J. A. HEANY.

PNEUMATIC ENGINE STARTER.

APPLICATION FILED JULY 17, 1911.

1,029,994.

Patented June 18, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

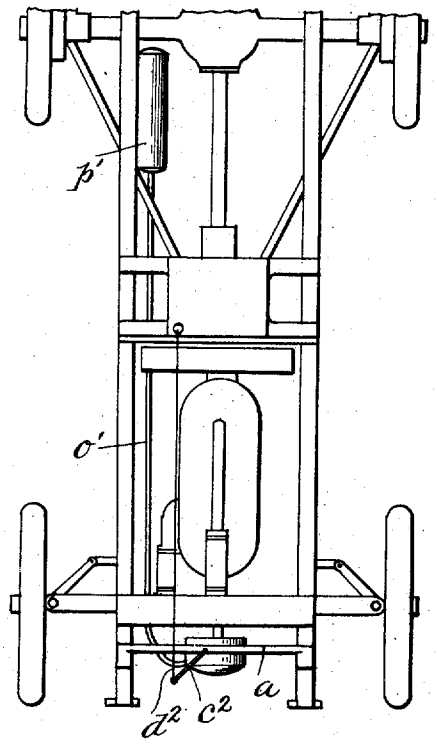
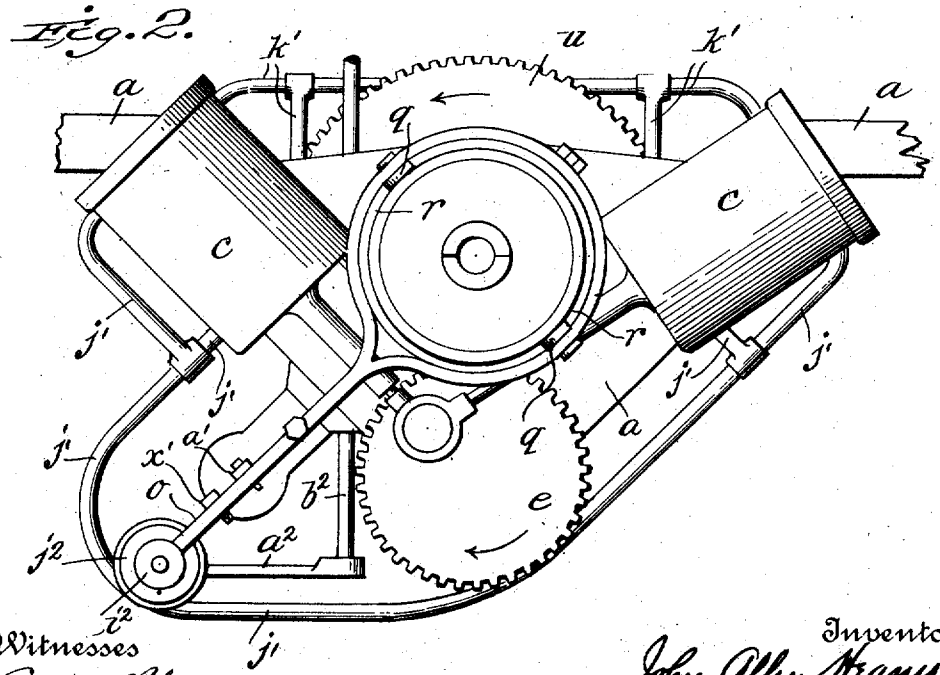


