

March 6, 1945.

E. WORKMAN

2,370,902

INTERNAL-COMBUSTION ENGINE

Filed May 22, 1944

4 Sheets-Sheet 1

Fig. 1.

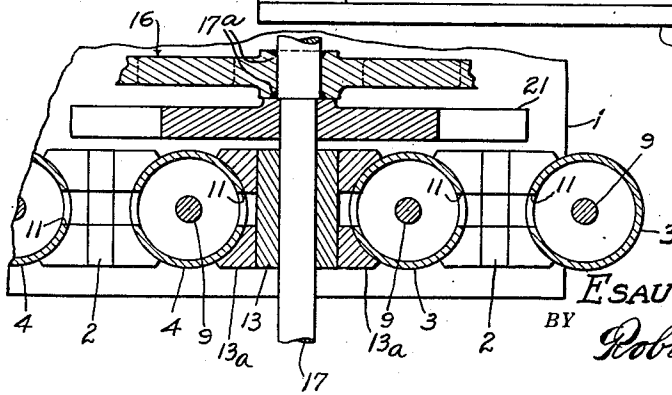
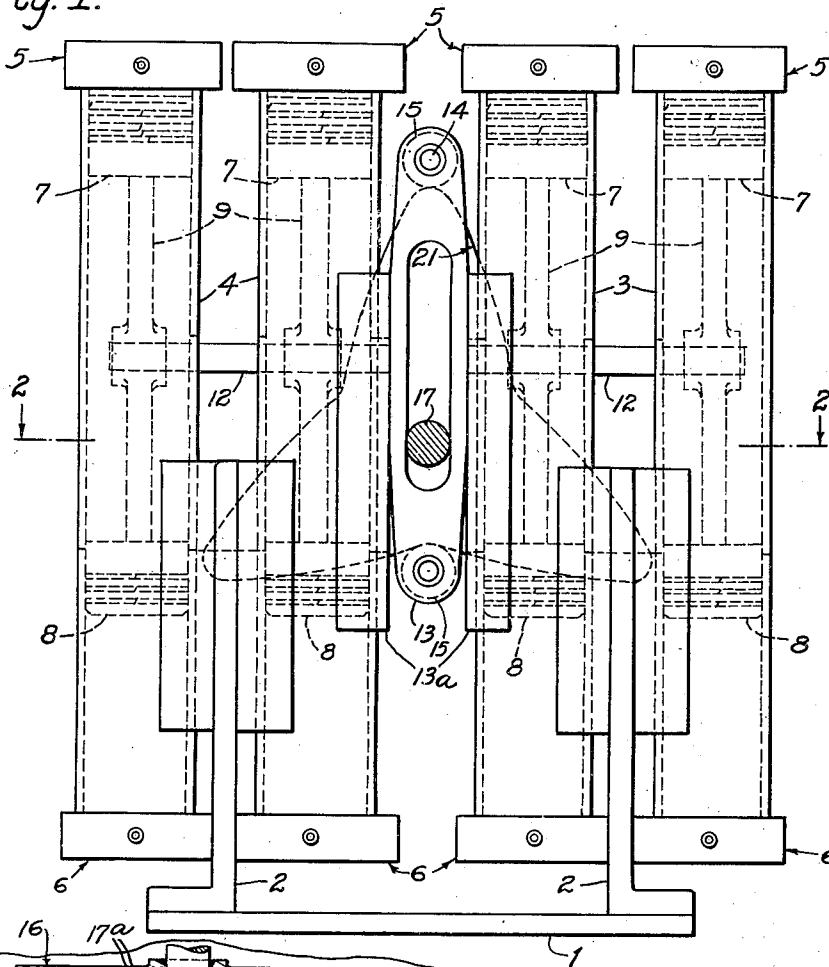


Fig. 2.

INVENTOR
E. SAU WORKMAN
BY *Robt. W. Pearson*
ATTORNEY

March 6, 1945.

