May 16, 1933. C. E. SOUTHWICK 1,909,729

ENGINE

Filed June 20, 1931 3 Sheets-Sheet 1

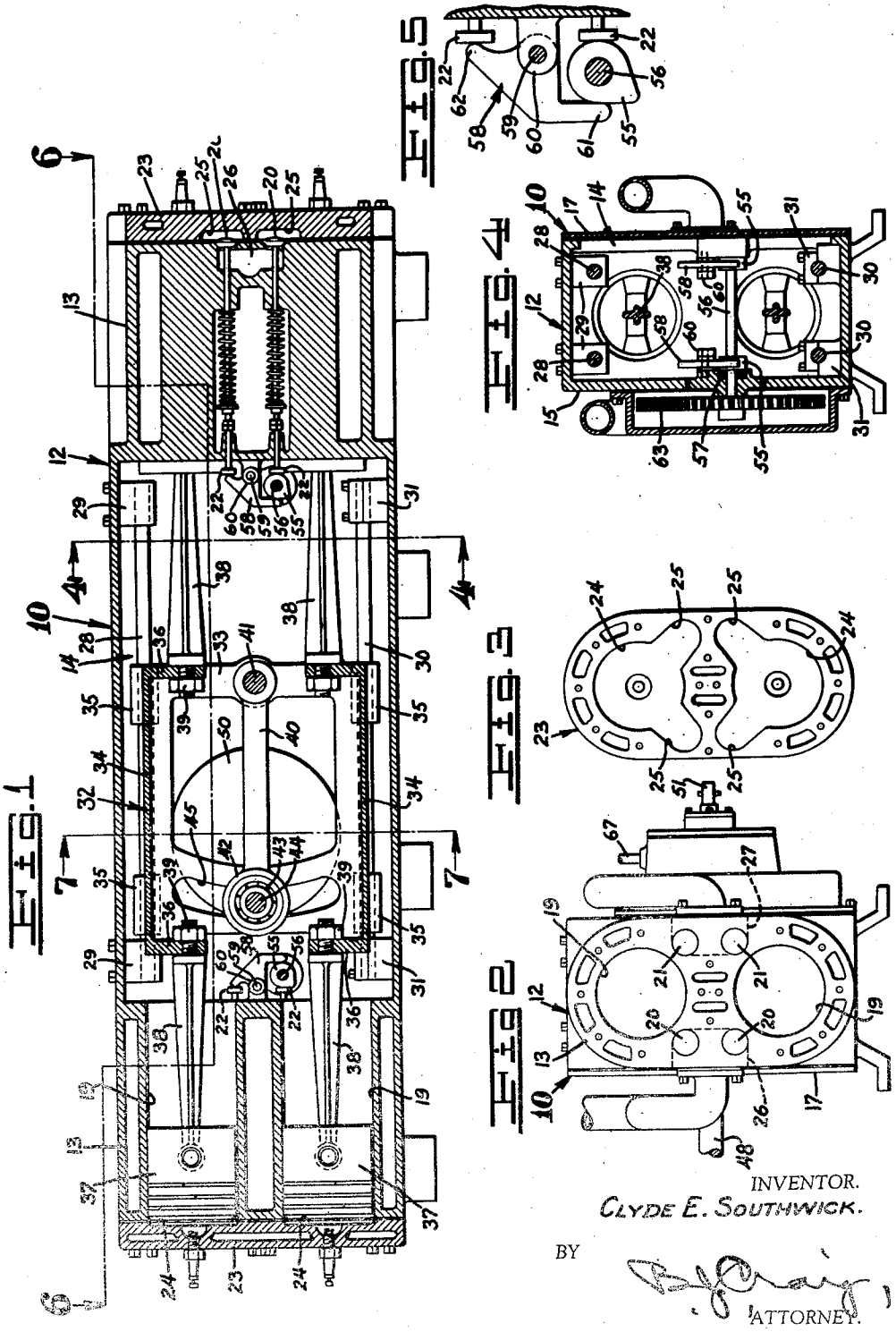


Fig. 1

Fig. 5

Fig. 4

Fig. 3

Fig. 2

INVENTOR.
CLYDE E. SOUTHWICK.

BY

ATTORNEY.

