PATENT SPECIFICATION

Convention Date (Germany): July 22, 1929.

357,690

Application Date (in United Kingdom): July 22, 1930. No. 22,097/30.

Complete Accepted: Oct. 1, 1931.

COMPLETE SPECIFICATION.

Improvements in Multi-cylinder Internal Combustion Engines.

We, CENTRA HANDELS- & INDUSTRIE A.-G., a corporation organized under the laws of Switzerland, of Quaderstrasse, Chur, Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to multi-cylinder internal combustion engines wherein several sets of radial cylinders, each set having a separate combustion chamber common to the cylinders of the set, are disposed around a crank shaft, to which the pistons in the inwardly directed radial cylinders are connected, the other pistons being connected indirectly to the said crank shaft by gearing.

This arrangement has been proposed heretofore with sets of three cylinders, two of which work in a four-stroke cycle, and the third (the inwardly directed cylinder) working in a two-stroke cycle, the principal function of this third cylinder being to control the supply of fuel mixture and exhaust, in conjunction with a rotary valve.

According to our invention all the cylinders (of which there are at least three in each set) work in a two-stroke cycle, and all of them are power cylinders in the sense of imparting power to the drive of the crank shaft.

An engine in accordance with our invention is shown in the annexed drawings in which the same letters of reference are used in all the views to indicate corresponding parts.

Fig. 1 is a sectional elevation showing the engine, and

Figs. 2 and 3 are sectional plan views on an enlarged scale taken respectively on the lines A—B and C—D of Fig. 1.

In the example shown in the drawings the engine comprises a casing having end walls g and g^1 and a circumferential wall g^2. In the example shown in the figures the engine comprises six sets 1 to 6 of radially disposed cylinders a, b, c, and accordingly the circumferential wall g^2 is hexagonal in cross-section. The said wall g^2 is formed at its corners with six inwardly directed pockets, which are open at their inner and outer ends, and which have the inwardly directed cylinders a of the sets of cylinders mounted therein. Within the cylinders a, b, c pistons a^1, b^1, and c^1 are mounted, which have a common combustion chamber e. In bearings f of the casing g a crank shaft d is mounted. The outwardly directed cylinders b and c are fixed in position by lids i and k.

The connecting rods m of the inner pistons a^1 are connected to a crank n of the crank shaft d, and the pistons b^1 and c^1 of the outwardly directed cylinders b and c of adjacent sets are connected by their connecting rods m respectively with cranks o of the crank shafts p rotatably mounted in extensions of the walls g and g^1. To each of the said crank shafts p a pinion q is fixed which is in mesh with a gear wheel r, and the said gear wheel r is in mesh with a pinion s meshing with a gear wheel t secured to the crank shaft d.

The pistons a^1, b^1 and c^1 of each set of cylinders are controlled so that they move simultaneously into the combustion chamber e or out of the same, and for insuring a uniform torque the cycles of the individual sets 1 to 6 are displaced with relation to one another. As is indicated by the arrows shown in Fig. 1 the rotary movement of the cranks o is transmitted in the reverse direction to the main shaft d.

The six sets 1 to 6 of cylinders are disposed in one plane, as appears from Figs. 2 and 3, and the power developed by the outer pistons of said sets is transmitted through the transmission gears q, r, s, t to the main shaft d. Therefore the power developed by the engine composed of six individual engines is high, and its axial length is small, the said axial length corresponding to the breadth of a single set of cylinders. Further, considering the high power developed by the engine its construction is simple, because only seven cranks, viz. six cranks o and the median crank n, are needed, which result is obtained by transmitting the movement of the cranks o in reverse direction to the shaft d. The operation of the pistons of

each set of cylinders and the sets of cylinders is regular, if the pistons b^1 and c^1 of adjacent sets are connected with a common crank o.

The efficiency of each set of cylinders is high because the pistons a^1, b^1 and c^1 thereof have a common combustion chamber e, which is particularly advantageous in case of Diesel engines. By subdividing the power of the engine and developing the same in a set of individual engines having a good thermic efficiency the thermic strain on the cylinders is reduced so far that cooling of the pistons may be dispensed with. Further, the torque of the engine is uniform.

In the drawings we have shown an engine in which two engines each comprising several sets of cylinders are combined in the same casing g for increasing the power, the said engines being located axially one beside the other. The inner pistons a^1 of both engines are connected with the same crank shaft d, and the outer pistons b^1 and c^1 act on cranks o of the common crank shaft p. The gear wheels q, r, s and t transmitting the power from the outer crank shafts p to the main crank shaft d may be common to both engines. By disposing several engines axially one beside the other, the number of the cranks of the shafts p and d is increased. But in view of the high power of the whole engine its construction is simple and compact.

From the foregoing description of the invention it will be understood that high power is developed by means of a large number of cylinders of small diameter. Therefore cooling of the pistons may be dispensed with, because the heat to be transmitted from the pistons is small. Further, a large number of pistons is connected with the crank shaft, and yet the number of the cranks of the said crank shaft and the axial length of the engine are small. The engine may be manufactured at low cost, and it is reliable in operation.

In the main engine each set of cylinders arranged in the form of a star is an engine capable of developing high power, and the said engine has a high efficiency because a plurality of cylinders have a combustion chamber in common.

