W. G. BLACK & E. R. ST. JOHN.

ENGINE STARTER.

APPLICATION FILED DEC. 29, 1911.

1,066,985.

Patented July 8, 1913.

3 SHEETS—SHEET 1.

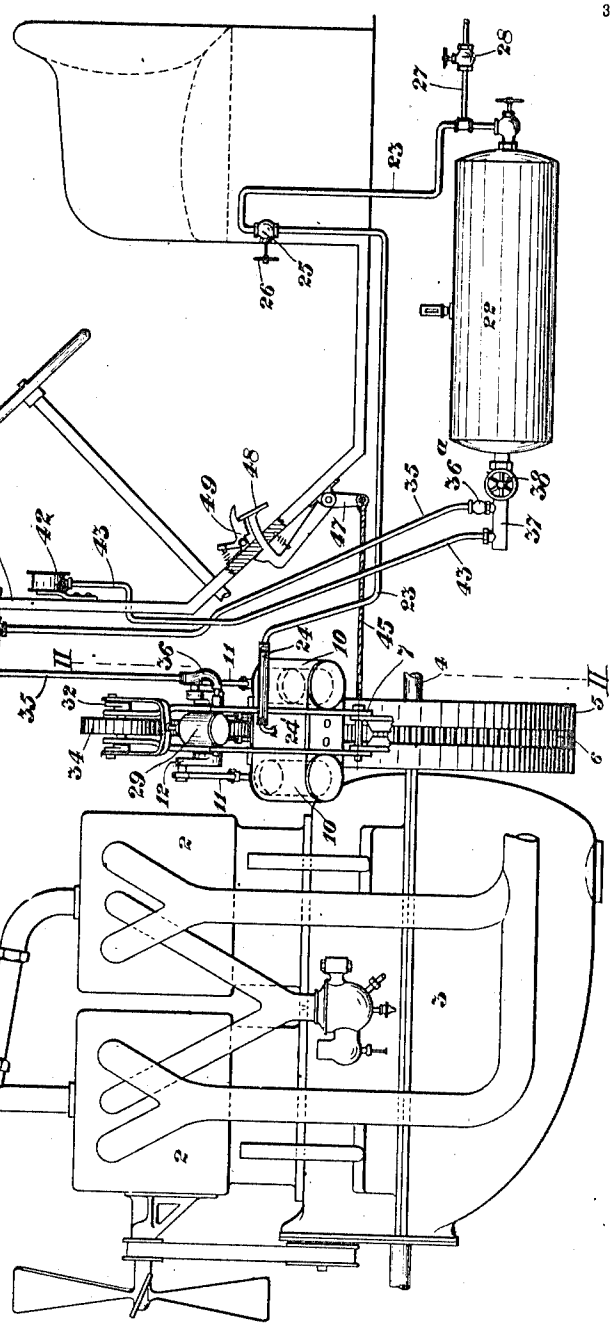


Fig. 1.

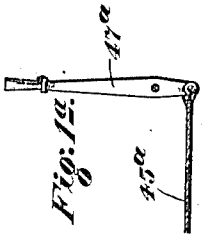


Fig. 12.

Witnesses:
Wm. Heckman
Fredk. Staub

Inventors:
William G. Black
Erastus R. St. John
by O. M. Clarke
their Attorney.

W. G. BLACK & E. R. ST. JOHN.

ENGINE STARTER.

APPLICATION FILED DEC. 29, 1911.

1,066,985.

Patented July 8, 1913.

3 SHEETS—SHEET 2.

Fig. 3.

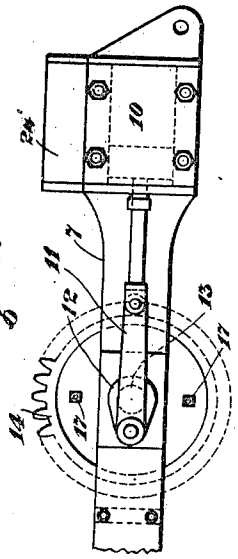


Fig. 4.

