C. J. COLEMAN.

ENGINE STARTER.

APPLICATION FILED AUG. 13, 1904.

898,438.

Patented Sept. 15, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

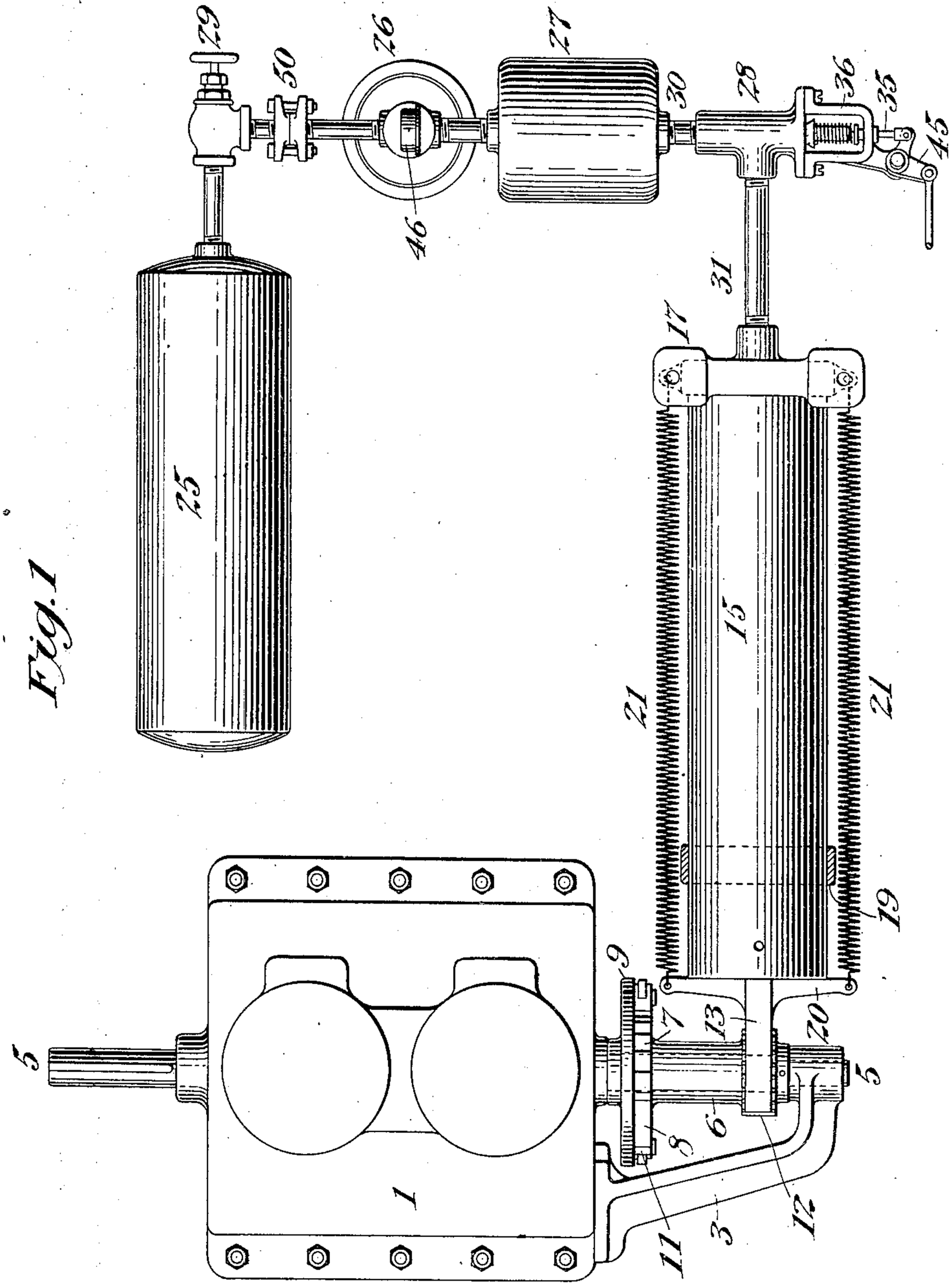

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