Fig. 2.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

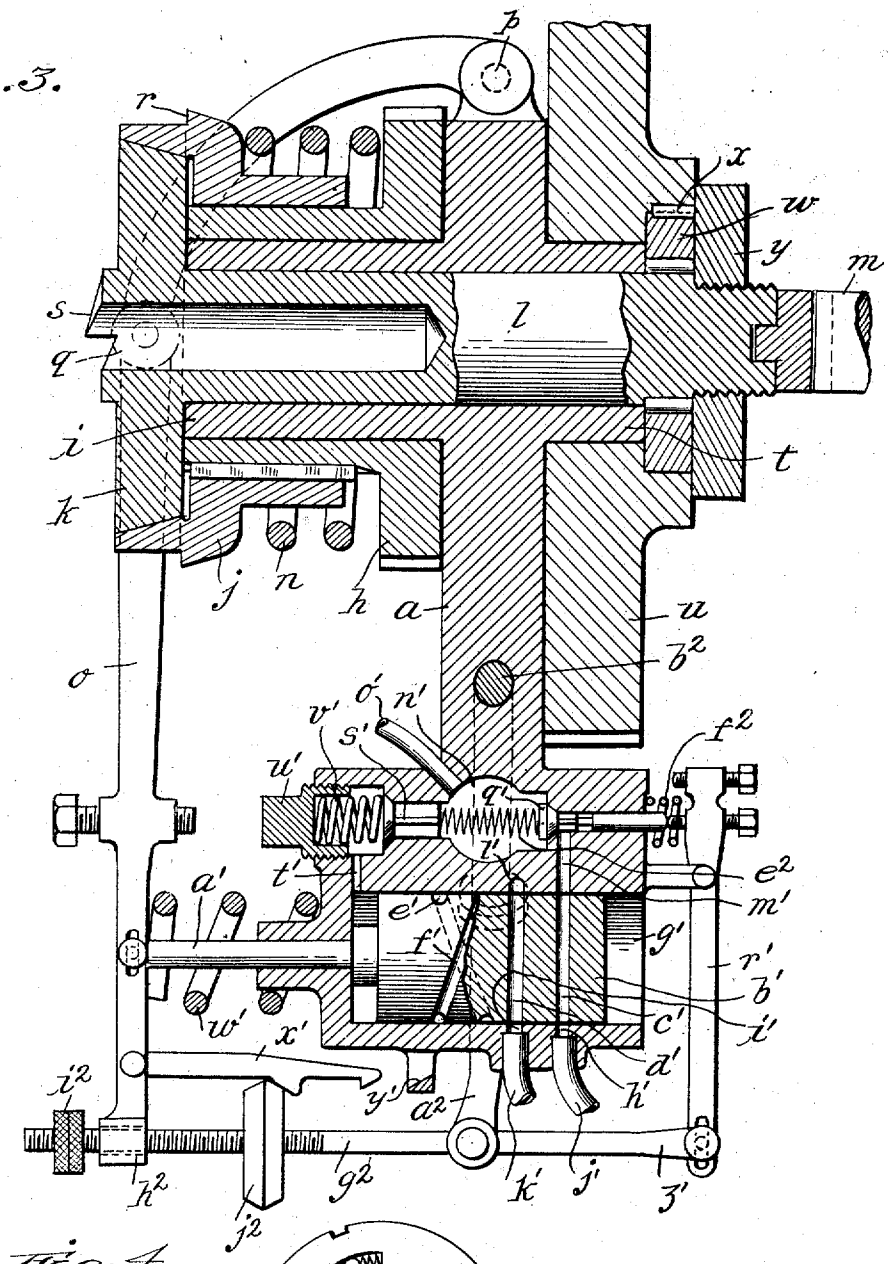
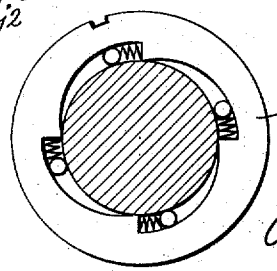


Fig. 4.



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3 SHEETS—SHEET 3.

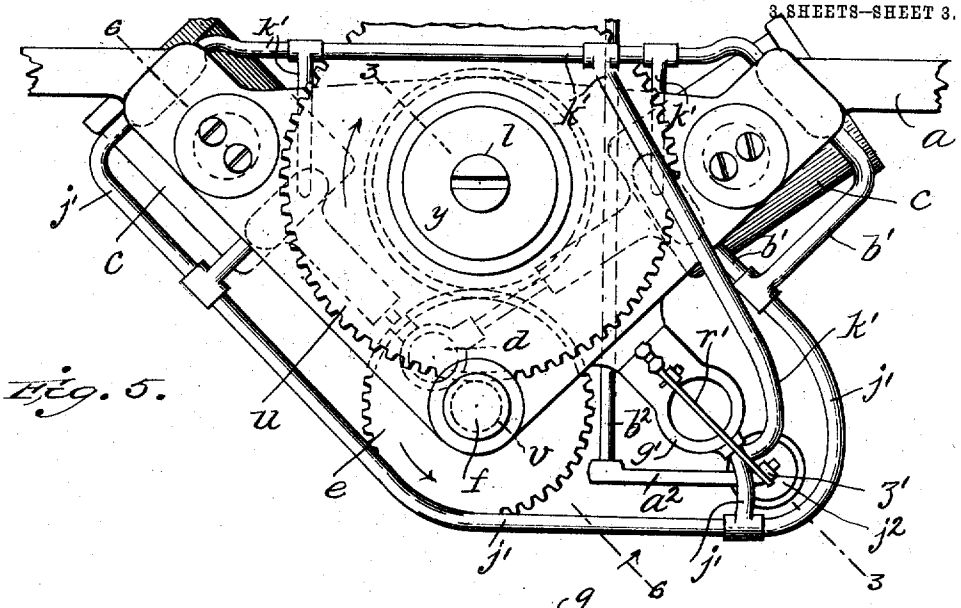

Fig. 5.