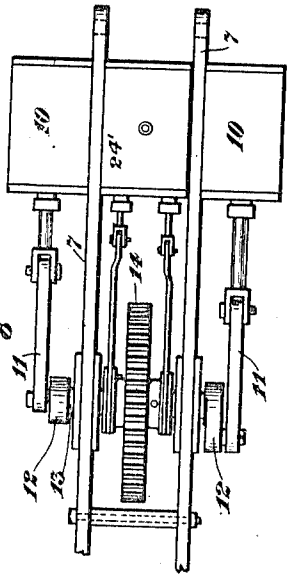


Fig. 6.

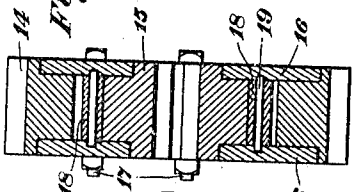


Fig. 5.

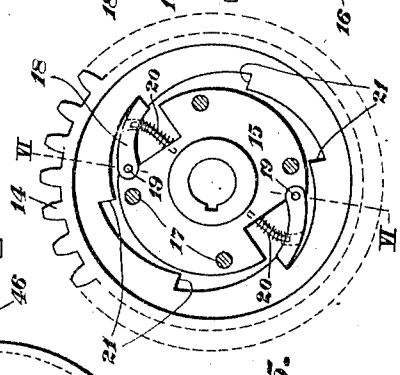
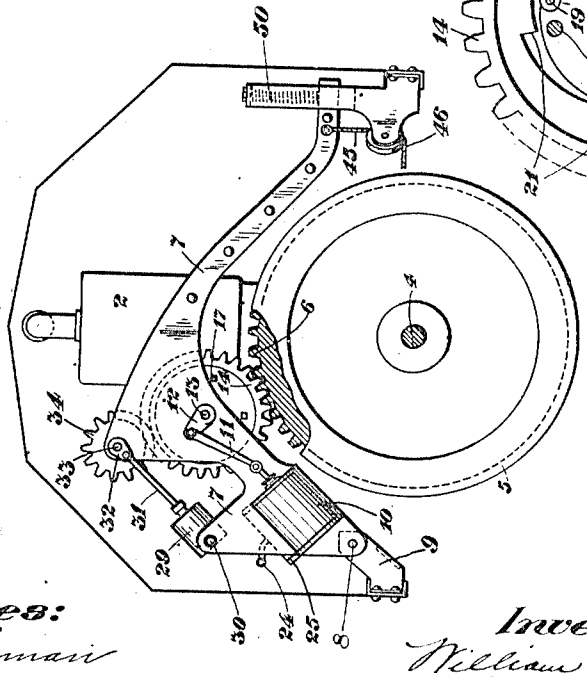


Fig. 2.



Witnesses:

Walter Lechemair

Fred'k. Staub.

Inventors:

William G. Black

Erastus R. St. John

by C. M. Clarke

their attorney

W. G. BLACK & E. R. ST. JOHN.

ENGINE STARTER.

APPLICATION FILED DEC. 29, 1911.

1,066,985.

Patented July 8, 1913.

