

March 29, 1927.

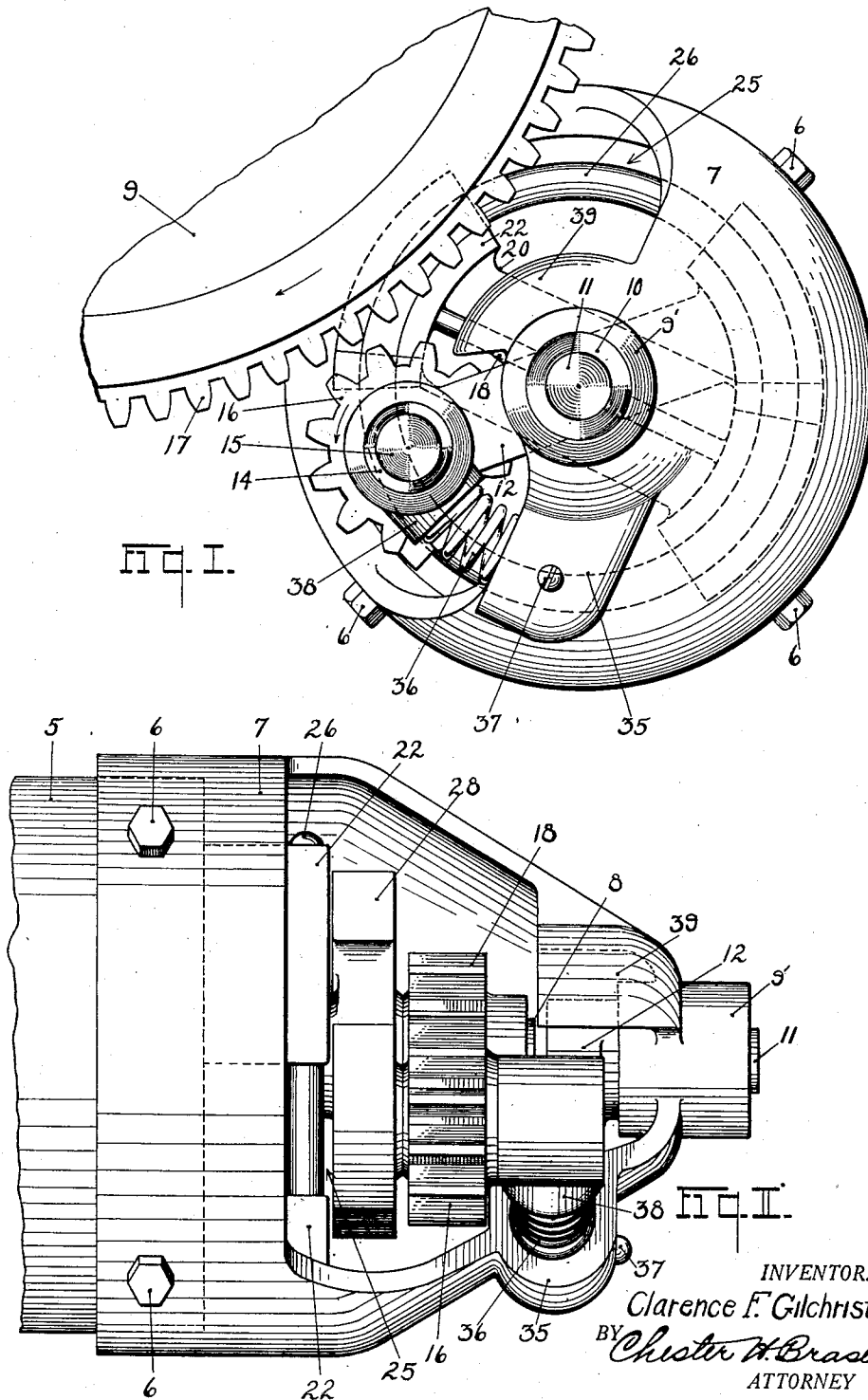
C. F. GILCHRIST

1,622,377

ENGINE-STARTER

Original Filed Oct. 3, 1919

5 Sheets-Sheet 1



