July 2, 1929. A. SALA ET AL 1,719,562

ENGINE

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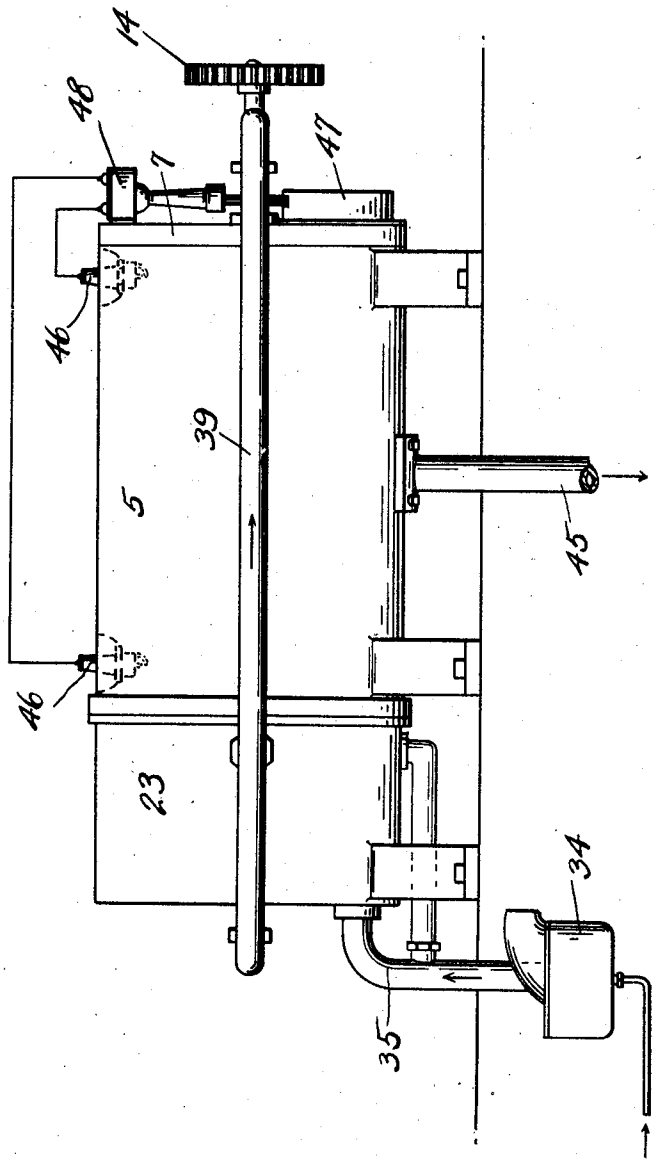


Fig. 1.

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Fig. 7.

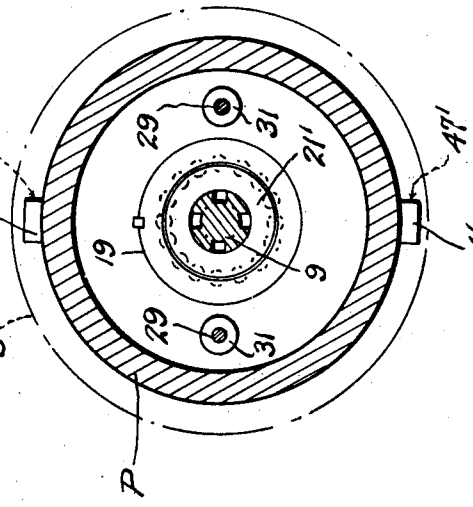


Fig. 8.