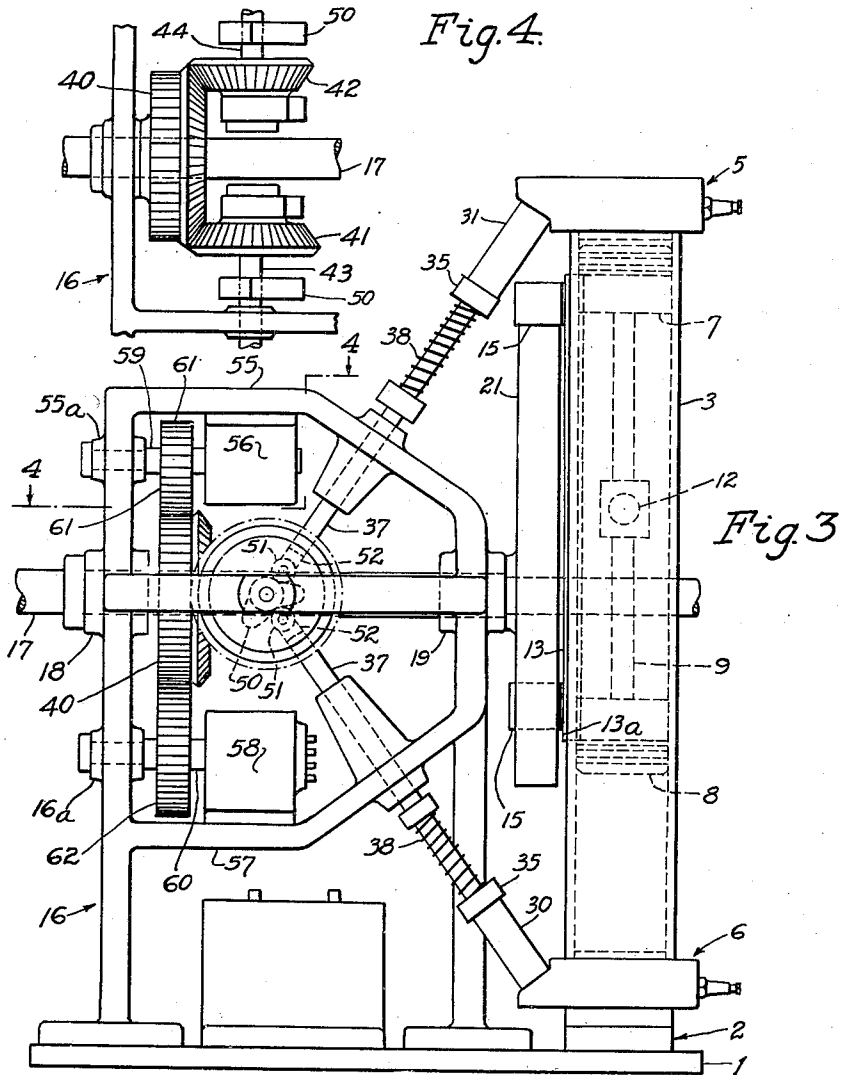
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INVENTOR
ESAU WORKMAN
BY *Robt. D. Pearson*
ATTORNEY

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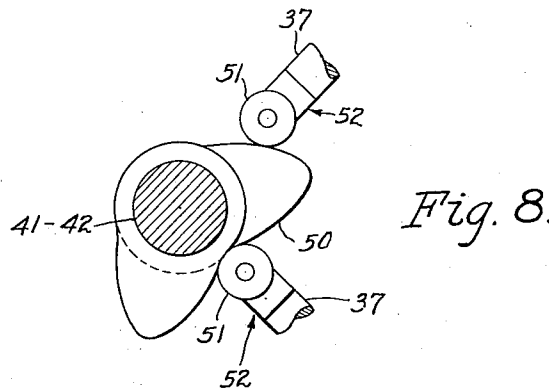
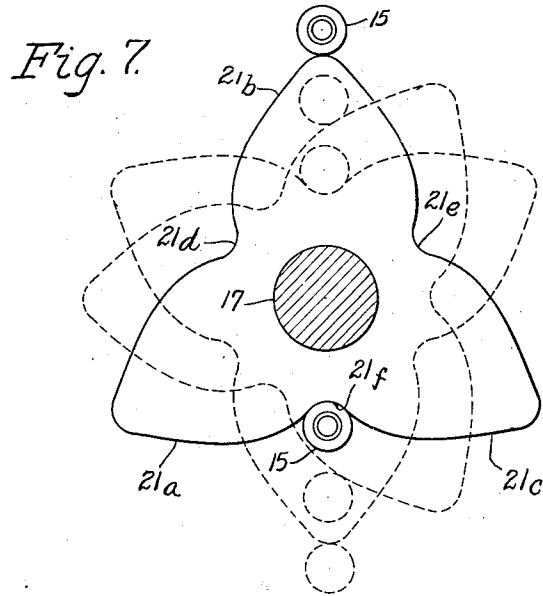
E. WORKMAN

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4 Sheets-Sheet 4



INVENTOR
ESAU WORKMAN
BY *Robt. W. Pearson*
ATTORNEY

UNITED STATES PATENT OFFICE

2,370,902

INTERNAL-COMBUSTION ENGINE

Esau Workman, Corcoran, Calif.

