G. A. BRÄUER.

TWO STROKE CYCLE INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 3, 1912.

1,045,505.

Patented Nov. 26, 1912.

2 SHEETS—SHEET 1.

Fig. 2.

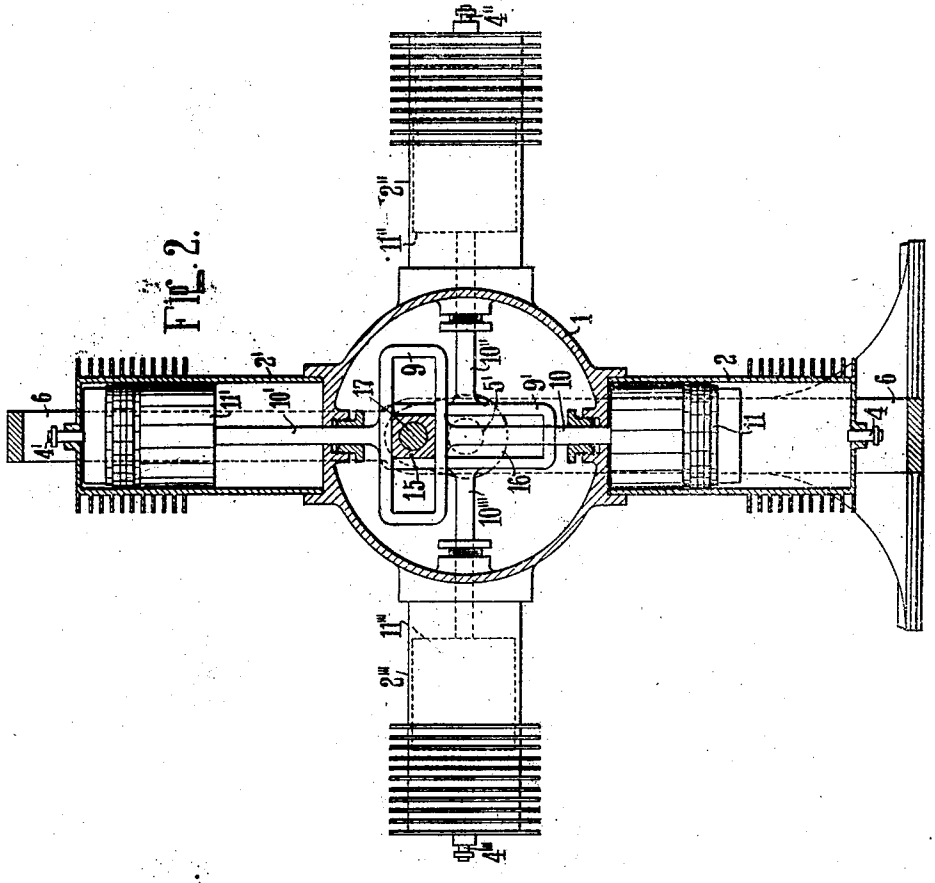
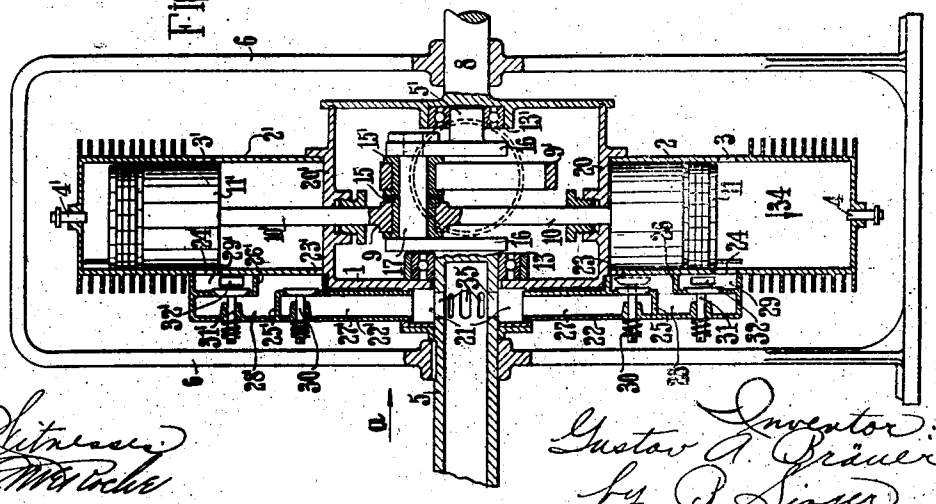


Fig. 1.



Witnesses:
Emil Roche
Carl H. Crawford

Inventor:
Gustav A. Bräuer
by S. Singer Atty

G. A. BRÄUER.

TWO STROKE CYCLE INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 8, 1912.

1,045,505.

Patented Nov. 26, 1912.