The pistons of adjacent cylinders of adjacent sets may be connected with separate cranks, one beside the other, but we prefer to use cranks, each of which is common to two pistons belonging respectively to two adjacent sets. The rotation of the said cranks is transmitted to the main crank in reverse direction, because for obtaining a uniform torque the cycles of the sets of cylinders must be displaced with relation to each other.

The engine is particularly useful in air craft.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An internal combustion engine, comprising a central crank shaft, a plurality of sets of cylinders each set having a common combustion chamber and comprising at least three cylinders extending radially from said combustion chamber, all three working in a two-stroke cycle, said sets being disposed around said crank shaft, pistons in said cylinders, means directly connecting the pistons of the inwardly directed cylinders with said main crank shaft, and gearing connecting the pistons of the outwardly directed cylinders with said crank shaft.

2. An internal combustion engine as claimed in claim 1, wherein the gearing connecting the pistons of the outwardly directed cylinders to the central crank shaft includes auxiliary crank shafts, and means for transmitting rotation therefrom in reverse direction to the central crank shaft, each of said auxiliary crank shafts being common to two pistons belonging respectively to different sets of cylinders.

3. An internal combustion engine as claimed in claim 1, wherein the sets of cylinders are disposed in circular groups side by side around the central crank shaft.

Dated this 22nd day of July, 1930.

For the Applicants,
HERBERT HADDAN & Co.,
Chartered Patent Agents,
31 and 32, Bedford Street, Strand, London,
W.C. 2.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1931.

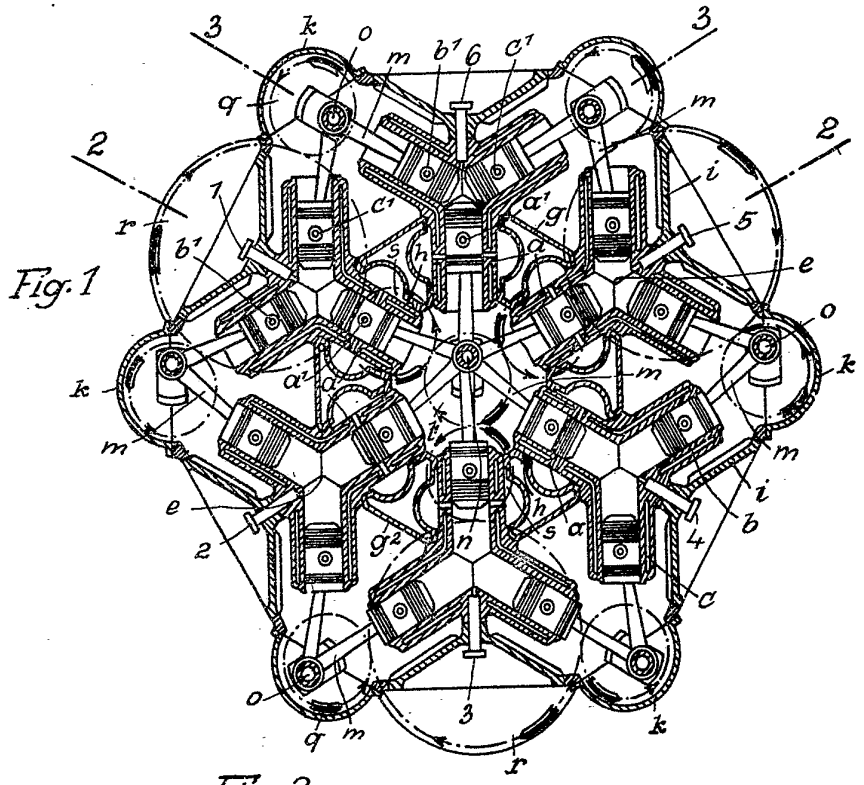


Fig. 1

Fig. 2

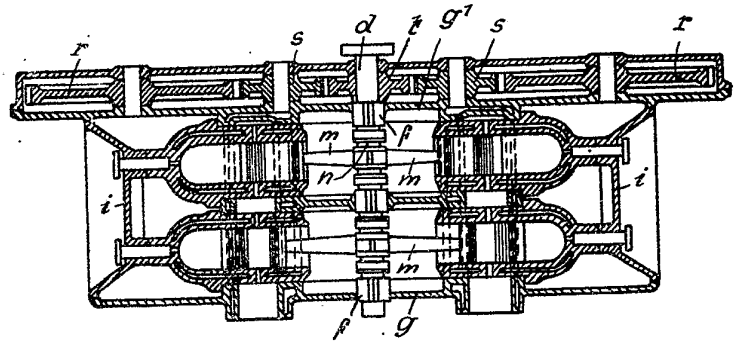
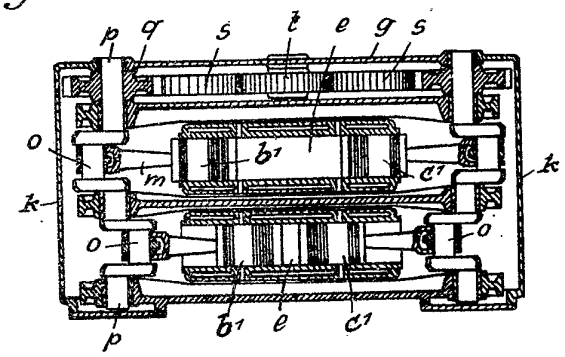


Fig. 3



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