3 SHEETS—SHEET 3.

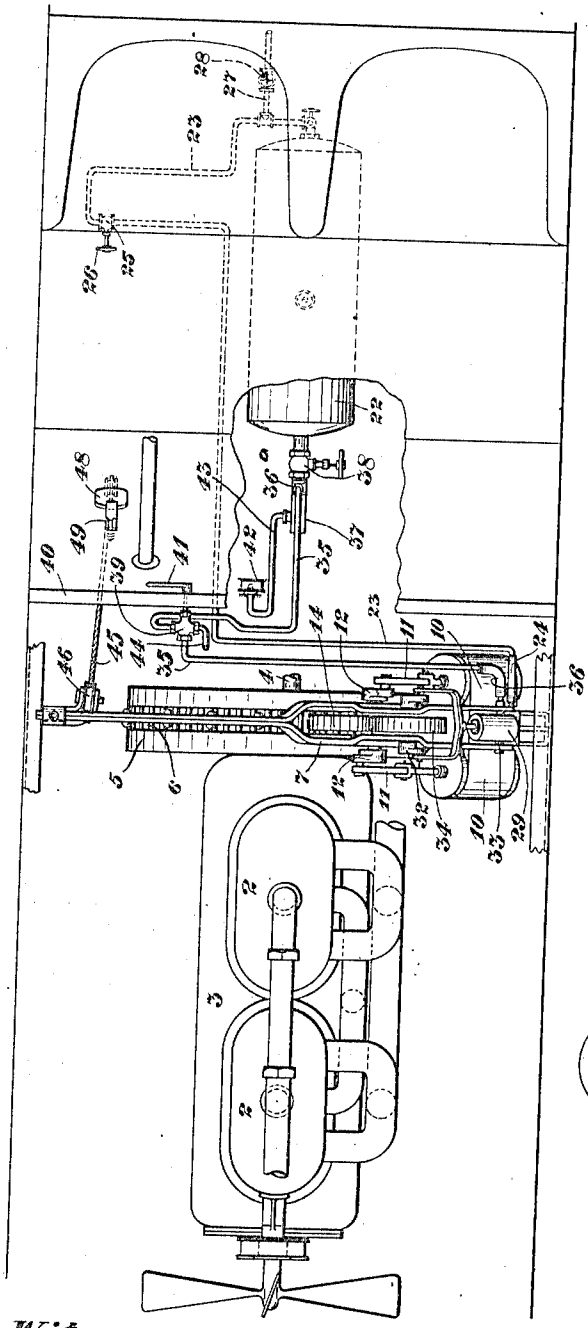


Fig. 7.

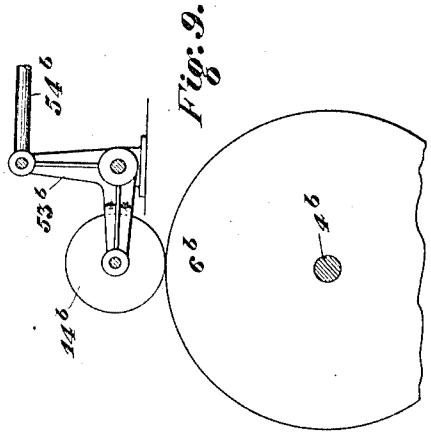


Fig. 9.

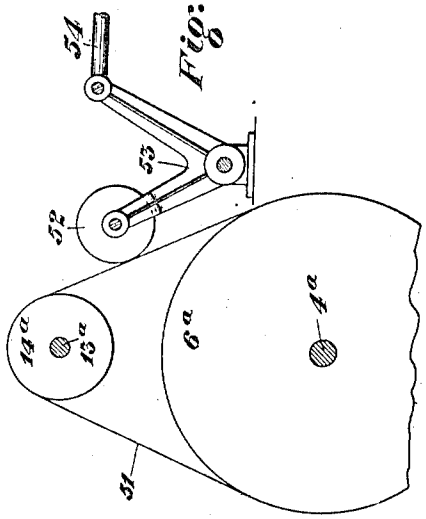


Fig. 8.

Witnesses:
Wm. Lickman
Fred. J. Staub.

Inventors:
William G. Black
Erastus R. St. John
by C. M. Keys
their attorney

UNITED STATES PATENT OFFICE.

WILLIAM G. BLACK AND ERASTUS R. ST. JOHN, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS OF ONE-FOURTH TO SAID BLACK, ONE-FOURTH TO SAID ST. JOHN, ONE-FOURTH TO W. A. RICHWINE, AND ONE-FOURTH TO A. H. SARVER, ALL OF PITTSBURGH, PENNSYLVANIA.

ENGINE-STARTER.

1,066,985. Specification of Letters Patent. Patented July 8, 1913.

Application filed December 29, 1911. Serial No. 668,544.

To all whom it may concern:

Be it known that we, WILLIAM G. BLACK and ERASTUS R. ST. JOHN, citizens of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Engine-Starters, of which the following is a specification.

Our invention consists of an improvement in starting mechanism for explosive engines and it has in view to provide means for imparting rotation to the main shaft of the engine, in lieu of the usual cranking mechanism commonly employed, in automobile and other similar motors.

The mechanism comprises a fluid actuated motor, preferably operable by compressed air, adapted to be geared with the main shaft of the explosive engine through the fly wheel or any suitable gearing connected therewith, or with the main shaft. Said motor is suitably mounted for geared engagement with the main shaft and disengagement therefrom, provided with automatic release mechanism, in the construction shown, and includes a pumping device operable from the main engine for storing fluid pressure, as air, in a storage tank.