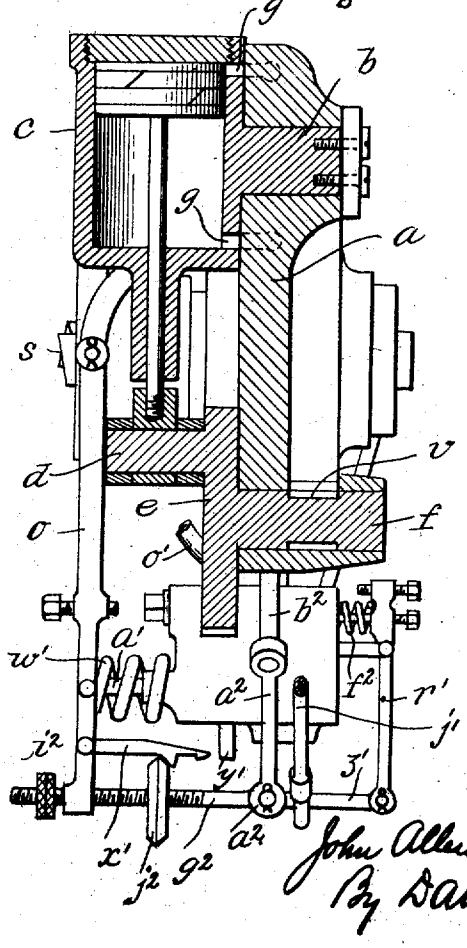

Fig. 6.

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UNITED STATES PATENT OFFICE.

JOHN ALLEN HEANY, OF WASHINGTON, DISTRICT OF COLUMBIA.

PNEUMATIC ENGINE-STARTER.

1,029,994. Specification of Letters Patent. Patented June 18, 1912.

Application filed July 17, 1911. Serial No. 638,875.

To all whom it may concern:

Be it known that I, JOHN ALLEN HEANY, a citizen of the United States, and a resident of Washington, in the District of Columbia, have invented certain new and useful Improvements in Pneumatic Engine-Starters, of which the following is a full and clear specification, reference being had to the accompanying drawings, in which—

Figure 1 is a diagram view of a motor vehicle showing the preferred location of my device thereon; Fig. 2 is a view of my apparatus from the front side thereof; Fig. 3 is a diagonal sectional view taken on the line 3—3 of Fig. 5; Fig. 4 is a detail side elevation of the clutch for locking the large spur gear to the driving shaft when the appliance is used as a motor for driving the crank shaft of the engine; Fig. 5 is a back view of the appliance, that is, a view taken from the side opposite to that seen in Fig. 2; and Fig. 6 is a diagonal sectional view on the line 6—6 of Fig. 5.

This invention has relation to that class of pneumatic engine starters especially adapted for starting internal combustion engines by applying stored up power to the crank shaft of the engine to rotate the crank shaft independently of the power of the engine itself until the engine begins to run on its own power; and the object of this invention is to provide a simple pneumatic appliance which may be used as an air motor for starting the crank shaft of the engine and which, after the engine is started and is running on its own power, will be converted into an air pump or compressor which shall restore or replenish the pressure which was consumed in starting the engine, suitable automatic means being provided for stopping the action of the device as a pump or compressor and restoring the parts to position for operation as an air motor as soon as a predetermined pressure in the storage tank is obtained, as more fully hereinafter set forth.

In the preferred embodiment of my apparatus I mount the same on a frame *a* which is adapted to be fastened to the frame of the motor vehicle just in front of the radiator, as shown in Fig. 1. Mounted to oscillate on trunnions *b* journaled in this frame is a pair of cylinders *c* whose piston rods are both connected to a wrist pin *d* carried by a cog wheel *e* whose shaft *f* is journaled in the frame *a* at a point below and exactly mid-way between the trunnions of the two cylinders. These cylinders cooperate with suitable ports in the frame, the ports being alternately brought into register with ports *g* at opposite ends of the cylinder by the oscillation of the cylinders, this construction constituting a well known form of motor in which the oscillation of the cylinders automatically admit and cut off the motive fluid.