2 SHEETS—SHEET 2.

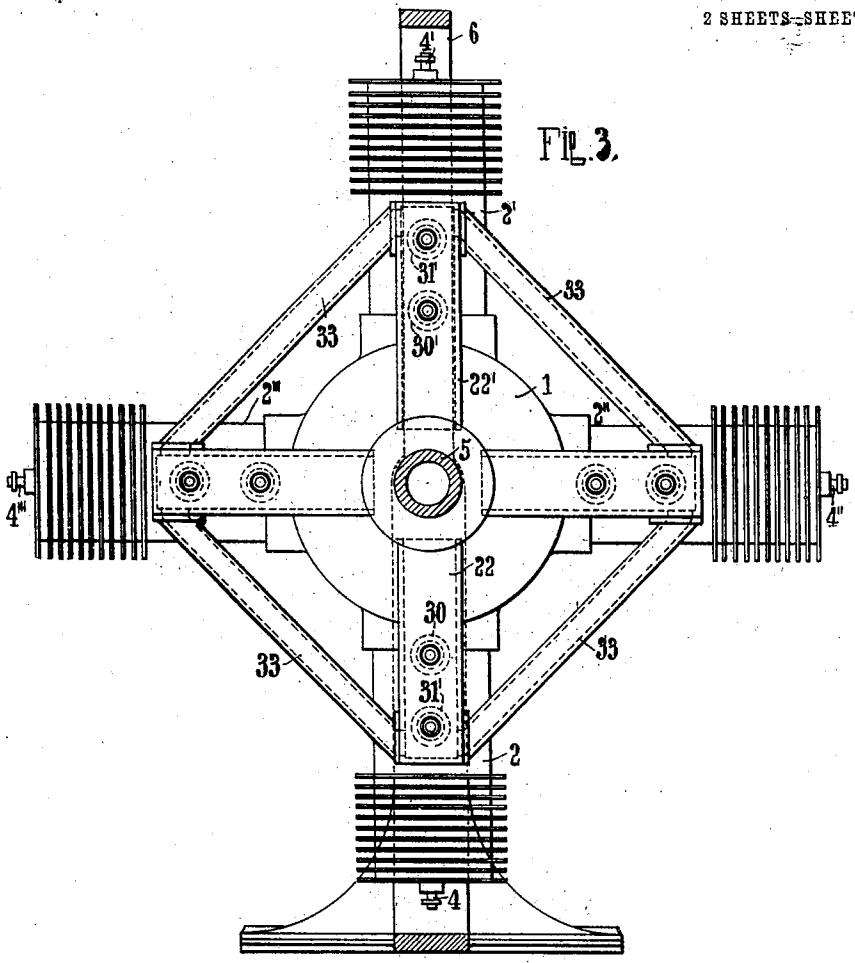


Fig. 3.

Witnesses:
Carl H. Crawford

Inventor:
Gustav A. Bräuer
by B. Singer Atty

UNITED STATES PATENT OFFICE.

GUSTAV AUGUST BRÄUER, OF CHEMNITZ, GERMANY.

TWO-STROKE-CYCLE INTERNAL-COMBUSTION ENGINE.

1,045,505. Specification of Letters Patent. Patented Nov. 26, 1912.

Application filed April 3, 1912. Serial No. 689,333.

To all whom it may concern:

Be it known that I, GUSTAV AUGUST BRÄUER, a citizen of the German Empire, and residing at Chemnitz, Saxony, Germany, have invented certain new and useful Improvements in Two-Stroke-Cycle Internal-Combustion Engines, of which the following is a specification.

My invention relates to an internal combustion engine of the two-stroke-cycle type comprising one or more pairs of cylinders mounted radially relatively to the axle, in which cylinders the gaseous mixture is compressed on one side of a given piston while a fresh quantity of the mixture is simultaneously drawn by suction into the cylinder at the other side of the same piston.

A primary object of my invention is to provide a two-stroke-cycle engine of this type arranged in such manner, in contradistinction to known engines, that when any piston has completed its suction or backward stroke, its next operation is to deliver the gaseous mixture through a storage chamber into those cylinders whose compression chambers are just being connected with said storage chamber, and it is only when almost at the end of its stroke that the piston delivers said gaseous mixture to its own compression chamber. The result is that at the beginning of the backward stroke of said piston the gaseous mixture is pushed without appreciable pressure by the pistons of the other cylinders into the storage chamber and thence into the compression chamber of the cylinder. The advantage of this arrangement is that the gaseous mixture contained in the storage chamber does not attain an excessive pressure, but on the other hand remains constantly without appreciable pressure when it is in motion. Consequently, in an engine according to my invention the gaseous mixture does not expand in passing from the storage chamber into the compression side of the cylinder, as when such expansion occurs there results, as is well-known, not only loss of power, but also separation of the constituents of the gaseous mixture whereby the explosive effect is weakened.