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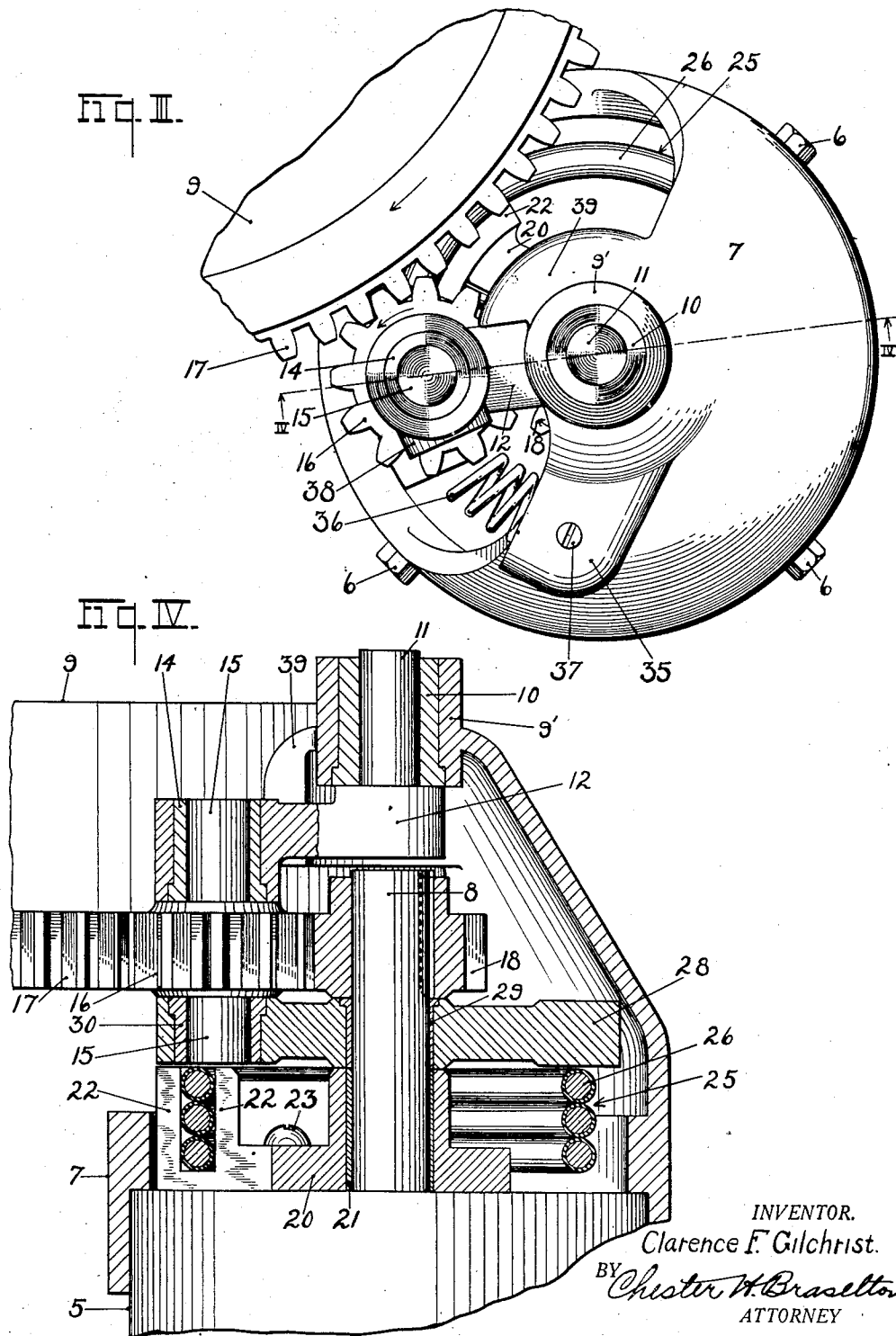
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FIG. V.