Fig. 3

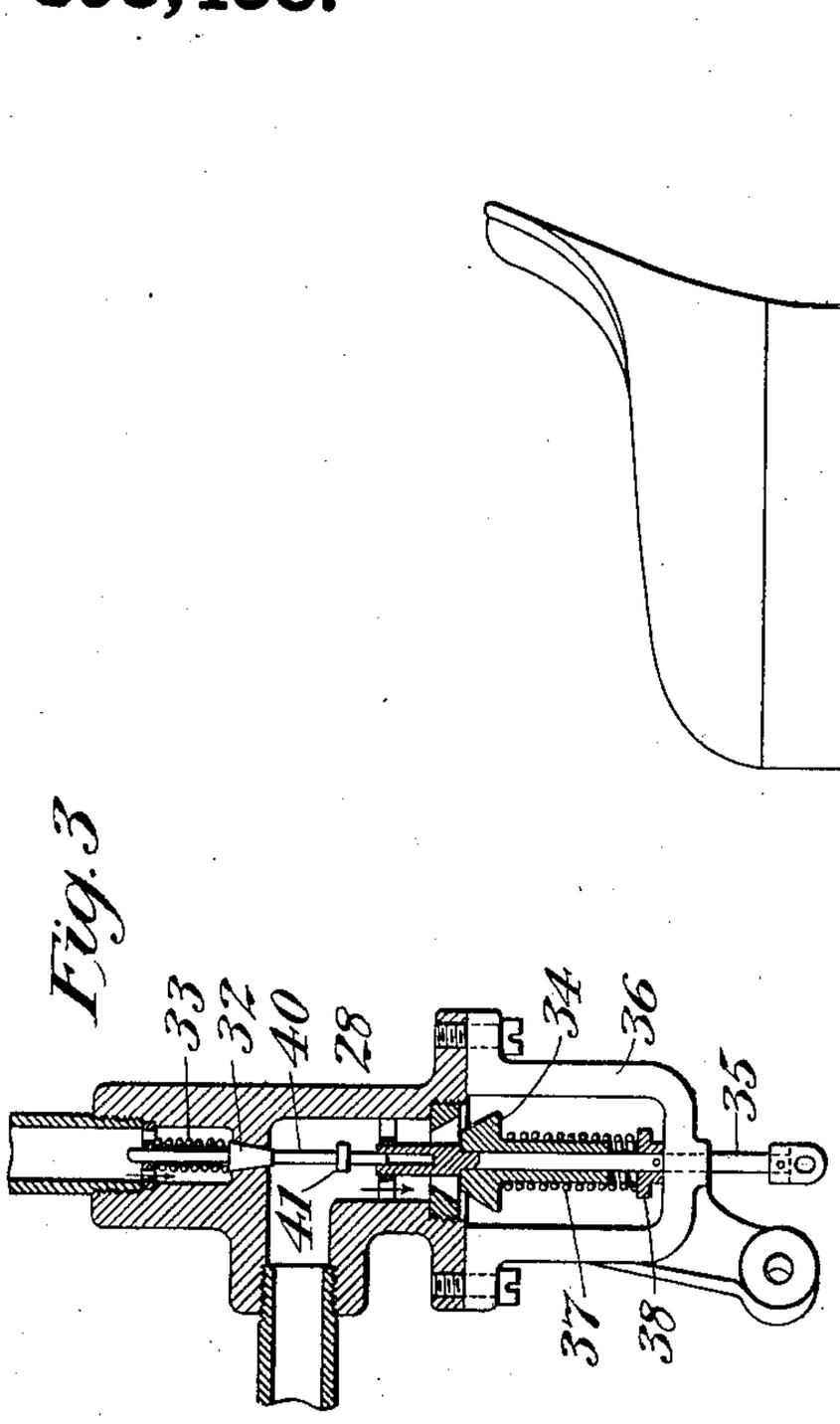
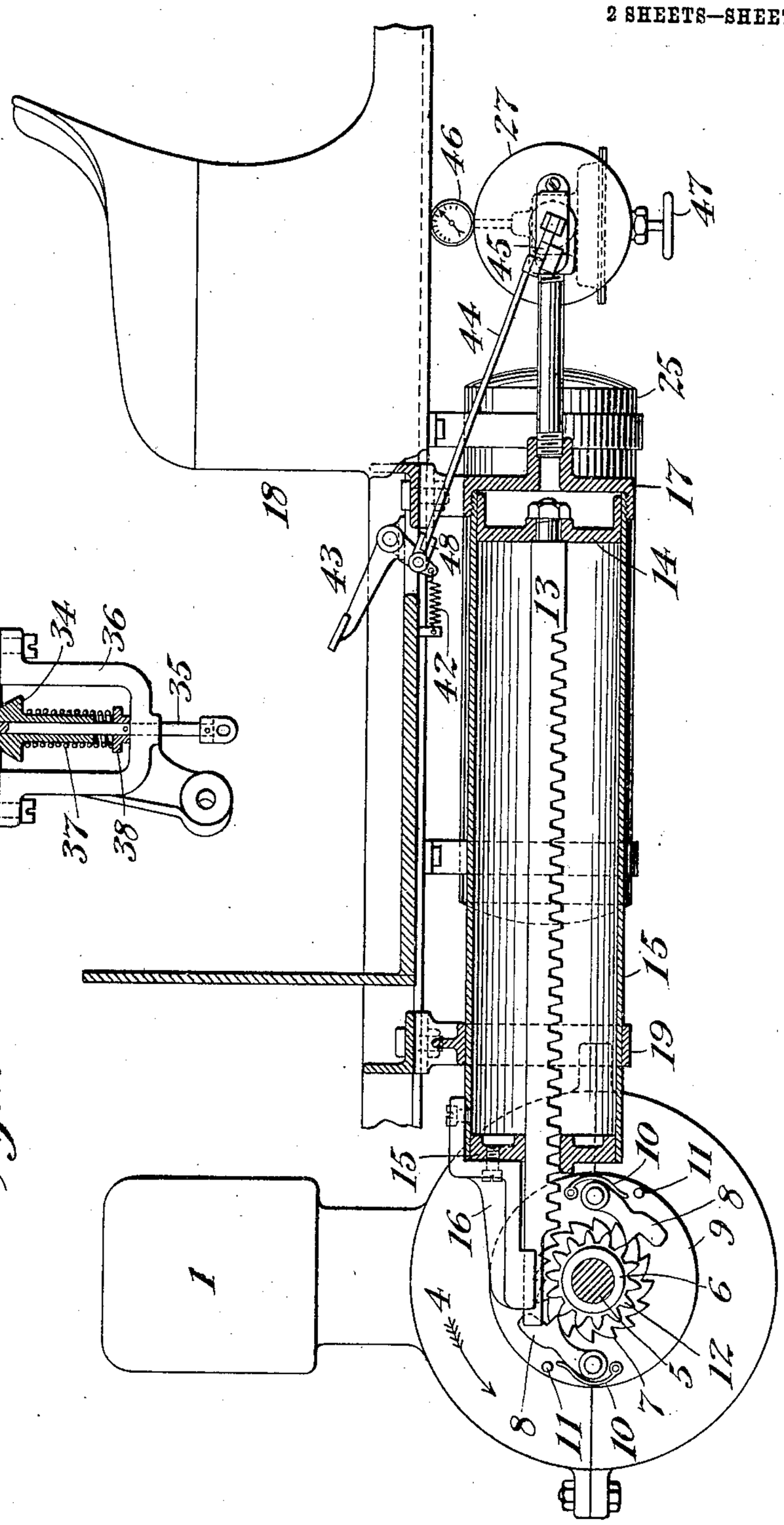