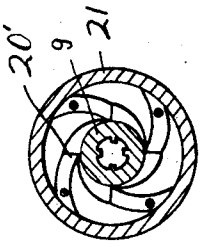
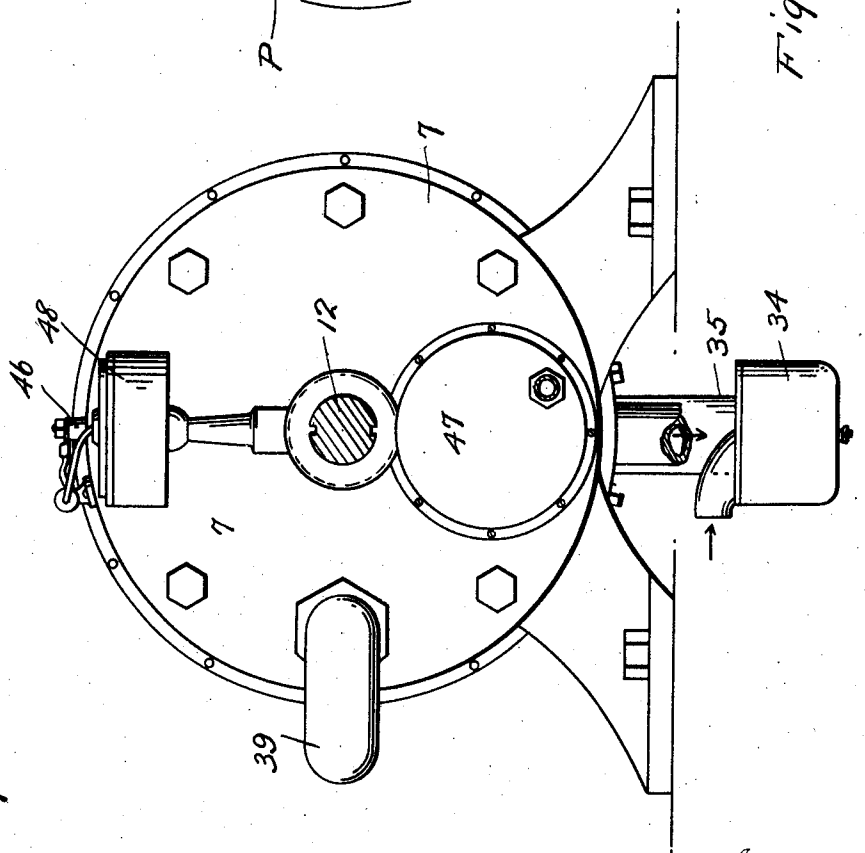


Fig. 2.



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Fig. 6.

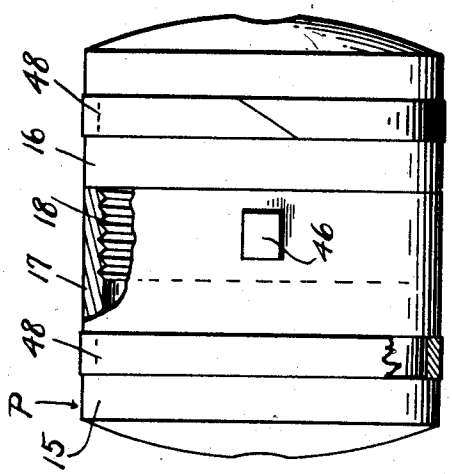
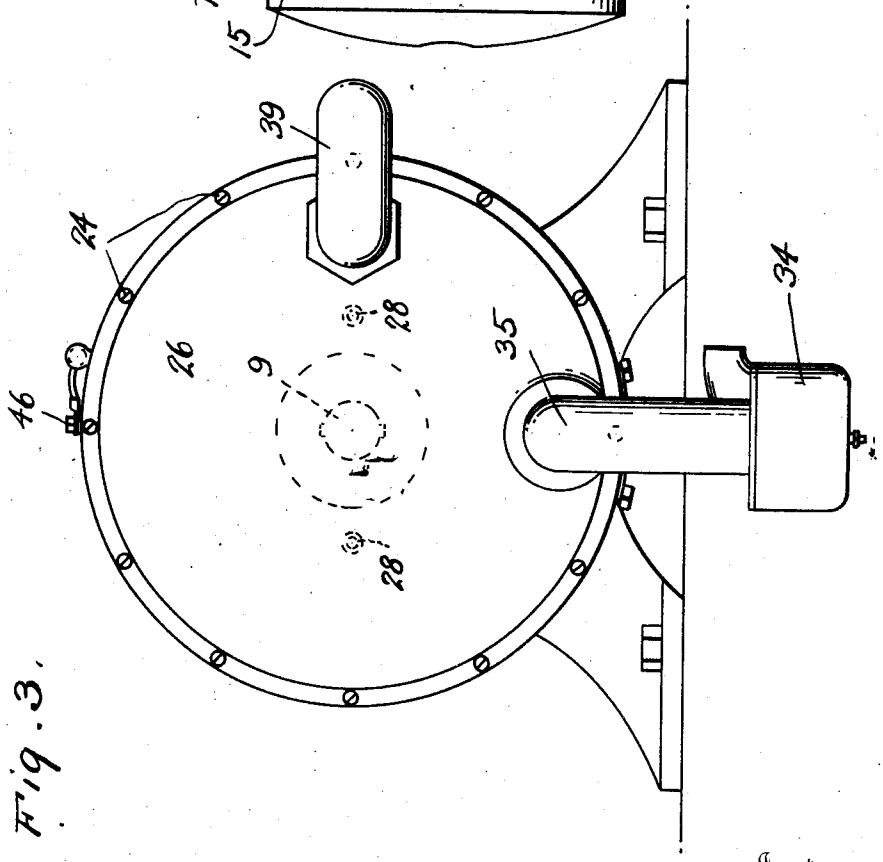


