

D. D. MILES, JR.
 STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED MAY 20, 1913.

1,098,047.

Patented May 26, 1914.

2 SHEETS—SHEET 1.

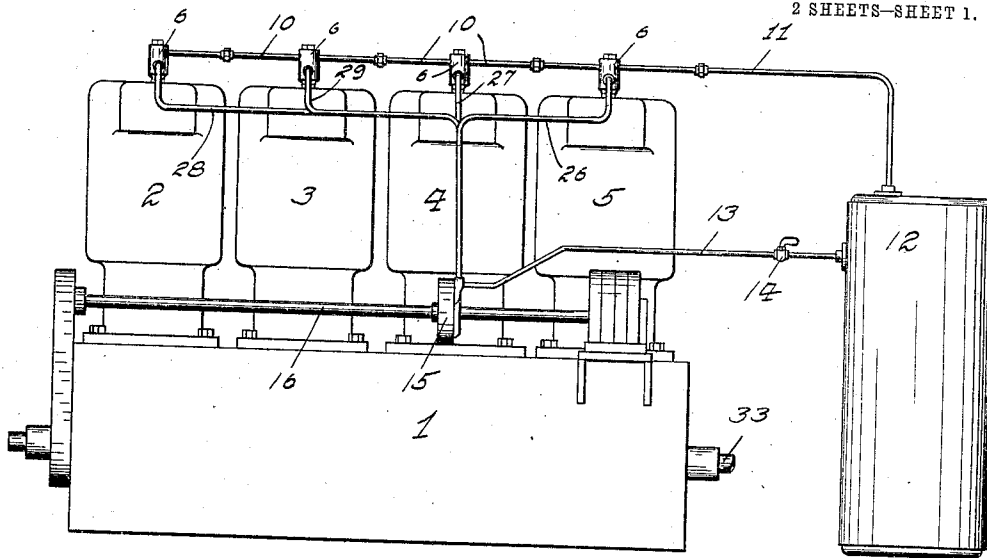


Fig. 1.

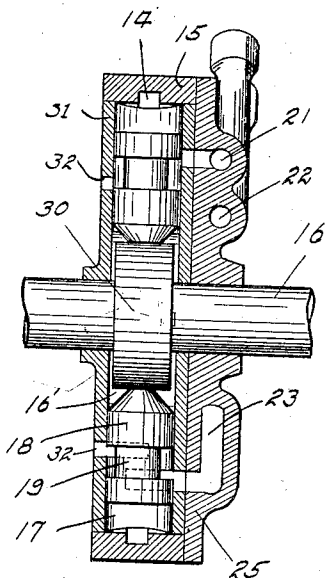


Fig. 3

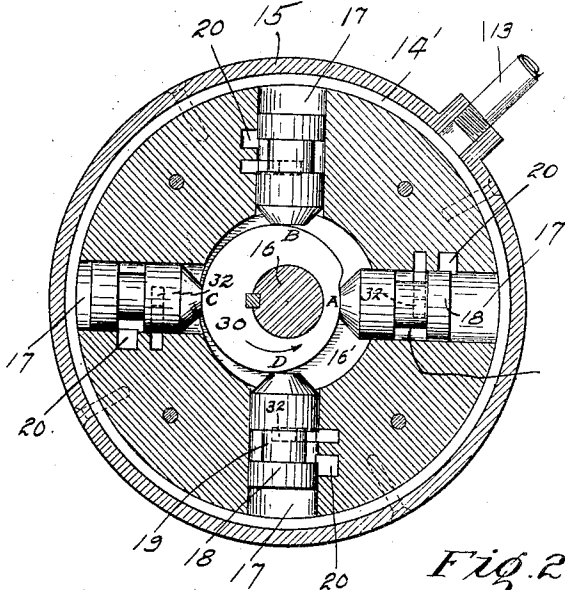


Fig. 2

WITNESSES:

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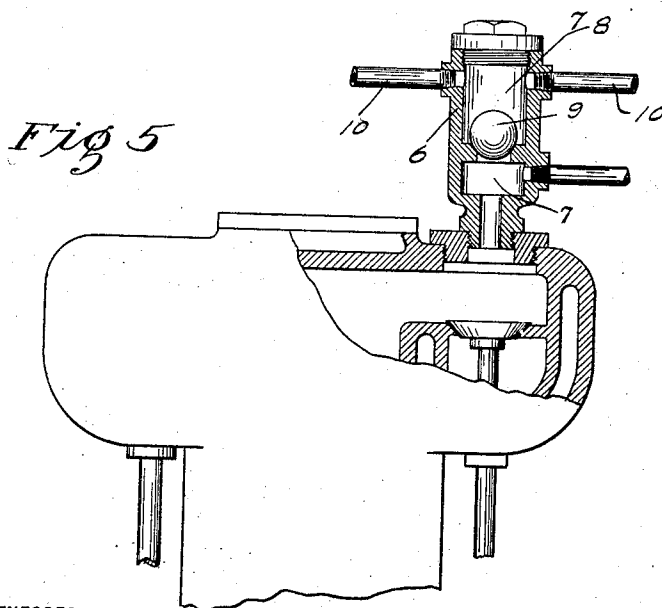
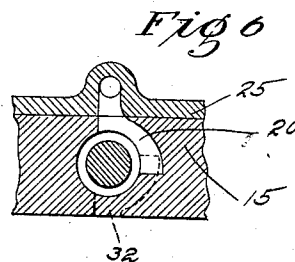
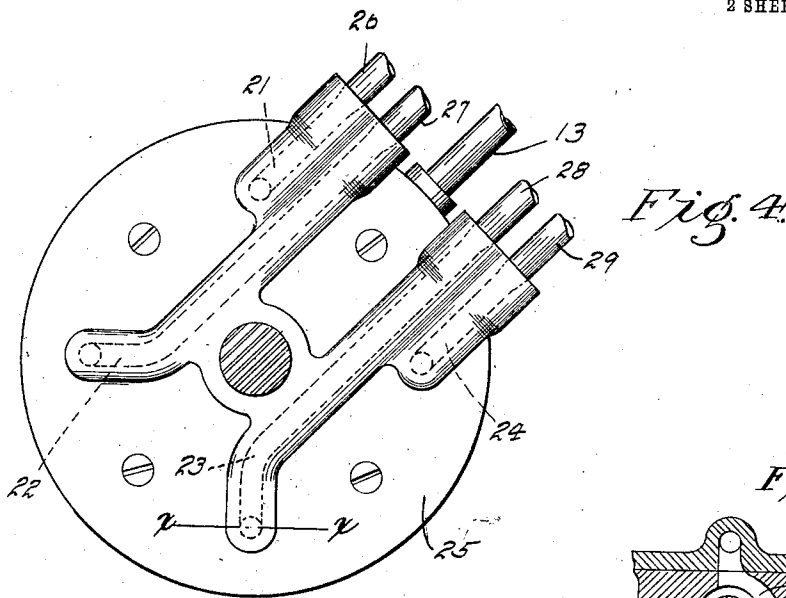
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WITNESSES:

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UNITED STATES PATENT OFFICE.

DON D. MILES, JR., OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO GOODWIN AND MILES COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,098,047.

Specification of Letters Patent.

Patented May 26, 1914.

Application filed May 20, 1913. Serial No. 768,735.

To all whom it may concern:

Be it known that I, DON D. MILES, JR., a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented certain new and useful Improvements in Starting Devices for Internal-Combustion Engines, of which the following is a specification.