One illustrative embodiment of my invention is represented by way of example in the accompanying drawing, wherein—

Figure 1 is a vertical section through the engine, Fig. 2 is a like section taken in a plane at right angles to the former, and Fig. 3 is a side elevation after removing the front of the frame of the engine.

Referring to the drawing, 1 designates the crank-chamber with which one or more pairs of cylinders are rigidly connected. In the illustrative embodiment two pairs of cylinders 2, 2′ and 2″, 2‴ are so connected. For the sake of clearness the arrangement of the engine will be described with reference to only one pair of opposite cylinders 2, 2′; the arrangement of the engine with reference to the other pair of cylinders 2″ 2‴ will then be readily understood.

3 and 3′ designate the exhaust ports in the walls of the cylinders, and 4, 4′ show the spark-plugs of the two cylinders. The crank-shaft 5, 5′ is fixedly mounted in the engine-frame 6. The crank-chamber 1 is revolubly mounted by means of the bearings 13, 13′ on the stationary crank-shaft 5, 5′ and provided with a journal 8 rotatable in the frame 6. In each of the four cylinders a piston 11, 11′, 11″, 11‴ is arranged to reciprocate, the pistons being rigidly connected to piston-rods 10, 10′, 10″ and 10‴ respectively. The inside ends of the piston-rods 10, 10′ terminate in a slotted guide 9 and those of the piston-rods 10″, 10‴ in a slotted guide 9′, the piston-rods 10, 10′ being rigidly connected together by the guide 9, and the piston-rods 10″, 10‴ by the guide 9′.

The stationary crank-shaft 5, 5′ comprises the crank 16. On the crank-pin 17 of this crank are journaled the guide blocks 15, 15′, of which the first slides within the guide 9 and the second in the guide 9′.

Those ends of the cylinders 2, 2′ which are away from the ignition ends are closed gas-tight by the covers 20, 20′ constituting parts of the crank-chamber. Rigidly connected to one side of the latter is an annular chamber 21 forming a collecting chamber for the gases, to which the inlet-pipes 22, 22′ leading into the cylinders are connected. Each of the said pipes 22, 22′ is divided by the walls 25, 26 and 25′, 26′, respectively, into three chambers 27, 28, 29 and 27′, 28′, 29′, respectively. The chamber 27 is connected with the chamber 28 by the back pressure valve 30 opening toward the latter chamber, and the chamber 27′ is connected in like manner by the back-pressure valve 30′ to the chamber 28′. Furthermore, the chamber 29 is connected with the chamber 29′ by the back-pressure valve 31 open-

ing toward the latter chamber, and the chamber 28′ with the chamber 29′ by the back-pressure valve 31′. The valves 30, 31 and 30′, 31′ are very light and hollow, are under resilient control and are mounted parallel to the crank-shaft, so that centrifugal-force will not cause any undue influence on the same. It will be apparent that the hollow crank shaft 5, the collecting chamber 21 and the chambers 27, 27′ form the gas-supply means while chambers 28, 28′ and 29, 29′ constitute the distribution chambers for the gaseous mixture.

The port 23 connects the chamber 28 to the suction chamber at the end of the cylinder away from the ignition device, while the chamber 28′ is connected to its suction chamber by the port 23′. The chambers 29 and 29′ are connected to the middle parts of the respective cylinders by the ports 24 and 24′, respectively, and by the ports 32 and 32′ to the storage-chamber 33 (Fig. 3) which may, for example, be formed by four tube-like portions.

The described engine operates as follows:—As soon as the piston 11 of cylinder 2 (Fig. 1) starts from its position shown in the drawing and moves backward in the direction of the arrow 34, the valve 30 will be opened and take up the position shown in dotted lines. Consequently, the mixture of gas and air is admitted through the lateral ports 35 of the hollow crank-shaft 5 to the collecting chamber 21 owing to the suction of the piston. The gaseous mixture flows from the collecting chamber 21 through the pipe 27 and the opened valve 30 into the chamber 28 and thence through the port 23 into the suction chamber of the cylinder, while the gaseous mixture on the other side of the piston is compressed. The suction of the piston being completed, the valve 30 is closed by its controlling spring, the compression of the gaseous mixture in the combustion chamber of the cylinder is completed and ignition takes place. The piston 11 now has the position of the piston 11′ in the cylinder 2′ in Fig. 1. As soon as the piston makes its stroke toward the crank-case after the explosion the gaseous mixture which had previously been sucked in is discharged through the port 23 into the chamber 28, and thence through the valve 31, the port 32 and the storage-chamber 33 into the combustion chamber of any other cylinder which is at that time directly connected with the storage chamber 33. This displacement of the mixture will take place during the greater part of the forward-stroke of the piston until the piston opens the port 24. From this moment up to the termination of the stroke of the piston, *i. e.*, until the piston reaches the position of piston 11 in Fig. 1, the gaseous mixture delivered from the cylinder 2 will enter through the port 24 into the combustion chamber of its own cylinder. As soon as the piston commences its backward stroke, *i. e.* moves away from the crank-chamber, the valve 31 will first be closed by its spring; then the gaseous mixture delivered by the pistons of the two other cylinders 2′, 2″, is discharged into the combustion chamber of the cylinder 2, which is still in connection with the storage-chamber 33 through the port 24, until the latter is again closed by the piston moving in the direction of the arrow 34 and the compression of the gaseous mixture takes place, after which the above described operations are repeated.