One preferred arrangement of the apparatus, together with various features of accompanying detail construction and equipment, is illustrated in the drawings, in which—

Figure 1 is a view in side elevation of the power equipment of an automobile provided with our improvement. Fig. 1ª is a detail view showing a hand operated lever for actuating the adjustable frame. Fig. 2 is a cross sectional view, indicated by the line II. II. of Fig. 1. Figs. 3 and 4 are enlarged detail views in side elevation and plan respectively, of the actuating motor for the main engine shaft. Fig. 5 is an enlarged face view of the interior of the mechanism embodying the driving pinion of said motor, illustrating the automatic release mechanism. Fig. 6 is a vertical sectional view on the line VI. VI. of Fig. 5. Fig. 7 is a plan view of Fig. 1. Figs. 8 and 9 are diagrammatic detail views illustrating belt driven and friction driven mechanism for transmitting motion from the starting motor to the main shaft.

In the drawings, 2 represents the usual cylinder of an explosive engine mounted upon the customary crank case 3 and provided with the usual supply, exhaust and water circulation connections, etc., and the main shaft 4 having the usual fly wheel 5, and any suitable clutch mechanism for transmission of the power to the driving axle of the vehicle. The fly wheel 5 or shaft 4 is provided with a gear wheel 6, or a series of teeth corresponding thereto, for the purpose of transmitting motion therethrough to the main shaft. The adjustable frame 7, of any preferred construction or design, is suitably mounted, as by a pivotal bearing 8, on a supporting bracket 9 connected with the chassis frame work, whereby the frame 7 may be adjusted toward and from the gear 6 of shaft 4. Mounted on frame 7 is the supplemental or secondary starting motor, which may conveniently consist of a pair of fluid actuated cylinders 10. The pistons of said cylinders are connected through connecting rods 11 and cranks 12 with a shaft 13, mounted in bearings in the frame 7. Secured to shaft 13 is a pinion 14 which, by the motors 10, is actuated, upon admission of fluid pressure thereto, to rotate the shaft 4, when, by the usual ignition equipment, the main engine is set into operation. Pinion 14 is so designed and combined with automatically releasable clutch mechanism that when shaft 4 is set into action at a faster speed, it will rotate pinion 14 loosely around driving shaft 13. For such purpose pinion 14 is rotatably mounted around a central hub 15 which is keyed to shaft 13 and provided with side plates 16, 16, secured to said hub by bolts 17, and between said side plates the pinion 14 is rotatably mounted. The hub 15 is provided with one or more pawls 18 pivotally mounted at 19 and normally thrown outwardly by suitable springs 20 into operative engagement with a series of ratchet abutments 21 arranged annularly of the interior of pinion 14. By such construction, when the hub 15 is actuated by shaft 13 of the supplemental motor, the pinion 14 will drive pinion 6, imparting the desired rotation to fly-wheel 5 and shaft 4.

Upon ignition occurring in the main cylinders 2, main shaft 4 will be driven in the usual way, whereby pinion 14, if actuated at a faster speed than that due to the motor

10, will merely slip around over the pawls 18. Frame 7, being adjustable by the means hereinafter described, may then be adjusted to throw the teeth of pinion 14 out of mesh with the teeth of gear 6.

Fluid pressure for driving the supplemental motors 10 is stored in a suitable storage tank 22 mounted in any suitable location, as underneath the chassis, and from said storage tank by connection 23 and flexible hose connection 24, fluid pressure is communicated to the valve chest 24' of motors 10.

Inserted in the line of pipe 23 is a controlling valve 25 having an operating handle 26, suitably located at any convenient point, as below the driver's seat, for opening and closing communication to the starting motor.

A branch connection 27 with valve 28 may be led off from the supply pipe of tank 22, as indicated, for the purpose of furnishing fluid pressure for any other use, as for inflation of tires, etc.

Storage tank 22 is charged from time to time by a pump 29, mounted on frame 7 in any suitable manner, as by pivotal bearings 30, the plunger of which pump is actuated through a plunger rod 31 and a crank or cranks 32 mounted on driving shaft 33 having a pinion 34 in intermeshing engagement with pinion 24. Connection from pump 29 is by pipe 35, connected with the pump by a piece of hose 36, if desired, at one end, and at the other end through suitable check valve 36ª, with pipe 37 leading through valve 38 to tank 22. It will be understood, however, that tank 22 may, if desired, be charged in any other suitable manner, as by an independent stationary pump, or a pump mounted on the vehicle and operated by means independent of the starting motor.

