft, and means constructed and arranged to effect a shifting of the frame upon the drive shaft to cause rotation of the second shaft to operate said energy storing means.

18. In an engine starting device, the combination with a supporting means, a drive shaft rotatably mounted in the supporting means, a frame slidably mounted upon the drive shaft and provided with arms slidably mounted in the supporting means, gears loosely mounted upon the drive shaft within said frame, a shaft disposed at a right angle to the drive shaft and journaled through said frame, a gear fixed on the second shaft for mesh constantly with the aforesaid gears, an energy storing spring having connection with the second shaft, and means constructed and arranged to effect a shifting of the frame upon the drive shaft to cause rotation of the second shaft to operate said energy storing spring.

19. In an engine starting device, the combination with a drive shaft, a slidable frame, a second frame connected to the first mentioned frame, a gear mechanism slidably mounted upon the drive shaft within the second mentioned frame, a shaft extending through both frames and connected to said gear mechanism, and an energy storing means having connection with the second mentioned shaft.

20. In an engine starting device, the combination with a drive shaft, a slidable frame, a second frame connected to the first mentioned frame, a gear mechanism slidably mounted upon the drive shaft within the second mentioned frame, a shaft extending through both frames and connected to said gear mechanism, and a spring having connection with the second mentioned shaft.

21. In an engine starting device, the combination with a drive shaft, a movable frame, a second frame connected to the first mentioned frame and movable with and independently thereof, a gear mechanism carried by the second mentioned frame, an energy storing means operable by the gear

mechanism, and means for operating the gear mechanism to alternately wind and unwind the energy storing means.

22. In an engine starting device, the combination with a drive shaft, gears loosely and slidably mounted upon the drive shaft, a frame upon the drive shaft in which said gears are slidably mounted, a shaft journaled in said frame, a gear fixed on the second shaft and interposed between and in constant engagement with the aforesaid gears, and means for shifting said frame, the shaft journaled therein and said gears longitudinally of the drive shaft.

23. In an engine starting device, the combination with a drive shaft, gears loosely and slidably mounted upon the drive shaft, a frame upon the drive shaft in which said gears are slidably mounted, a shaft journaled in said frame, a gear fixed on the second shaft and interposed between and in constant engagement with the aforesaid gears, means for shifting said frame, the shaft journaled therein and said gears longitudinally of the drive shaft, and means for effecting a binding of the first mentioned gears to the drive shaft alternately.

24. In a starting device, the combination with a frame, a countershaft, clutch mechanisms, a gear mechanism having operative connection with the countershaft and whose gears are constantly in mesh, an energy storing spring having connection with the said frame and the counter shaft, means operable to throw one of said clutch mechanisms into operation and thereby effect a winding of the spring to store the energy, the distance between the ends of the spring being decreased upon the spring reaching a certain tension and thereby throwing said operating clutch mechanism out of operation and effecting a discontinuance of the winding of the spring.

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

JOHN WILLIAM TUDOR.

Witnesses:
J. H. SIGGERS,
E. S. DALTON.