It will be seen that it is always that piston which has completed the suction of the fresh gaseous mixture which will first of all discharge the said mixture through the storage chamber into those cylinders whose compression-chambers are at that time in direct connection with the storage-chamber 33, and that only toward the end of its stroke toward the crank-case will the said piston discharge the mixture to the combustion chamber of its own cylinder. On the other hand, the gaseous mixture will at the beginning of the backward-stroke of the piston be exclusively discharged by the pistons of the other cylinders into the storage-chamber, and from this into the combustion chamber in front of the piston. The capacity of the suction-chambers of the several cylinders should be so designed that when the gaseous mixture is delivered from the suction chamber of one cylinder to its own combustion chamber, the gaseous mixture is not subjected to an increase of pressure, and also that afterward no expansion of the gaseous mixture on its way from the storage-chamber to that particular combustion chamber will occur. Taking one of the four cylinders, say cylinder 2′, it will be always the cylinder, say 2″, that follows the first one in the direction of rotation which helps to fill the common storage chamber, while the other two cylinders, say 2 and 2‴, in their turn will use the gaseous mixture from the storage-chamber. The amount of gaseous mixture admitted into the storage-chamber will always be the same as that of the mixture removed from it. It follows that the capacity of the storage-chamber may be made as small as desired.

The engine-frame 6, which in the illustrative embodiment is arranged vertically, may be arranged in a horizontal or slanting position.

For preventing the friction of the guide blocks 15, 15′ in the guides 9, 9′ the former may be provided with ball-bearings or roller-bearings in well-known manner. Moreover, the piston-rods 10, 10′, 10″, 10‴ may be linked with connecting-rods instead of being rigidly connected with guides.

One of these connecting-rods may then be rigidly connected with a disk journaled on the crank-pin, and the other may be pivoted to said disk. Further, the exhaust-ports may be arranged in the bottom of the cylinders and the spark-plugs somewhat laterally therein. It will be understood that an engine provided with such modifications would still come within the scope of my invention.

I claim:—

1. In an internal combustion engine of the character described, the combination of an engine-frame, a crank-shaft secured in the frame, a crank-case rotatable about the crank-shaft, a plurality of working cylinders closed at both ends and rigidly connected with the crank-case and radially disposed around said crank-shaft, a double acting piston in each cylinder, each piston being connected with the crank-shaft by means of a piston rod and adapted to rotate around said crank-shaft, each cylinder having two gas-inlets one thereof being located at the inward end of the cylinder and the other at such a point of the cylinder that the inlet cannot be closed by the piston when the same has almost completed its inward-stroke, a storage-chamber permanenfly connected by one of said gas-inlets with each cylinder, gas-supply means connected to the storage-chamber, distributing chambers the number of which corresponds to the number of the cylinders, said distributing chambers being permanently connected with each cylinder by the gas inlets at the inner end of the cylinder and with the gas-supply means by way of non-return-valves opening toward the distributing chamber, and with the storage chamber by non-return-valves opening toward the storage.

2. In an internal combustion engine of the character described, the combination of an engine frame, a hollow crank-shaft secured in the frame, a crank-case rotatable about the crank-shaft, a plurality of the working cylinders closed at both ends and rigidly connected with the crank-case, a double-acting piston in each cylinder, each piston being connected with the crank-shaft by means of a piston-rod and adapted to rotate around said crank-shaft, each cylinder having two gas-inlets one located at the inward end of the cylinder and the other at such a point of the cylinder that the inlet cannot be closed by the piston when the same has almost completed its inward-stroke, a storage chamber permanently connected with each cylinder by one of said gas-inlets, said hollow crank-shaft being provided with lateral ports, an annular chamber mounted to rotate about the crank-shaft and opening into said lateral ports, distributing chambers, corresponding in number to the number of the cylinders and permanently connected with each cylinder by said gas-inlets and with the said annular chamber by non-return valves opening toward the distributing chamber, and with the storage chamber by non-return valves opening toward the storage-chamber.

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

GUSTAV AUGUST BRÄUER. [L. S.]

Witnesses:
CARL ARTHUR REICHALT,
SIDNEY RICH.