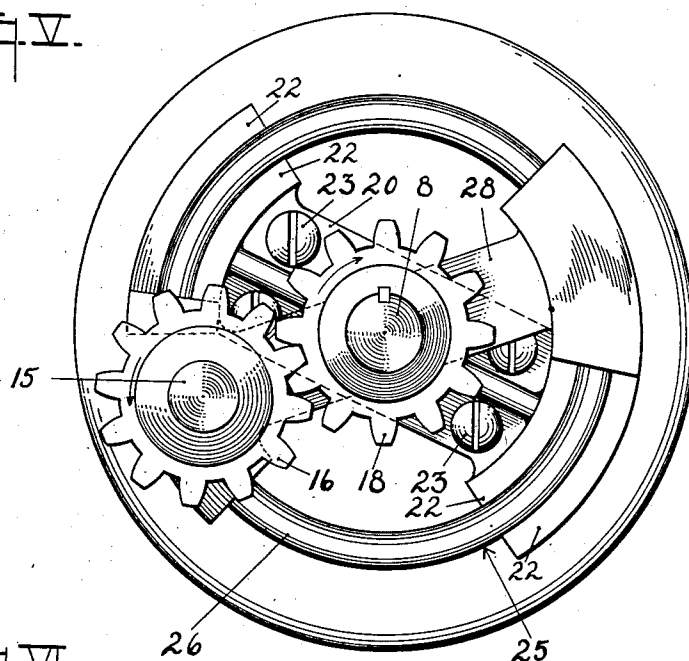
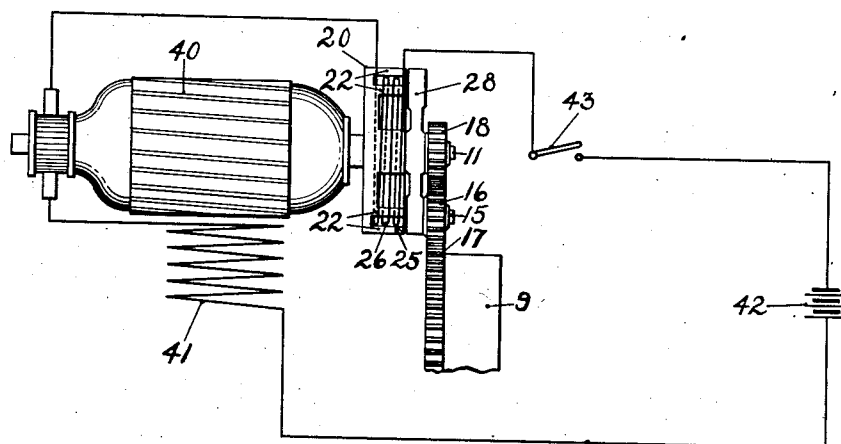


FIG. VI.