The hereinafter described invention relates to an improved pressure actuated starting device for internal combustion engines generally, and is particularly adapted to be employed in connection with marine engines and engines of motor driven vehicles, where it is desired to start the same without the necessity of cranking, and the invention has for its principal objects to provide a master selective cam for operating the valves for admitting air under pressure into the cylinders and for releasing the compression therein, and to provide a structure wherein the controlling valves are thrown into operative relation with their actuating cam on the admission of air from the air storage means to start the engine, and upon the cutting off of the flow of air from the air storage means and the starting of the engine are thrown by their actuating cam into inoperative relation therewith and in a position to close the ports controlled thereby; to provide a structure in which the controlling valves are in contact with their actuating cam only when the device is employed in starting the engine; and to provide a device wherein the controlling valves admit air under compression into the cylinders on their firing stroke and permit a release of compression from the cylinder next in the order of firing.

With the above mentioned and other objects in view, the invention consists in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended; it being understood that various changes in the form, proportion, size and minor details of construction within the scope of the appended claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

To more fully comprehend the invention, reference should be had to the accompany-

ing drawings disclosing one form of my invention, in which—

Figure 1 is a view in elevation of an internal combustion engine with my improved starting mechanism connected thereto, disclosing the air storage reservoir, the valve controlled connections from the cylinders to the reservoir, the master selective valve casing, and the connections therefrom to the cylinders, the shaft extending through the master selective valve casing, and the valve controlled connection from the air storage reservoir to the valve casing. Fig. 2 is a transverse central sectional view of the master selective valve casing, disclosing the sliding valves therein and the ports controlled thereby, the cam for actuating the valves, and the air inlet connection from the air storage reservoir. Fig. 3 is a vertical central sectional view of the master controlling valve casing, disclosing certain of the slide valves, the operating means therefor, the inlet port from the air storage reservoir, the ports leading from said valves to their respective engine cylinders, and the compression escape ports controlled by said valves. Fig. 4 is a view in elevation of the master selective valve casing, disclosing the communications from the respective sliding valves to the cylinders, and the connection from the air storage reservoir to the interior of the casing. Fig. 5 is a vertical sectional view of one of the casings attached to each cylinder, disclosing the connection therefrom to the air storage reservoir, the check valve controlling the same, and the connection from the master distributing valve casing to the interior of the cylinder. Fig. 6 is a section taken on line *x-x*, Fig. 4.

Referring more particularly to the drawings, wherein like reference numerals designate corresponding parts throughout the several views, 1 indicates the crank case of an internal combustion engine on which are mounted the engine cylinders 2, 3, 4 and 5 and mounted on each cylinder is a suitable casing 6 formed with the interior bore 7 which communicates at one end with the combustion chamber of the cylinder, and at its opposite end opens into the chamber 8 in which is mounted a valve 9 for controlling the passage between the bore 7 and chamber 8.

The chambers 8 of the respective casings are connected by the pipes 10 and the casings communicate through a pipe 11 with an air storage reservoir 12 of any suitable capacity, and located at any suitable point, and it will be apparent that when the engine is operating under its own power, the exhaust gases from the cylinders will be forced into the chambers 8 and stored under pressure in the reservoir 12.

A pipe 13 controlled by a suitable valve 14 intersects the pipe 11, and at its opposite end communicates with the annular channel 14' formed in the interior of a suitable solid annular casing 15, secured to the crank case, and through the center of which passes a shaft 16, preferably the magneto shaft, which is in geared relation with the engine crank shaft.

The interior of the casing is provided with a disk-shaped bore 16' from which radiate the bores 17, which communicate at their outer ends with the annular channel 14', and correspond in number to the number of cylinders of the engine, in this case four.

In each of the bores 17 is slidably mounted a suitable valve 18, each formed adjacent its outer end with an annular channel 19, said channels are adapted to control the passages 20 which connect through the bores 21, 22, 23 and 24 formed in the cover 25 of the casing, with the pipes 26, 27, 28 and 29, one of which communicates with the bore 7 of each casing 6 immediately below the valve 9.

Keyed to rotate with the shaft 16 and positioned in the bores 16' is a cam 30, the peripheral edge of which is adapted to contact with the inner end of each of the valves 18 and force the same outwardly.