Fig. 3.



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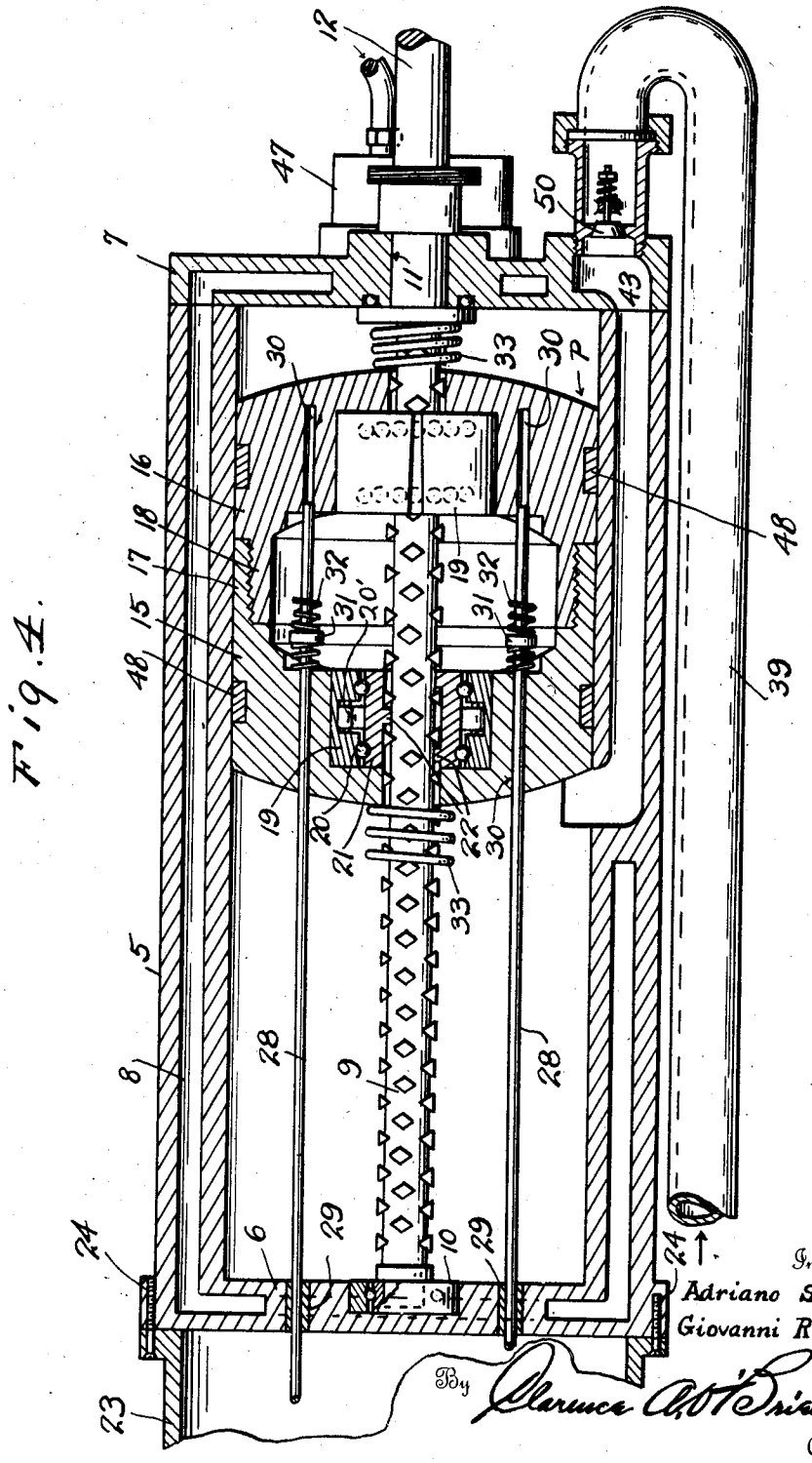