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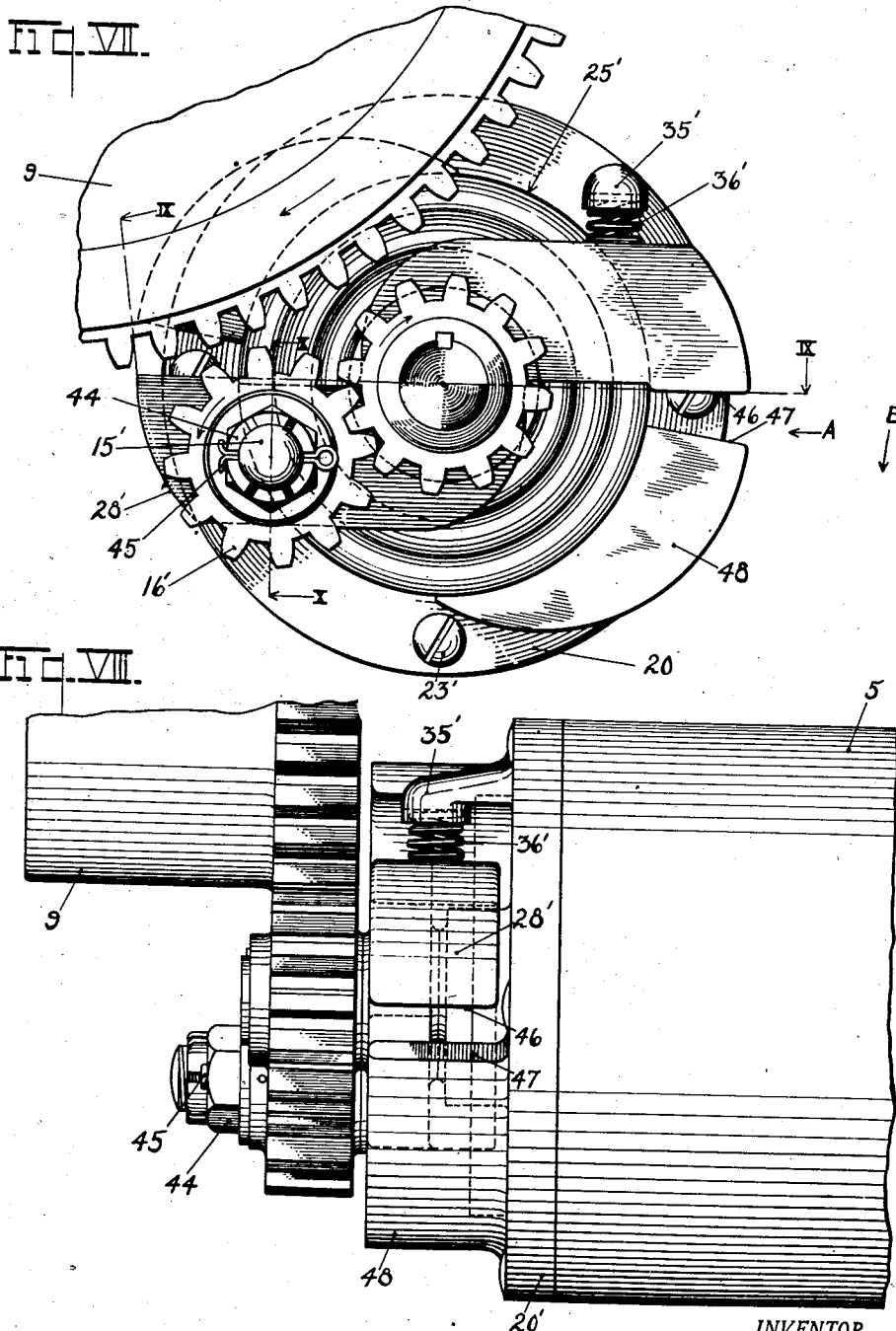
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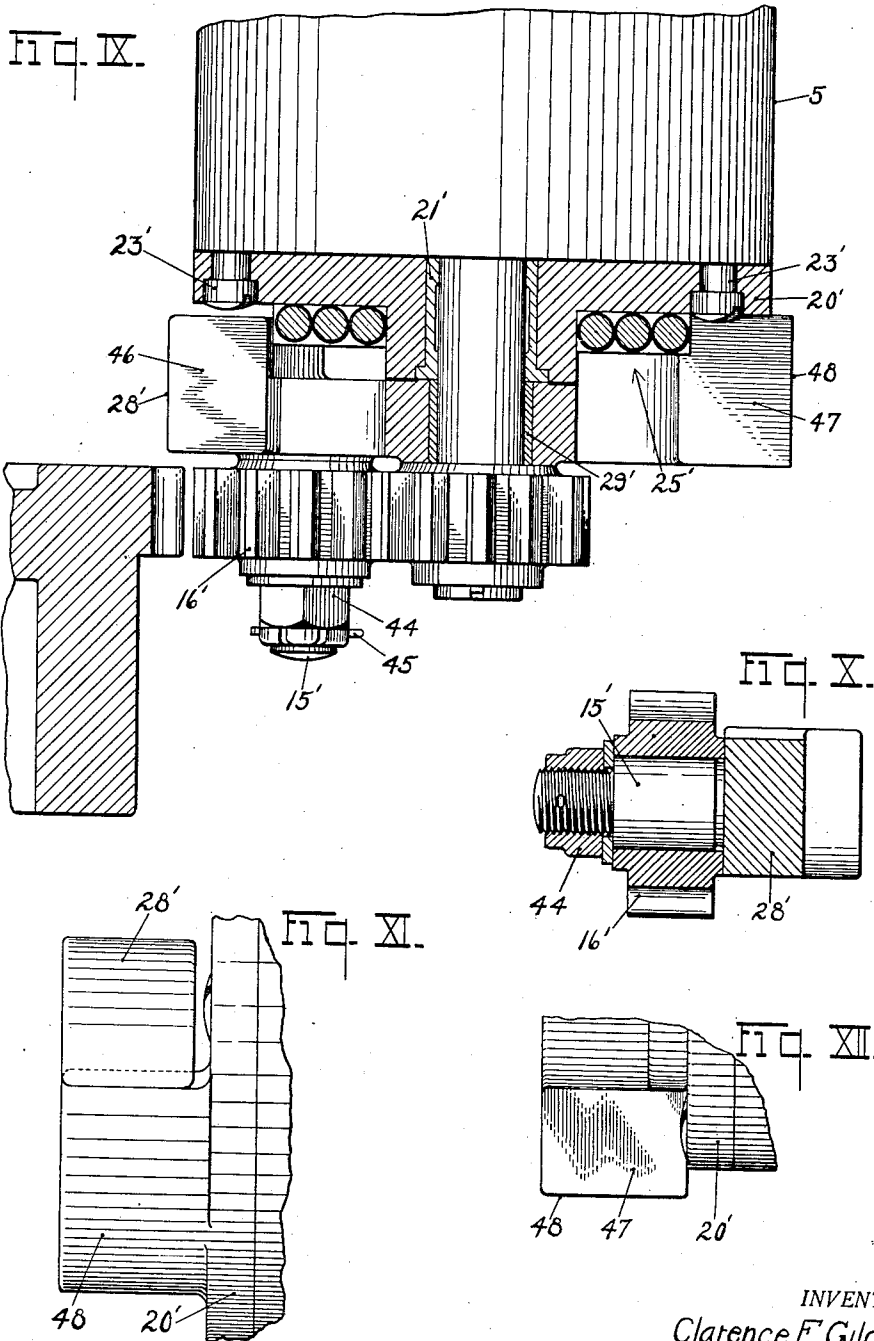
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ENGINE STARTER