Fig. 2



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UNITED STATES PATENT OFFICE.

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ENGINE-STARTER.

No. 898,438. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed August 13, 1904. Serial No. 220,648.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Rockaway, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Engine-Starters, of which the following is a specification, reference being had therein to the accompanying drawing, forming a part thereof.

My invention relates to starting means for engines not self-starting, such as explosive engines, and for engine driven vehicles, such as automobiles.

It is frequently necessary to perform the starting operation of automobiles and highly desirable that the performance of this operation may be simple and readily controllable so that the engine may usually be stopped when the automobile is stopped for any substantial period of time. The carrying capacity of such vehicles is limited and it is desirable that the power storage means employed in such vehicles shall be capable of storing a very considerable amount of power. Where the engines are of high power and particularly where they include a number of cylinders and pistons, the power required for the starting operation is considerable, and it is desirable that power storing means may be employed of compact dimensions and capable of storing a very considerable amount of power and readily controllable to perform the starting operation whenever desired.

My invention contemplates the employment of a pressure storage tank containing liquefied gas to supply the power for starting the engine and the liquefied gas employed is capable of supplying the requisite power in the form of a gas under the desired pressure when the pressure on the liquid in the storage tank is reduced. I have found that liquefied carbon dioxid is peculiarly well adapted for employment as the liquefied gas and have devised means whereby it may be readily controlled and applied to the performance of the desired operation.

My invention includes power applying means capable of co-acting with the engine when it is desired to apply the power to start the engine, such power applying means being so constructed that the ordinary operation of the engine is not impaired thereby, and my invention also includes a gas pressure applying chamber in operative connection with the power applying means and in controllable connection with the liquefied gas supplying means.

My invention also includes means located within reach of the operator for controlling the supply of gas to the gas pressure applying chamber.

My invention also includes various improvements in the construction and combination of parts.

I will now describe the engine starter for automobiles shown in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is a general plan view of the engine and starter. Fig. 2 is a side elevation of the same and of portions of an automobile body, with the pressure applying chamber or cylinder and other parts in section. Fig. 3 is an enlarged horizontal section of the controlling valve.

The engine 1 illustrated in outline is a two-cylinder explosion engine of ordinary construction, which, by reason of the fact that it is not self-starting, requires the application of a rotative force to its main shaft 5 to initiate the rotative movement thereof and to continue such movement until the engine is self-actuated. The direction of rotation of the engine is indicated by the arrow 4, Fig. 2. The engine-shaft 5 has an outer bearing-bracket 3, and carries a sleeve 6 fitted to rotate freely on the engine-shaft and adapted to be connected thereto by directional engaging means, such directional engaging means being shown as comprising a ratchet-wheel 7 on the sleeve and centrifugal pawls 8, of which two are shown, carried by a disk 9 which is fast upon the engine-shaft. The centrifugal pawls are moved inward into engagement with the ratchet-wheel by light springs 10, which are, however, not sufficiently strong to overcome the centrifugal force of the pawls developed at normal speed of the engine. Stop pins 11 are provided on the disk 9 to limit the outward movement of these pawls. As the pawls are held out of contact with the ratchet at normal speed, they will not rub over the teeth of the wheel, and the wear and noise which might otherwise result will thus be avoided. When, however, the engine slows down or stops, the centrifugal pawls are moved inward by their springs into engagement with the ratchet-wheel and are retained in such engagement during the starting operation and until the

self-actuated operation of the engine advances the pawls clear of the teeth with which they are engaged, and then the pawls are thrown outward by centrifugal force and continue in such outer positions until the engine slows down or stops. The sleeve 6 also has a toothed pinion 12, which is shown as formed upon the sleeve, and a power-actuated rack 13 is provided which is so located as to be engaged with the teeth of the toothed pinion when it is actuated, but is normally out of contact therewith. This power-actuated rack is carried by the pressure-actuated part, which is shown as a piston 14 working in a pressure-applying chamber or cylinder 15, the rack emerging from the cylinder through an opening in the front head 15 thereof and having an upper guide-bearing just above its point of engagement with the toothed pinion, this bearing being provided in a bracket 16 secured to the front cylinder-head and cylinder. The rack is untoothed at its front portion and for such a distance back that in its normal inactive position, as shown in Fig. 2, its toothed portion is entirely clear of the pinion 12, so that it will not interpose any element of friction in the ordinary operation of the engine, the sleeve 6 being free to rotate with the engine-shaft when the starter is in such normal inactive position.

The rear head 17 of the cylinder is shown as integral with a supporting bracket bolted to the automobile body 18, and a front supporting bracket 19 is also shown which is also bolted to the automobile body. Resilient means are provided for returning the rack and piston to the normal inactive position shown, such resilient means comprising extension helical springs 21, of which two are shown, one on each side of the cylinder and connected, respectively, to ends of a cross-head 20 on the rack at their front ends and to suitable projections on the rear head and bracket 17 at their rear ends.