The spur gear *e* meshes with a gear *h* of suitable size and journaled on a tubular bearing *i* carried by the frame *a*, and slidably mounted on the hub of the gear *h* is one member *j* of the clutch, the other member *k* of which is rigidly carried by a shaft *l* suitably coupled to the crank shaft *m* of the engine that is to be started. The slidable member *j* is feathered on the hub of the wheel *h* so as to slide thereon but not rotate independently thereof. The coil spring *n* normally tends to keep the clutch members *j* and *k* in engagement, and a yoke-like lever *o*, pivoted at *p* to the frame *a*, is employed to push back the clutch member *j*, this lever *o* being provided with a pair of rollers *q* which bear upon an annular flange *r* formed on said clutch member *j*.

The shaft *l* is journaled in the frame *a* and one end of it is provided with ratchet teeth or lugs *s* whereby it may be rotated manually in the usual way by a starting crank, should the pneumatic appliance be out of order or the pressure tank be exhausted, and the other end of the shaft is, as stated coupled up to the engine shaft. The tubular bearing *i*, on which the gear *h* is journaled projects forwardly from the frame, and on a similar projection *t* on the rear side of the frame is journaled a larger gear wheel *u* which meshes with a small gear *v* cut in the shaft *f*. The gear *u* carries a suitable spring-ball-clutch *w* which causes the gear *u* to automatically clutch the shaft *l* when rotating in one direction and to run free thereof when running in the opposite direction. The clutch *w* is fastened within the hub of the wheel *u* by a key *x*, and the wheel and its clutch are held in position by means of a collar *y* screwed on the end of the shaft *l*.

The depending end of the clutch lever *o* has pivotally connected to it a valve stem *a'* extending backwardly, and on the rear end of this valve stem is a cylindrical valve *b'*, this valve being provided with a pair

of straight diametrical ports c', d', and also with a pair of diagonal semi-circumferential ports e' and f'. This valve b' works in a cylinder g' formed in or attached to the frame a, in the lower side of this cylinder are formed two ports h', i' connected respectively to pipes j' and k', which lead by various branches, as shown in Figs. 2 and 5, to the opposite ports of the cylinders c, in a well known manner.

In the top of the cylinder is formed a port l' which leads to the atmosphere, and also another port m' which leads to a valve chamber n', into which chamber is connected a pipe o' whose other end is connected to a storage tank p' mounted in a suitable place on the vehicle. An inwardly-opening check valve q' controls the port m', and this valve is adapted to be opened by means of a lever r' pivoted on the frame. An outwardly-opening check valve s' controls a passage leading from the valve chamber n' to a port t' entering the cylinder b' back of the valve therein, said valve s' being held to its seat with a pressure which may be varied at will by means of a screw plug u' and a coil spring v'.

A coil spring w' interposed between the cylinder g' and the clutch lever o tends to restore the valve b' to pumping position, as shown in Fig. 3. A latch finger x', pivotally connected to the lever o is adapted when said lever o is pulled inwardly to engage a catch y' and thus lock the lever o in that position. The lever r' may be manually operated in any suitable way; I have shown it connected by a link z' to an arm a^2 carried by a vertical rock shaft b^2 which is operable through the medium of an arm c^2 at its upper end and a wire or rod d^2 connected to said arm c^2 and extending to a point within convenient reach of the chauffeur. By means of this mechanism or any suitable equivalent arrangement the check valve q' may be opened at will and held open. A suitable spring e^2 tends to normally close said check valve q' and a coil spring f^2 tends to swing lever r' out of the way of said valve q'. Another rod or link g^2 is pivotally connected to the arm a^2 and has its free end extending loosely through an eye h^2 in the lower end of the lever o. On this rod g^2 beyond the eye h^2 is threaded a suitable nut or nuts i^2, and between the eye h^2 and the arm a^2 is mounted a cam j^2, which is circular in shape and is threaded on said rod g^2 for the purpose of permitting it to be adjusted along the rod.