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

CLARENCE F. GILCHRIST, OF TOLEDO, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
THE ELECTRIC AUTO-LITE COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

ENGINE STARTER.

Application filed October 3, 1919, Serial No. 328,113. Renewed August 15, 1924.

This invention relates to engine starting apparatus particularly to electrically operated mechanism for starting internal combustion engines.

5 An object of the invention is the provision of simple and effective mechanism for setting in rotation an engine shaft with automatic means for connecting the engine and a starting motor when the circuit of the
10 starting motor is closed and for disconnecting the engine and starting motor when the former has started.

Another object is the provision of improved engine starting apparatus where the
15 driving connection, between a suitable rotating member of the engine, such as a fly wheel, and the starting motor, is effected by electrical means.

Another object is the provision of a compact, durable and reliable apparatus of this
20 character, which is inexpensive to manufacture and is easily applied to new or old engines.

Further objects of this invention relate
25 to economies of manufacture and details of construction as will hereinafter appear from the detailed description to follow. I accomplish the objects of my invention in certain instances by the devices and means described in the following specification, but
30 it is evident that the same may be varied widely without departing from the scope of the invention, as pointed out in the appended claims. Structures constituting certain embodiments of my invention, any one of which may be the preferred, are illustrated in the accompanying drawings forming a part thereof, in which:

35 Figure I is an end view of the starting motor, showing a portion of an engine fly wheel and the transmission mechanism between motor and fly wheel out of engagement with the fly wheel.