The gas pressure is supplied from a source of liquefied gas, which, in the embodiment of my invention shown, is a tank 25 containing liquefied carbon dioxid, and detachably connected to the other parts of the system at the coupling 50. A pressure-reducing valve 26, which may be of any suitable construction, is arranged so as to control the pressure at which the gas is delivered, and an expansion-chamber 27 and a controlling-valve 28 are also provided. The reducing valve delivers the medium at a pressure which will not maintain liquefaction thereof, with the consequence that the medium expands in the tank 25 and flows in expanded condition through the reducing valve 26 in quantities just sufficient to maintain the predetermined pressure at the low pressure or delivery side of the reducing valve. The expansion-chamber is located between the controlling-valve 28 and the reducing-valve 26, and its function is to act as a reservoir of evaporated gas, to permit of the expansion without undue increase of pressure of any particles of unexpanded liquid or snow which may pass through the reducing-valve and generally to equalize the pressure delivered at the controlling-valve under the conditions of irregularly occurring periods of comparatively large and rapid consumption of gas with intervening comparatively long intervals of inaction.

The controlling-valve 28 includes a suitable casing connected by a pipe 30 to the expansion-chamber and by a pipe 31 to the pressure-applying chamber or cylinder 15. An inlet-valve and an exhaust-valve are provided, the inlet-valve 32 being of the needle type and being resiliently held to its seat by an expansion helical spring 33 and being also held to its seat by the gas pressure from the expansion chamber. The exhaust-valve 34 is shown as of frusto-conical form and opens outward to the atmosphere, its stem 35 having a sliding bearing in a bridge-piece 36 of the valve casing. The exhaust-valve 34 has a resilient connection with its stem, such resilient connection being shown as provided by a compression helical spring 37 arranged between a collar 38 on the valve-stem and a shoulder on the valve, the valve having a bearing of sufficient length upon its stem to assure its accurate guidance and being held by this spring against a shoulder on the valve stem which limits its closing movement relatively to the stem. The stem 40 of the inlet-valve is shown as entering a perforation in the stem of the exhaust-valve and as provided with a collar 41, which is engaged by the end of the stem of the exhaust-valve after the exhaust-valve has been closed, and thus the valves are arranged so that they will be successively operative, the initial movement of the stem in one direction closing the exhaust-valve and the further movement thereof in the same direction opening the inlet-valve, and the initial movement of the stem in the other direction closing the inlet-valve and the further movement thereof in such other direction opening the exhaust-valve. Thus the inlet-valve is always closed when the exhaust-valve is open and therefore waste of gas is prevented. The controlling-valve 28 is actuated by suitable means arranged within reach of the operator, such means being shown as an actuating pedal 43 conveniently located in the body 18 of the automobile so that it may be readily actuated by the operator and depressed to move the valve-stem inward and first close the exhaust-valve and then open the inlet-valve. This pedal 43 is normally held in upper position by an extension helical spring 42, and has a connecting rod 44 connected thereto by a universal joint 48, the connecting rod being also pivotally connected to a

bell-crank 45 which has a slotted engagement with the valve-stem 35. The bell-crank 45 is pivoted on a lug extending from the bridge-piece 36 of the valve-casing.

A needle-valve 29, of usual construction, is shown as provided between the pressure-storage tank 25 and the coupling 50, this valve being however opened as soon as the tank is coupled to the reducing-valve, and remaining open until the tank is uncoupled. The reducing-valve 26 is shown as carrying a gage 46 and having a regulating stem 47 whereby the reduced pressure may be indicated and determined.

In the operation of the starter a full stroke of the piston may be employed, if necessary. The controlling-valve will remain with its inlet open and exhaust closed as long as the pedal 43 is depressed. When the pedal is released and restored by its spring to the normal upper position shown, the inlet will be closed and the exhaust opened and the gas permitted to escape to atmosphere, the actuating-rack 13 being retracted by its springs 21 until it returns to the normal inactive position shown. The starting operation may be repeated as often as desired, the contents of a single pressure-storage tank of liquefied gas being sufficient for a very great number of operations. When a tank is exhausted, however, it may be readily disconnected at the coupling 50 and replaced by a fully charged tank.

It is obvious that various modifications may be made in the construction shown and above particularly described within the principle and scope of my invention.

What I claim as new, and desire to secure by Letters Patent is:—

An engine starter comprising power-applying means engageable with the engine, a pressure-applying chamber, the power-applying means being actuatable by pressure in the chamber to move it in one direction to start the engine, means opposed to such movement and operative to return the power-applying means to starting position when the pressure in the chamber is relieved, pressure-storage means, and a pressure and exhaust valve controlling the communication from the storage means to the chamber and also controlling an exhaust from the chamber.

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

CLYDE J. COLEMAN.

Witnesses.

HENRY D. WILLIAMS,

HENRY BARNES.