Application May 22, 1944, Serial No. 536,813

4 Claims. (Cl. 123—52)

This invention relates to an internal combustion engine.

Among the objects of the invention are to provide a more efficient internal combustion engine construction preferably of the opposed piston type; to provide a more efficient power transmitting means between the pistons of the engine and the power delivery shaft; to provide a cam-type crank means between the source of power and the delivery end of said power.

A further and more specific object of the invention is to provide a power transmission means of a compact, simplified character, which is particularly well adapted to cooperate with the pistons of an internal combustion engine.

A still further object of the invention is to provide an improved engine-driven means, including a rotatable star-shaped cam, to operate the intake and exhaust valves of an internal combustion engine.

Other objects, advantages and features of invention will hereinafter appear.

Referring to the accompanying drawings, which illustrate what is at present deemed to be a preferred embodiment of the invention,

Fig. 1 is a front view of a cylinder type engine equipped with the power transmission means provided by the invention.

Fig. 2 is a fragmentary sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a side elevational view of Fig. 1.

Fig. 4 is a fragmentary sectional view taken on line 4—4 of Fig. 3.

Fig. 5 is a plan view of Fig. 3.

Fig. 6 is a fragmentary sectional view taken on line 6—6 of Fig. 5.

Fig. 7 is a diagrammatical view of the star-shaped power transmission means.

Fig. 8 is a diagrammatical view of the intake and exhaust valve operating means.

Referring in detail to the drawings, the engine construction comprises a bed plate 1 to each end portion of which is bolted an upright standard 2, said standard affording a mounting means for two cylinders 3 and 4 having on their ends cylinder heads 5 and 6. Said heads are provided with conventional intake manifolds leading from a carburetor, not shown, and conventional exhaust manifolds are also provided for the products of combustion. Spark plugs are provided in the cylinder heads within the usual electrical circuit leading to distributor, generator and battery, with the usual (conventional) accessories required for the operation of cooling, oiling, etc.

Describing further details of the embodiment

of the invention illustrated by way of example in the drawings, in each of the above mentioned engine cylinders are two opposed piston heads, namely, an upper piston head 7 and a lower piston head 8, the piston heads of each pair being rigidly connected together by means of a rod 9. The engine cylinders 3 and 4 are arranged parallel to each other and are sufficiently spaced apart to receive between them certain parts presently to be described. Each of said cylinders is furnished along its mid-length portion with a longitudinal slot 11 formed in the side of the cylinder which is directed toward its mate. A cross bar 12 has a working fit in each of said slots and has its ends rigidly secured to said piston rods. Between the engine cylinders said cross bar has secured to it a vertical slide bar 13, each end of which carries a pivot stud 14, said studs projecting from the same side of the bar 13 and each of them carrying an anti-friction roller 15. Said slide bar 13 operates between and travels along guides 13a carried by the center engine cylinders 3 and 4.

In addition to the standard 1 the base plate 2 carries two other upright standards 16, between and upon which are rotatably supported a horizontal shaft 17, bearings 18 and 19 being provided for this shaft. One end of said shaft 17 projects beyond the bearing 19 and the space between the engine cylinders 4 and 5. To this end portion of said shaft is welded at 17a or otherwise secured a plate-like cam 21 which is so dimensioned and positioned that it at all times bridges the space between the anti-friction rollers 15. Said cam has three radially projecting portions 21a, 21b and 21c, which are symmetrically disposed in relation to each other, which are placed 120 degrees apart and are comprehended within its sinuous peripheral outline, each of said projections having a rounded extremity which adapts it for passing smoothly across the two anti-friction rollers. From another viewpoint the cam 21 may be said to have three equal peripheral recesses 21d, 21e, and 21f, which are spaced 120 degrees apart and which are rounded in such a manner that they drive smoothly across the anti-friction rollers during the operation of the engine. Said cams may be described as star-shaped plates having rounded extremities between which intervene rounded recesses.

In Figs. 2 and 3 a preferred means is illustrated for operating the intake valves 30 and the exhaust valves 31. The two means shown are identical, therefore a description of only one

of them will be necessary, it being needful only to state that to each cylinder head is attached an inclined guide sleeve 35 within which slides a push rod 37 normally held in an extended position by a spring 38.