40 Fig. II is a side elevation of the starting motor, as shown in Fig. I looking away from the engine fly wheel.

45 Fig. III is a view similar to Fig. I with the transmission mechanism in engagement with the fly wheel.

50 Fig. IV is a sectional view taken on a line IV—IV of Fig. III.

Fig. V is an end view of the starting motor and transmission mechanism, with the end housing removed.

55 Fig. VI is a diagrammatic view of the

apparatus, showing the electrical connections thereto.

Fig. VII is an end elevation similar to Fig. I showing a modification.

Fig. VIII is a side view of the modification illustrated by Fig. VII, looking from
60 right to left.

Fig. IX is a sectional view taken on the line IX—IX of Fig. VII.

Fig. X is a fragmentary sectional view
65 taken on the line X—X of Fig. VII.

Fig. XI is a fragmentary view looking in the direction of the arrow "A" of Fig. VII with the transmission mechanism in engagement and Fig. XII is a fragmentary
70 view looking in the direction of arrow "B" of Fig. VII.

In the drawings, similar reference numerals refer to similar parts throughout the several views, and the sectional views are
75 taken looking in the direction of the arrows at the ends of the section lines.

Referring to the drawings, the end portion of a starting motor 5 has secured to it by bolts 6 a housing 7 of a general conical shape
80 which supports and protects the transmission mechanism between the motor shaft 8 and the fly wheel 9 of the engine. The outer end portion of the casing 7 is formed into a bearing 9' carrying a sleeve 10 in which
85 is journaled a stub shaft 11 having an arm 12. This arm 12 at its opposite end carries a bearing sleeve 14 in which is journaled a second stub shaft 15 upon which is secured a pinion 16 which is adapted to mesh with
90 suitable teeth 17 on the periphery of the fly wheel 9. The stub shaft 11 is in axial alignment with the motor shaft 8 which latter shaft has secured to it by a key or other suitable means a driving pinion 18, the
95 pinions 16 and 18 being at all times in mesh with each other.

In order to move the pinion 16 into engagement with the fly wheel 9 to transmit motion thereto from the motor shaft, an
100 electromagnetic operating mechanism is employed which will now be described. A member 20 of magnetic material having an opening 21 through which the motor shaft extends and having two pairs of upstanding
105 segmental projections 22 is secured as by screws 23 to the end of the motor 5. Between the projections 22 lie portions of an energizing coil 25 comprising, in this particular instance, three turns of coarse wire
110

26. This member 20 with its winding forms a field magnet, the polar faces of which lie in a plane at right angles to the motor axis. The armature which cooperates with this field magnet is the member 28 having a sleeve 29 rotatably mounted on the shaft 8, the armature carrying at one end a bearing sleeve 30 in which is journaled the opposite end of the stub shaft 15. The housing is provided on its exterior with a small spring housing 35 in which is seated a buffer spring 36 securely held in place by a set screw 37. When the armature 28 is in its released position the arm 12 rests against this spring 36 and it is provided with a boss 38 having a face to engage the spring. The weight of the pinion 16, its shaft 15 and the arm 12 will normally return the gear 16 to release position and out of mesh with the fly wheel gear. However, if it is found desirable, a suitable spring may be employed to make this operation more positive. The casing 7 is also provided with a projection 39 forming a stop for the forward movement of the armature 28 to thereby limit the engagement of the pinion 16 and the fly wheel gear.

Referring to the circuit diagram or Fig. VI, the armature 40 of the motor 5 is shown in a series circuit with a field winding 41, a battery 42 and a starting switch 43. Also connected in series in this circuit is the winding 25 of the field member 20 which, it will be seen, is energized whenever the starting switch 43 is closed to start the motor.

The operation of the device is as follows: With the armature member carrying the pinion 16 in the normal released position such as indicated in Fig. I, the closing of the starting switch 43 energizes the motor field and armature members and at the same time energizes field winding 25. The armature 28 is immediately caused to rotate in a clockwise direction carrying the pinion 16 into engagement with the fly wheel and is held firmly against the projection 39 on the casing by the combined forces of the magnetic attraction and a component of the driving effort of the motor. As soon as the engine begins to turn under its own power, the starting switch will be opened and the armature 28 carrying pinion 16 will return to normal release position while the motor armature 40 comes to rest.