Fig. 4.

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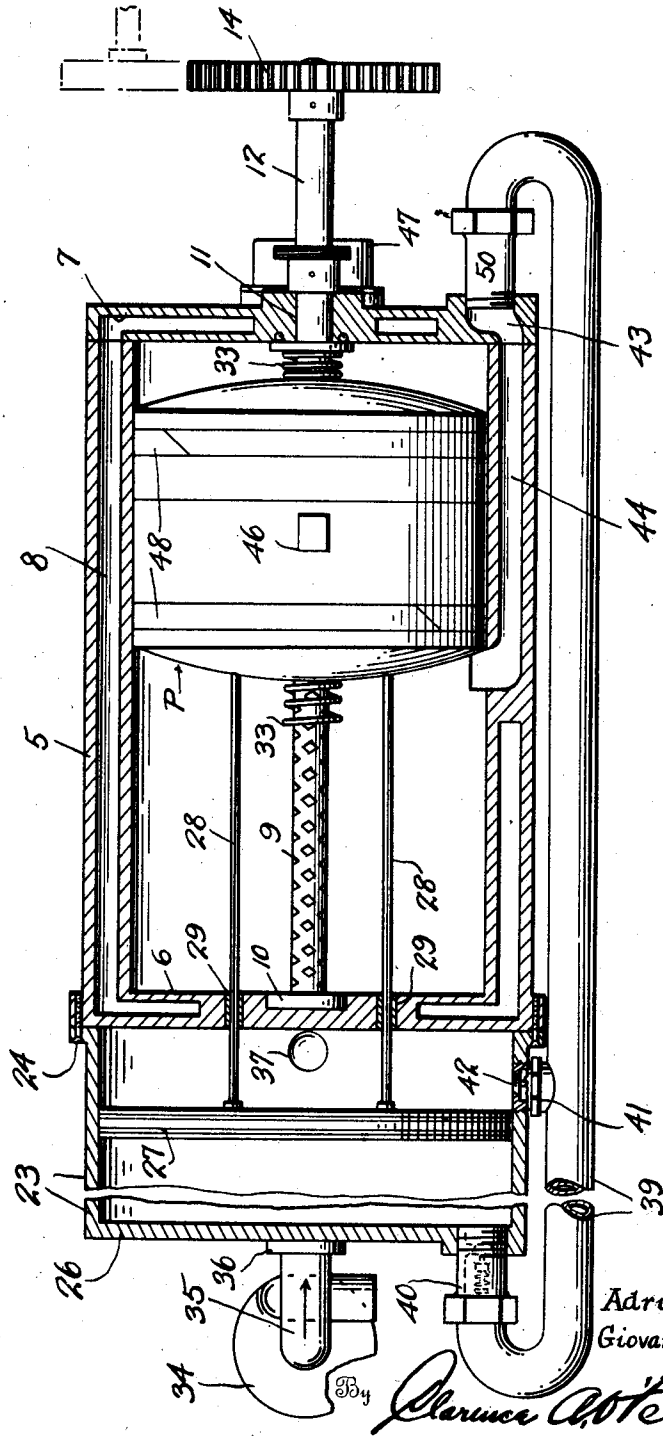
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Fig. 5.