Interposed in the line of pipe 35 is a two-way valve or cock 39 mounted on the dashboard 40 of the vehicle and provided, on the inner side of the dash, with an operating handle or lever 41. A pressure gage 42, also preferably mounted on the inner face of the dash, is connected by pipe 43 with the tank 22, whereby to indicate the pressure therein at all times.

When it is desired to charge the tank, two-way valve 39 is thrown to registering position and pump 29 is driven from the main engine through pinion 14 and gear 34, pinion 14 in such case operating merely as an idler and slipping around its pawls 18 without affecting the motor 10 and its parts. In such case communication to such motor is ordinarily cut off by valve 25. Tank 22 being charged to the desired limit, as indicated by gage 42, two-way valve 39 may then be closed, opening communication to the atmosphere through exhaust port or connection 44. Likewise, in the ordinary operation of the motor in starting, compression of air through pump 29 will merely have outlet to the atmosphere through valve 39, so that it is in no way subject to back pressure during the starting operation.

The adjustable frame 7 is actuated by any suitable mechanism, as a flexible connection 45 passing over a suitable guiding sheave wheel 46 to an operating lever 47. Said lever may be a foot lever, as indicated in Fig. 1 provided with a pedal terminal 46 and suitable locking or arresting latch 49, arranged to hold the lever in either position, or may, if desired, be a hand lever 47ª connected with the flexible connection 45ª, as in Fig. 1ª. By said mechanism, or any equivalent means, frame 7 may be drawn down to bring the teeth of pinion 14 into intermeshing engagement with the teeth of gear wheel 6, sufficiently long to turn shaft 4 to start the engine. Upon releasing the lever 47 or 47ª, the frame 7 and pinion 14 may be raised out of such operative position by any suitable means, as a tension spring 50.

While the gearing arrangement embodying gear 6 and pinion 14 are capable of giving good results, it will be obvious that motion may be imparted to the main shaft of the engine by any other suitable mechanism, as a belt 51 passing around and driving the pulley 6ª on shaft 4ª of the main engine, as in Fig. 8. Belt 51 is normally slack and is thrown into driving engagement with said pulleys by a tightening pulley 52 mounted on lever 53 and operable by connecting rod 54 from a suitable lever device within easy reach of the operator, in the same manner as lever 47 or 47ª. It will be understood in such case that the frame carrying the auxiliary motor may be stationary and that the pump 29 may also be stationary and geared with shaft 13 by intermeshing gears or otherwise as preferred.

In Fig. 9, we show a further modified arrangement for imparting movement from the starting motor to the main engine employing a friction wheel 14ᵇ adapted to be thrown into and out of engagement with the face of a friction-actuated pulley or wheel 6ᵇ mounted on main shaft 4ᵇ and operable by a suitable lever 53ᵇ and connecting rod 54ᵇ, in the same manner as above described.

The construction and operation of the invention will be readily understood from the foregoing description. The starting mechanism is comparatively simple in construction and very compact in design so as to be readily installed without disturbance or change in location of the other portions of the regular equipment.

The advantages of the invention will be readily appreciated by all those familiar with the use of automobiles or other uses of explosive engines. The facility of maintaining a supply of compressed air at all times greatly contributes to the efficiency

and availability of the invention, and in its entirety, the mechanism possesses advantageous features which add to the convenience and ease of operating motors of this type.

Having described our invention what we claim is:

1. The combination with the main shaft of an explosive engine, of a starting motor, gearing adapted to communicate motion from said motor to the main shaft, a storage tank communicating with the said auxiliary motor, and a pump adapted to be geared with said main shaft through the gearing of the starting motor for charging said tank, substantially as set forth.

2. The combination with the main shaft of an explosive engine, of a starting motor, a pump, gearing arranged to transmit motion from the starting motor to the engine shaft and from said shaft through the motor gearing to the pump, means arranged to adapt said gearing to operative relation, and means providing for automatic disengagement between the starting motor and engine shaft upon independent action thereof, substantially as set forth.