In the modified form illustrated by Figs. VII to XII inclusive the pinion 16' is journaled upon a stub shaft 15' carried by an armature member 28' of somewhat different shape from that of the preceding form. In this case, the armature 28' has polar faces 46 which are parallel with the motor axis and which lie opposite polar faces 47 on the polar projections 48 of a field member 20' secured to the motor 5 by screws 23'. The field member 20' is shown carrying an exciting winding 25' similar to that of the

preceding form and also has a bearing sleeve 21' against which abuts armature 28' having a bearing sleeve 29'. The cooperating polar faces 46 and 47 of the armature and field members limit the engagement of pinion 16' and fly wheel gear and to avoid sticking, one or both of these faces may be provided with a non-magnetic spacer. A buffer spring 36' partially housed by a projecting arm 35' on the field member 20' serves to cushion the return movement of the armature member. Inasmuch as the circuit arrangement as well as the operation of this modification is similar to that of the preceding form of the invention a detailed description thereof is believed to be unnecessary.

While I have described my invention in more or less detail, and as being embodied in certain precise forms I do not desire or intend to be limited thereto, as on the contrary my invention contemplates broadly all proper changes, as well as the omission of immaterial elements and the substitution of equivalents therefor, as circumstances may suggest or necessity render expedient.

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

1. In an engine starting mechanism, the combination of a frame, a driving member rotatably mounted in said frame, an electro-magnetic device comprising co-operating field and armature elements, an arm rotatably mounted in said frame, a stub shaft carried by one of said elements and said arm and transmission means on said stub shaft in engagement with said driving member and adapted to be moved into operative connection with a rotatable element of said engine when said electro-magnetic device is energized.

2. In an engine starting mechanism, the combination of an engine member, a starting motor therefor having a shaft with a pinion thereon, an electromagnet comprising a field structure having polar projections arranged on opposite sides of said shaft and an engaging winding encircling said shaft and associated with said projections, an armature for said magnet having polar faces at opposite sides of said shaft to co-operate with said polar projections, a pinion held in mesh with said first pinion and adapted to be moved by said armature to a meshing position with said engine member.

3. In an engine starting mechanism, the combination of an engine member, a starting motor, a casing secured at one end to said motor and having an arm journaled in the other end thereof, a pinion secured to the shaft of said motor, an electromagnet including an armature pivoted concentrically of said shaft, a stub shaft connecting said arm and said armature, a pinion mounted on said stub shaft and in engagement with

said first pinion, said armature being adapted to swing said second pinion into engagement with said engine member.

4. In an engine starting mechanism, the
5 combination of an engine member, a starting motor having a shaft and pinion, a casing associated with the end of said motor, an electromagnet having an armature pivoted concentrically with said shaft, an arm
10 pivotally mounted in said casing in alignment with said shaft and a pinion supported jointly by said armature and said arm, said pinion being at all times in mesh with said first pinion and adapted to be swung by
15 said armature into mesh with said engine member.

5. A starting mechanism for an internal combustion engine comprising an electric motor, a casing secured to said motor, an
20 arm having a stub shaft journaled in said

casing co-axially with the shaft of said motor, a pinion secured to said motor shaft, a shaft journaled in said arm, a second pinion on said shaft in mesh with said first pinion, a field member having a winding
25 secured to said motor, a cooperating armature therefor providing a second bearing for said shaft and mounted to rotate co-axially with said motor shaft upon energization of said winding to move said
30 second pinion into mesh with teeth on the fly wheel of said engine, said casing providing a stop to limit the forward movement of said arm and having a buffer spring mounted therein to arrest the rearward or
35 release movement of said arm.

In testimony whereof, I affix my signature.

CLARENCE F. GILCHRIST.