Formed in the rear face plate 31 of the casing 15 are a plurality of ports 32 one communicating with each bore 17 immediately below the passage 20, and said ports 32 are controlled by the slide valves 18 and are adapted, when the valves are in a certain position, to communicate with the passages 20 through the annular channel 19 and permit the escape of the compression from the cylinder next in the order of firing.

Assuming that the engine has just been started and is operating under its own power, the device operates in the following manner: The valve 14 is closed to shut off the communication 13 between the tank 12 and channel 14', thus cutting off the air pressure against the outer ends of the slide valves 18. The cam 30 in its rotation, in the direction of the arrow—Fig. 2, will force the valves 18 outwardly in their bores so that the same will cut off communication between the channel 14' and the ports 20, and between the ports 20 and 32, and there being no pressure in the channel 14' the valves will

remain stationary in their outermost position until the valve 14 is again opened. On each explosion in the cylinders, the exhaust therefrom will lift the ball valves 9 and enter the chambers 8 under compression, and will be stored in the tank 12 recharging the pressure therein. Assuming that the engine is now stopped and the cam 30 carried by the shaft 16 is resting in the position as in Fig. 2, the starting mechanism operates in the following manner to start the engine. The valve 14 is now opened admitting air under pressure from the reservoir 12 through the pipe 13 to the channel 14' and the pressure of the air forces the valves 18 inwardly in contact with the cam 30 as in Fig. 2, the valve associated with the cylinder on its firing stroke resting on the depressed portion A of the cam 30 which will permit the outer end of the valve to pass the port 20 associated therewith and will permit the air under compression to pass from the channel 14' through the pipe 29 into the engine cylinder 2. The valve associated with cylinder 5 which is in its compression stroke is resting on the portion B of cam 30, which permits the channel 19 of the valve to register with ports 20 and 32, which will permit the compression in the cylinder 4 to escape to the atmosphere through pipe 28 and passages 20 and 32. When the valves are in their above described position, the valve associated with the cylinder 4, which is on its suction stroke, is in contact with the portion C of the cam 30, which forces the valve outwardly its full distance and blinds or shuts off communication between all ports associated therewith, permitting the cylinder piston to draw in an undiluted charge of fuel. The valve associated with cylinder 3, which is in its exhaust stroke, is in a similar position to the valve associated with cylinder 2, and in contact with portion A of the cam, permitting the exhaust of the cylinder to pass through pipe 26, ports 20 and 32 to the atmosphere. The admission of air into the cylinder on its firing stroke will force the piston downwardly thereon, and the revolving of the engine crank shaft 33 will cause the shaft 16 carrying the cam 30 to rotate and present the indicated portions thereof alternately in sequence to the respective valves, which will permit the air under compression to alternately enter the cylinders on their firing stroke and will permit a release of compression from the cylinders in advance of their order of firing. On the starting of the engine and after the valve 14 is closed, the cam 30 will force the valves 18 outwardly in their bores, as before described, where the same will remain idle until such time as it is again necessary to start the engine. The air storage reservoir is being charged at all times when the engine is op-

erating under its own power and when the pressure therein balances the pressure of the explosion strokes of the engine the exhaust gases will pass through the engine exhaust manifold to the atmosphere.

It will be apparent that I have provided a compressed air starting device consisting of but few parts which remain idle when the engine is operating under its own power, and are thrown into operative relation with their actuating cam by the air pressure when admitted to start the engine.