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UNITED STATES PATENT OFFICE.

ANDRIANO SALA AND GIOVANNI RINALDI, OF SOUTH PLAINFIELD, NEW JERSEY.

ENGINE.

Application filed March 19, 1928. Serial No. 262,906.

The present invention relates generally to engines either of the internal combustion type or steam type and has for its primary object to provide a reciprocating piston on the well known type of Horsfall shaft, that is a shaft having a pair of spiral grooves formed therein, said grooves being spiralled in opposite directions and a piston reciprocatable along the shaft and having means to cause the shaft to rotate in but a single direction.

Another very important object of the invention resides in the provision of an engine of this nature having a highly novel piston structure.

A still further very important object of the invention resides in the provision of a piston on a double spirally grooved shaft and ball bearing means disposed between the piston and the shaft for causing the constant rotation of the shaft.

Another very important object of the invention resides in the provision of a unit of this nature having spring buffers at the ends of the piston about the shaft to assist the piston in its change of direction when reciprocating back and forth.

Another important object of the invention resides in the provision of an internal combustion engine of the tractor type, of the unit mentioned above in combination with a compressor operatively connected in a novel manner with the piston for operation thereby.

A still further very important object of the invention resided in the provision of an engine which attains the maximum of power by doing away with connecting rods, crank shafts, and other parts used in engines now in common use.

A still further very important object of the invention resides in the provision of an engine of this type which is comparatively simple in its construction, compact and convenient in its arrangement of parts, strong and durable, thoroughly efficient and reliable in operation, easy to assemble and disassemble, not likely to easily become out of order, and otherwise well adapted to the purpose for which it is designed.

With the above and numerous other objects in view as will appear as the description proceeds, the invention resides in certain novel features of construction, in the combination and arrangement of parts as will be hereinafter more fully described and claimed.

In the drawings:

Figure 1 is a side elevation of an internal combustion engine of the two cycle type embodying the features of this invention,

Figures 2 and 3 are end elevations thereof,

Figure 4 is a fragmentary horizontal section therethrough,

Figure 5 is a longitudinal vertical section therethrough,

Figure 6 is a side elevation of the pistons showing portions in section,

Figure 7 is a transverse section, and

Figure 8 is a detail section through our driving member to shown the conventional pawl and rachet mechanism.

Referring to the drawings in detail it will be seen that the numeral 5 denotes a cylinder having a fixed head 6 at one end and a removable head 7 at the other end, the cylinder and head being jacketed as at 8 for the circulation of water to function as a cooling medium. A double spirally grooved shaft 9 has one end journalled in the center of the head 6 as at 10 and the other end journaled through the center of the head 7 as at 11 and is provided with a plane extension 12 having a gear 14 thereon for cranking purposes by any suitable or preferred means. A piston P is mounted for reciprocation on the shaft 9 within the cylinder. This piston comprises a pair of hollow sections 15 and 16 having respectively flanges 17 and 18 threadedly engaged the former over the latter. Bearings 19 are in the sections 15 and 16 and have ball bearings 20 therein for receiving driving members 21 21′ having ribs 22 cooperating with the spiral groove of the shaft 9.

The driving member 21 is free to rotate in one direction only, and the other member 21 being free to rotate in the other direction only, because of conventional pawl and ratchet means 20′ (see Fig. 8) so that as the piston P reciprocates back and forth in the cylinder the shaft 9 will be driven constantly in but a single direction.

A cylinder 23 is secured in any suitable manner such as at 24 to the head 6 and has a head 26 at the end remote from the head 6. A piston 27 reciprocates back and forth in the cylinder 23. Rods 28 are fixed to the piston 27

and are slidable through bearings 29 in the head 6 and through openings 30 in the sections 15 and 16 and between the space provided in the piston P. Shoulders 31 are formed on the rods 29 within the piston P and springs 32 are disposed about the rods on each side of each shoulder 31.

It will therefore be seen that we have provided a lost motion connection between the piston P and the piston 27 so that reciprocating motion will be imparted to the piston 27 which continues to rotate, but the action of the piston 27 is delayed.