3. The combination with the main shaft of an explosive engine, of a starting motor, gearing arranged to transmit motion from the starting motor to the engine shaft, a storage tank, a pump therefor, and actuating mechanism for the pump in driving engagement with the gearing of the starting motor, substantially as set forth.

4. The combination with the main shaft of an explosive engine, of a starting motor, a pump, gearing arranged to transmit motion from the starting motor to the engine shaft and from said shaft through the motor gearing to the pump, and an adjustable frame for the starting motor arranged to effect engagement and disengagement of said gearing, substantially as set forth.

5. The combination with the main shaft of an explosive engine having a gear wheel, of an adjustable frame, a pump and gear on said frame, and a starting motor thereon having gearing adapted to intermesh with said gear wheel and with the pump gear, substantially as set forth.

6. The combination with the main shaft of an explosive engine having a gear member, of an adjustable frame, a pump and its gear and a starting motor on said frame, and a driving pinion and escapement mechanism operable by said starting motor and adapted to intermesh with the engine gear and with the pump gear, substantially as set forth.

7. The combination with the main shaft of an explosive engine having a gear wheel, of an adjustable frame, a motor thereon, a shaft geared with said motor provided with a surrounding loosely mounted pinion, ratchet and pawl mechanism arranged to transmit motion from the shaft to said pinion and to permit of free movement of the pinion at a faster speed than said shaft, a pump geared to said pinion, and means for adjusting said frame, substantially as set forth.

8. The combination with the main shaft of an explosive engine having a gear wheel, of an adjustable frame, a motor thereon, a shaft geared with said motor provided with a surrounding loosely mounted pinion, ratchet and pawl mechanism arranged to transmit motion from the shaft to said pinion and to permit of free movement of the pinion at a faster speed than said shaft, a storage tank connected with said motor, and a pump geared with said pinion and arranged to charge said tank, substantially as set forth.

9. The combination with the main shaft of an explosive engine having a gear wheel, of an adjustable frame, a motor thereon, a shaft geared with said motor provided with a surrounding loosely mounted pinion, ratchet and pawl mechanism arranged to transmit motion from the shaft to said pinion and to permit of free movement of the pinion at a faster speed than said shaft, a storage tank connected with said motor, a valve adapted to establish communication from the tank to the motor, and a pump geared with said pinion and arranged to charge said tank, substantially as set forth.

10. The combination with the main shaft of an explosive engine having a gear wheel, of an adjustable frame, a motor thereon, a shaft geared with said motor provided with a surrounding loosely mounted pinion, ratchet and pawl mechanism arranged to transmit motion from the shaft to said pinion and to permit of free movement of the pinion at a faster speed than said shaft, a storage tank connected with said motor, a pump geared with said pinion and connected with said tank, and a valve interposed between the pump and tank adapted to open communication from the pump to the tank or to the atmosphere respectively, substantially as set forth.

11. In a motor propelled vehicle, the combination with the motor shaft and a gear thereon, of a starting motor having a pinion, an adjustable frame therefor, a storage tank connected with the starting motor, a pump mounted on said frame, geared with the pinion of the starting motor and connected with the storage tank, a lever, and means connecting said lever with the adjustable frame, substantially as set forth.

12. In an engine starter, the combination of a main engine shaft having a gear wheel, an adjustable frame, a starting motor and pump thereon, gearing adapted to place the engine gear, motor, and pump in driving engagement, a storage tank, a connection be-

tween the pump and said storage tank embodying a two-way valve and a check valve, and a connection between the storage tank and the motor embodying a controlling valve, substantially as set forth.

13. In an engine starter, the combination of a main engine shaft having a gear wheel, an adjustable frame, operating mechanism for said frame embodying a foot lever, a starting motor and pump thereon, gearing adapted to place the engine gear, motor, and pump in driving engagement, a storage tank, a connection between the pump and said storage tank embodying a two-way valve and a check valve, and a connection between the storage tank and the motor embodying a controlling valve, substantially as set forth.

In testimony whereof we hereunto affix our signatures in the presence of two witnesses.

WILLIAM G. BLACK.
ERASTUS R. ST. JOHN.

Witnesses:
C. M. CLARKE,
FREDK. STAUB.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."