The parts are shown in pumping position in Fig. 3. In this position the clutch members j and k are in engagement and the valve b' is adjusted to its outer position, with its ports c', i' in engagement respectively with ports m' and l'. The rotation of the stub shaft l by the engine shaft m will drive the gear h through the medium of the clutch j, k, and the gear h will drive its companion gear e and thus reciprocate and oscillate the pistons connected thereto. This operation of the pistons will draw air into the cylinders through the ports l', i' and pipe system k' and will force air out of the cylinders through pipe system j', ports c', m', past valve q' and on to the pressure tank p' through the pipe o'. This pumping action will continue until the predetermined pressure in the tank is obtained, whereupon the relief valve s' will open and permit air to pass in behind the valve b' and move said valve inwardly, carrying with it the lever o against the action of springs n and w', thus releasing clutch j, k and thereby disconnecting the driving gear h from the engine shaft. When the lever o is thus pulled inwardly the latch x' engages the catch y' and locks the lever in inner position. In this position the ports c', i' will be out of action and the crossed circumferential ports e', f' will be brought into action, the port e' being in connecting position between pipe system j' and the atmospheric port l', and the other port f' being brought to register with port m' and the pipe system k'. With the parts in this position the apparatus is ready to be used as a starter for the engine. To start the engine it is simply necessary to manually open valve q' and hold it open during the operation of the device as a motor. Thus opening the valve q' connects the valve system k' with the pressure tank and this pipe system connects with the ports of the cylinders which are for the time being the inlet ports. The air is exhausted from the cylinders through pipe system j' and thence to the atmosphere through ports e' and l'. The location of the shaft f drives the large gear u through the medium of the small gear v, and this large gear through the medium of its clutch w drives the shaft l. The ratio of these two gears v and u is such that the engine shaft will be driven comparatively slowly but with the maximum of power.

When the engine has been started, the chauffeur releases the pull rod or wire d^2 and thus permits the valve q' to close and thus cut off the supply of motive fluid to the motor. Thus releasing the valve opening mechanism immediately returns the parts to pumping position in the following manner: When the valve q' was opened, the arm a^2 pulled the rod g^2 inwardly far enough to cause the cam j^2 to lift the latch x' off the catch y' and the latch will thus be held out of engagement with the catch during the time the operator is holding open the valve. When he releases the valve opening mechanism the springs f^2, w' and n all coöperate to bodily throw outwardly the rod g^2 with its

cam j^2 and the clutch lever o and its latch x', the latch lever being held up out of engagement with the catch y' during this operation. The parts will then be in pumping position, as shown in Fig. 3, and the power of the engine will be utilized to immediately restore the pressure in the tank p', thus immediately putting the apparatus in condition for use as a starting mechanism.

It will be observed that in the normal position of the parts the apparatus is converted into a motor, and the parts remain in this position until the valve q' is opened to start the motor. Should the pressure in the tank become reduced by leakage and it is thus desirable that the pressure shall be restored during the running of the engine, it is obvious that the operator may at will pull over the rod g^2 and thus release the latch x' and permit the parts to go to pumping position. Of course when this is done the valve q' will be opened and the motor will be started, but the operation of the motor will be an idle one since the engine shaft is being driven by the power of the engine itself and the gear u is running idly and besides the valve q' will be opened but for an instant.

It will be observed also that the lock nuts i^2 serve as a stop collar to prevent the clutch lever returning to normal position until the operator has released the valve opening mechanism. This stop device i^2 and also the cam j^2 are adjustable along the rod g^2 in order that the parts may be adjusted to operate nicely.

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

1. In an apparatus of the class described, the combination of a storage tank, a convertible air motor and pump, differential gearing between the same and the engine shaft, and automatic means for converting the apparatus from a pump to a motor upon the attainment of a predetermined pressure in the tank.

2. In an apparatus of the class described, the combination of a pressure tank, a convertible air motor and pump between the tank and the engine shaft, differential gearing between the same and the engine shaft, automatic clutches for the gearing, and means for automatically throwing out the pumping gearing and locking it out of action and converting the apparatus into a motor upon the attainment of a predetermined pressure in the tank.

3. In an apparatus of the class described, a storage tank, a pneumatic appliance convertible from a motor to a pump and vice versa, means connecting it to the engine shaft, and means operable by excess pressure in the tank for automatically converting the appliance from a pump to a motor and locking the parts in that position, and manual means for starting the motor and simultaneously unlocking the aforesaid locking means, whereby upon release of the manual means for starting the motor the parts will be restored to pumping position.

4. In an apparatus of the class described, a storage tank, a pneumatic appliance convertible from a pump to a motor and vice versa, means connecting the shaft thereof to the shaft of the engine, valve mechanism for said pneumatic appliance, automatic means for shifting this valve mechanism to motor position and locking it in that position, manual means for starting the motor and simultaneously unlocking the parts, and means for restoring the parts to pumping position when said manual means is released.

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

JOHN ALLEN HEANY.

Witnesses:
J. E. GARNER,
W. R. BROWN.