Bumper springs 33 are disposed about the shaft 9 one at each end of the piston P. A carbureter 34 of conventional construction communicates by suitable structure 35 with the interior of the cylinder 23 at the end thereof as is indicated at 36 and 37. A pipe 39 has a branch 40 leading from the head 26 of the cylinder 23 and a branch 41 leads from the other end of the cylinder 23.

These branches are provided with check valves 42. The pipe 39 is preferably composed along the cylinder 8 and communicates with an opening 43 in the head 7 which leads into a passage 44 formed in the wall of the cylinder 8 and terminating inwardly at the center thereof to communicate with the interior of the cylinder. An exhaust pipe 45 leads from the bottom center of the cylinder 8. Spark plugs 46 are engaged in the cylinder one at each end thereof. A water pump 47 is geared in any suitable manner to the shaft 9 and a distributor 48 is also geared thereto in a suitable manner for causing the energization of the parts at the proper time.

Starting with the piston in the position shown in Figure 5 it will be seen that the gases compresses between the right hand end of the piston P and the head 7 and when the right hand spark plug is energized the gas will explode driving the piston to the left. As the piston moves to the left it will compress gas to the left thereof between its left hand end and the head 6 and close the communication of the intake passage 44 and the outlet pipe 45 with the interior of the cylinder. When the piston reaches the left hand end of its stroke it will clear the use of passage 44 and the pipe 45 so that there will be a new rush of gas and an outrush of burnt gas. Thus the engine operates on the usual well known two cycle principle.

As the piston moves back and forth, of course, the Horsfall shaft 9 will be rotated in one direction. The buffer springs 33 will assist the piston in changing direction of its movement. The piston P is prevented from rotation by means of lugs 46 projecting outwardly therefrom and operating with the grooves 47′ provided in the inner surface of the walls of the cylinder 8. The piston P is provided with conventional piston rings 48. As the piston moves to the left in the above description it will be seen that as soon as the spring 32 moves to the right of the shoulder 31 engage the section 16 of the piston 27 will start to move to the left causing the fuel gases to the left thereof to be forced out through the branches 40 at the same time sucking in fresh gas to the right of the piston 27. As the piston P moves to the right and the spring 32 moves to the left of the shoulder 31 engages the section 15—15 the piston 27 will start moving to the right so as to suck in gas from the carbureter to the left of the piston 27 and compress the gas to the right thereof and force it out through branch 41. The gases forced in branches 40 and 41 are forced through the pipe 39 under pressure and through the opening and into the cylinder 5 as previously indicated.

The pipe 39 is preferably provided with a check valve 50 at its action with the opening 43 in the head 7.

The important features of the invention resides in the cooperation of the piston P with the shaft 9 and this unit may be used in a speed engine or the like with equal efficiency and reliability as in the two cycle internal combustion engine which we have described above for the purpose of giving an operative example of our important units.

It is thought that the construction, operation, and advantages of this invention will now be quite apparent to those skilled in this art without a more detailed description thereof. The present embodiment of the invention has been disclosed merely for the purpose of exemplification since in actual practice it will attain the features of advantage enumerated as desirable in the statement of the invention and the above description.

It will be apparent that changes in the details of construction, and in the combination and arrangement of parts may be resorted to without departing from the spirit or scope of the invention as hereinafter claimed or sacrificing any of its advantages.

Having thus described our invention, what we claim as new is:

1. In an engine unit, and in combination, a double spirally grooved shaft, means for rotatably mounting the shaft, a piston reciprocable on the shaft, said piston being sectional and having threadedly connected flanges on its section, driving elements in the piston, one in the section, said elements being cooperatively associated with the shaft by means of ribs operating in the grooves of the shaft, one element being free to rotate only in one direction and the other element being free to rotate only in the other direction, a cylinder in which said piston is reciprocable and in which said shaft is journaled, and buffer springs disposed at the ends of the piston about the shaft for assisting the piston in changing its direction during reciprocation.