Describing next the means for operating the push rods 37, near one of the standards 2 there is rigidly supported upon shaft 17 a combined spur and bevel gear 40. The beveled portion of this gear meshes at one side with a beveled pinion 41 and at its other side with a beveled pinion 42. The pinion 41 is fixed to a shaft 43 and the pinion 42 is fixed to a shaft 44, these shafts being disposed on opposite sides of and at right angles to the shaft 17. Only the end portions of said shafts 43 and 44 are shown in Fig. 4, it being understood that these shafts are rotatably supported in any desired conventional manner. To each of these shafts is fixed a set of cams 50 and (as shown in Fig. 3) said cams are positioned to act upon rollers 51 carried by suitably mounted plungers 52 that cooperate with the rods 37 to operate the intake and the exhaust valves of the engine. The cams 50 are timed to operate with the cam 21 already described and are relatively smaller. The cams 21 and 50 necessarily have unequal radial positions for the timing and power distribution, respectively.

One of the standards 4 has bolted to its upper end an upstanding angular bracket 55 having secured to its underside a generator 56, and to the lower portion of the same standard 16 is secured a horizontal bracket 57 which supports a current distributor 58. The generator is operated by a shaft 59, and the distributor 58 is driven by a shaft 60. The bracket 55 carries a bearing 55a for one end of the shaft 59 and the standard 16 carries a bearing 60a for one end of the shaft 60. The shaft 59 has fixed to it a gear 61 meshed with the aforesaid gear 40, the shaft 60 having to it a gear 62 also meshing with the gear 40.

It is understood that two or more engine assemblies hereinbefore described may be assembled around said driving shaft 17 at predetermined angles to one another to provide an increased and alternate power flow.

In the operation of the device the rollers 15 travel around the star-shaped cam 21, said cam being so contoured as to at all times completely fill up the space between said rollers. As the rollers reciprocate they act forcibly upon the cam and cause it to rotate, thereby also rotating the power transmission shaft 17 to which the cam is fixed.

It is to be understood that a single power transmission shaft 17 may have fixed to it a plurality of the cam driving members 21 and any desired multiple of engine cylinders, and valve timing cams 50, without exceeding the scope of the claimed invention.

I claim:

1. In an internal combustion engine having a pair of parallel adjacent spaced apart cylinders each of which contains a piston and is furnished with a longitudinal slot directed toward the other, a cross bar extending through said slots and rigidly connected with said pistons, a guide adjacent to and extending along the slotted portions

of said piston cylinders, a member mounted between and upon said guides and connected with said cross bar to reciprocate with said pistons, spaced apart rollers carried by said member, a power transmission shaft, and a star-shaped cam fixed to said shaft in a position at all times to bridge the space between said rollers and be by them rotated as the pistons reciprocate.

2. In an internal combustion engine having a pair of parallel adjacent spaced apart cylinders each of which contains a combustion chamber in each of its end portions and an intervening double piston and is furnished with a longitudinal slot directed toward the other, a cross bar extending through said slots and rigidly connected with said pistons, a guide adjacent to and extending along the slotted portions of said piston cylinders, a member mounted between and upon said guides and connected with said cross bar to reciprocate with said pistons, spaced apart rollers carried by said member, a power transmission shaft, and a star-shaped cam fixed to said shaft in a position at all times to bridge the space between said rollers and be by them rotated as the pistons reciprocate.

3. In an internal combustion engine having a plurality of parallel adjacent spaced apart cylinders each of which contains a piston and is furnished with a longitudinal slot directed toward the other of its pair, a cross bar extending through said slots of each pair and rigidly connected with said pistons, guides adjacent to and extending along the slotted portions of said piston cylinders, members mounted between and upon said guides and connected with said cross bars to reciprocate with said pistons, spaced apart rollers carried by said members, a power transmission shaft, and star-shaped cams fixed to said shaft in a position at all times to bridge the space between said rollers and be by them rotated as the pistons reciprocate, thereby to drive a single power transmission shaft from a plurality of pairs of engine cylinders.

4. In an internal combustion engine, a plurality of pairs of parallel, adjacently spaced apart cylinders, each cylinder of said pairs containing a combustion chamber in each of its end portions and an intervening double piston and having a longitudinal slot, the slot of one cylinder of each pair being directed toward that of the other piston of each pair, a cross bar extending through the slots of each pair of pistons and rigidly connected with such pistons, guides adjacent to and extending along the slotted portions of said piston cylinders, members mounted between and on said guides and connected with said cross bars to reciprocate with said pistons, spaced apart anti-friction members carried by each of said members, a power transmission shaft, and cams each having unequal radial dimensions, each of said cams being fixed to said shaft in a position at all times to bridge the space between aforesaid anti-friction members, thereby to drive a single power transmission shaft from a plurality of engine cylinders.

ESAU WORKMAN.