Having thus described my invention what I claim as new and desire to protect by Letter Patent is:—

1. A starting device for internal combustion engines and in combination with the engine cylinders thereof, the same comprising a gas storage reservoir, a valve controlled connection between the engine cylinders and said reservoir for supplying gas under pressure from the cylinders to the reservoir, a valve casing provided with a plurality of pairs of ports, one port of each of said pairs of ports leading directly to the atmosphere, a connection between the other port of each of said pairs of ports and one of the engine cylinders, a plurality of valves mounted in said casing and each controlling a pair of said ports, a valve controlled connection from said gas storage reservoir to said casing for admitting gas thereto to operate said valves in one direction, and operating means for said valves for successively positioning the same to open the communication from the gas pressure reservoir to the cylinder whose piston is on its firing stroke for admitting gas thereto to start the engine, and for successively positioning said valves to open the communication from the cylinder next in the order of firing through the ports associated therewith to the atmosphere for releasing the compression therein.

2. A starting device for internal combustion engines and in combination with the engine cylinders thereof, the same comprising a gas storage reservoir, a valve controlled connection between the engine cylinders and said reservoir for supplying gas under pressure from the cylinders to the reservoir, a valve casing provided in its surface with a plurality of pairs of ports, one port of each of said pairs of ports leading directly to the atmosphere, a connection between the other port of each of said pairs of ports and one of the engine cylinders, a plurality of radially disposed valves mounted in said casing and each controlling a pair of said ports, a valve controlled connection from said gas storage reservoir to said casing for admitting gas thereto to operate said valves in one direction, and a cam common to all of said valves for operating the same against the gas pressure from said

gas storage reservoir and for successively positioning the same to open the communication from the gas pressure reservoir to the cylinder whose piston is on its firing stroke for admitting gas under pressure thereto to start the engine, and for successively positioning said valves to open the communication from the cylinder next in the order of firing through the ports associated therewith to the atmosphere for releasing the compression therein.

3. A starting device for internal combustion engines and in combination with the engine cylinders thereof, the same comprising a gas storage reservoir, a valve controlled connection between said engine cylinder and said reservoir for supplying gas under pressure from said cylinders to the reservoir, a valve casing, a valve controlled connection from said casing to each of said engine cylinders, valve controlled ports in said casing communicating with each of said valve controlled connections and leading to the atmosphere, a valve controlled connection from the gas storage reservoir to the casing, and means for operating said valves to successively open to the engine cylinders in their order of firing the communications from said casing to the engine cylinders to admit gas under pressure thereto to start the engine and to successively open to the cylinder whose piston is on its compression stroke the port in said casing leading to the atmosphere for the release of the compression therein.

4. A starting device for internal combustion engines and in combination with the engine cylinders thereof, the same comprising a storage reservoir, a valved connection between an engine cylinder and the reservoir whereby the engine on its firing stroke will cause a portion of the burnt gases to pass to the reservoir, a gas controlled distributing member receiving the gas from the reservoir, a valve controlling the supply of gas to said distributing member, connections between said distributing member and the cylinders, said distributing member including independently operable means for consonantly supplying the gas to one cylinder and relieving the compression in only the cylinders which are next in the order of firing.

5. A starting device for internal combustion engines and in combination with the engine cylinders thereof, the same comprising a storage reservoir, means for supplying the burnt gases from one of the cylinders of the engine to the reservoir under pressure, a pressure controlled distributing member, a valved connection between the reservoir and said distributing member, conduits connecting the distributing member with each of the cylinders, said distributing member including independently operable means up-

erated in timed relation with the engine for admitting gas under pressure directly to one engine cylinder from the reservoir through the distributor and simultaneously bringing
 5 only the next cylinders in the order of firing into communication with the atmosphere to relieve the pressure therein.

6. In a starting device for internal combustion engines and in combination, a series of engine cylinders, a storage reservoir,
 10 a valved connection between one of the cylinders and the reservoir whereby upon the firing of the charge in the cylinder a portion of the gases are caused to pass to the
 15 reservoir, a connection between the reser-

voir and the cylinders for supplying the gases directly to the cylinders above the pistons, and combined supply and exhaust valves for each of the cylinders located in the connection between the reservoir and
 20 the cylinders, said valves being controlled by the pressure from said reservoir.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DON D. MILES, JR.

Witnesses:

HARRY A. TOTTEN,
 D. B. RICHARDS.

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