2. In an engine unit, and in combination, a double spirally grooved shaft, means for rotatably mounting the shaft, a piston reciprocable in the shaft, said piston being sectional and having threadedly connected flanges on its section, said elements being cooperating in the grooves of the shaft, one element being free to rotate only in one direction and the other element being free to rotate only in the other direction, ball bearing mounts in the piston section for said element, a cylinder in which said piston is reciprocable and in which said shaft is journaled, and buffer springs disposed at the ends of the piston about the shaft for assisting the piston in changing the direction during reciprocation.

3. In an engine unit, and in combination, a double spirally grooved shaft, means for rotatably mounting the shaft, a piston reciprocable in the shaft, said piston being sectional and having threadedly connected flanges on its section, said elements being cooperating in the grooves of the shaft, one element being free to rotate only in one direction and the other element being free to rotate only in the other direction, ball bearing mounts in the piston section for said element, a cylinder in which said piston is reciprocable and in which said shaft is journaled, and buffer springs disposed at the ends of the piston about the shaft for assisting the piston in changing the direction during reciprocation, a compressor cylinder on one end of the first mentioned cylinder, a piston, reciprocable in the compressor cylinder, rods connected to the compressor piston and extending into the first mentioned cylinder, and a lost motion connection between the rods and the first mentioned piston.

4. In an engine unit, and in combination, a double spirally grooved shaft, means for rotatably mounting the shaft, a piston reciprocable in the shaft, said piston being sectional and having threadedly connected flanges on its section, said elements being cooperating in the grooves of the shaft, one element being free to rotate only in one direction and the other element being free to rotate only in the other direction, ball bearing mounts in the piston section for said element, a cylinder in which said piston is reciprocable and in which said shaft is journaled, and buffer springs disposed at the ends of the piston about the shaft for assisting the piston in changing the direction during reciprocation, a compressor cylinder on one end of the first mentioned cylinder, a piston reciprocable in the compressor cylinder, rods connected to the compressor piston and extending into the first mentioned cylinder, and a lost motion connection between the rods and the first mentioned piston, said connection being provided by means of provision of openings in the first mentioned piston through which the rods are slidable, shoulders on the rods between the first mentioned piston.

5. In an engine unit, and in combination, a double spirally grooved shaft, means for rotatably mounting the shaft, a piston reciprocable in the shaft, said piston being sectional and having threadedly connected flanges on its section, said elements being cooperating in the grooves of the shaft, one element being free to rotate only in one direction and the other element being free to rotate only in the other direction, ball bearing mounts in the piston section for said element, a cylinder in which said piston is reciprocable and in which said shaft is journaled and buffer springs disposed at the ends of the piston about the shaft for assisting the piston in changing the direction during reciprocation, a compressor cylinder on one end of the first mentioned cylinder, a piston reciprocable in the compressor cylinder, rods connected to the compressor piston and extending into the first mentioned cylinder, and a lost motion connection between the rods and the first mentioned piston, said connection being provided by means of provision of openings in the first mentioned piston through which the rods are slidable, shoulders on the rods between the first mentioned piston, springs on the rods one to each side of each shoulder.

6. In an engine unit, and in combination, a double spirally grooved shaft, means for rotatably mounting the shaft, a piston reciprocable in the shaft, said piston being sectional and having threadedly connected flanges on its section, said elements being cooperating in the grooves of the shaft, one element being free to rotate only in one direction and the other element being free to rotate only in the other direction, ball bearing mounts in the piston section for said element, a cylinder in which said piston is reciprocable and in which said shaft is journaled, and buffer springs disposed at the ends of the piston about the shaft for assisting the piston in changing the direction during reciprocation, a compressor cylinder on one end of the first mentioned cylinder, a piston reciprocable in the compressor cylinder, rods connected to the compressor piston and extending into the first mentioned cylinder, and a lost motion connection between the rods and the first mentioned piston, said connection being provided by means of a provision of openings in the first mentioned piston through which the rods are slidable, shoulder on the rods between the first mentioned piston, springs on the rods one to each side of each shoulder, spark plugs engaged in the ends of the first mentioned cylinder, intake means leading from the compressor to the center of the first cylinder.

In testimony whereof we affix our signatures.

ANDRIANO SALA.
GIOVANNI RINALDI.