May 16, 1933. C. E. SOUTHWICK 1,909,729

ENGINE

Filed June 20, 1931 3 Sheets-Sheet 2

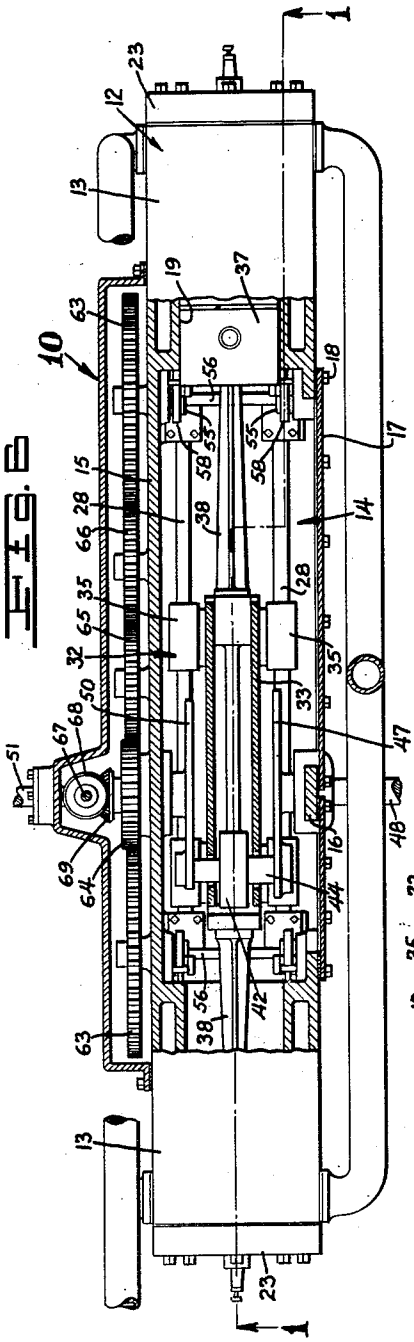


FIG. 8

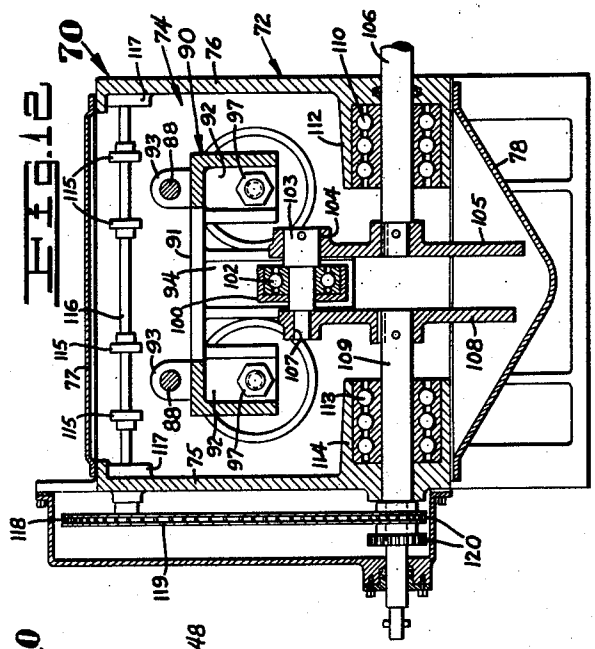


FIG. 12

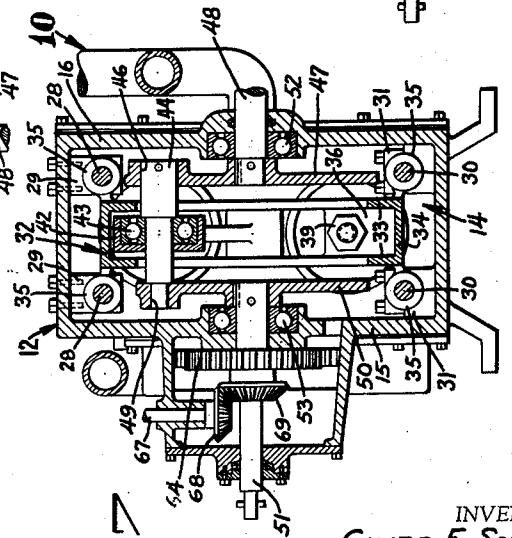


FIG. 7

INVENTOR.
CLYDE E. SOUTHWICK.

BY

ATTORNEY.

May 16, 1933. C. E. SOUTHWICK 1,909,729

ENGINE

Filed June 20, 1931 3 Sheets-Sheet 3

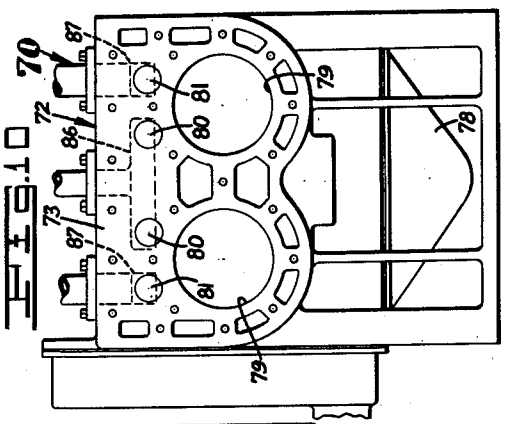


Fig. 10

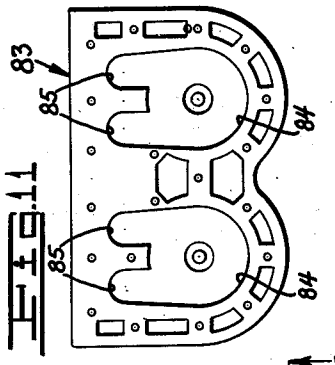


Fig. 11

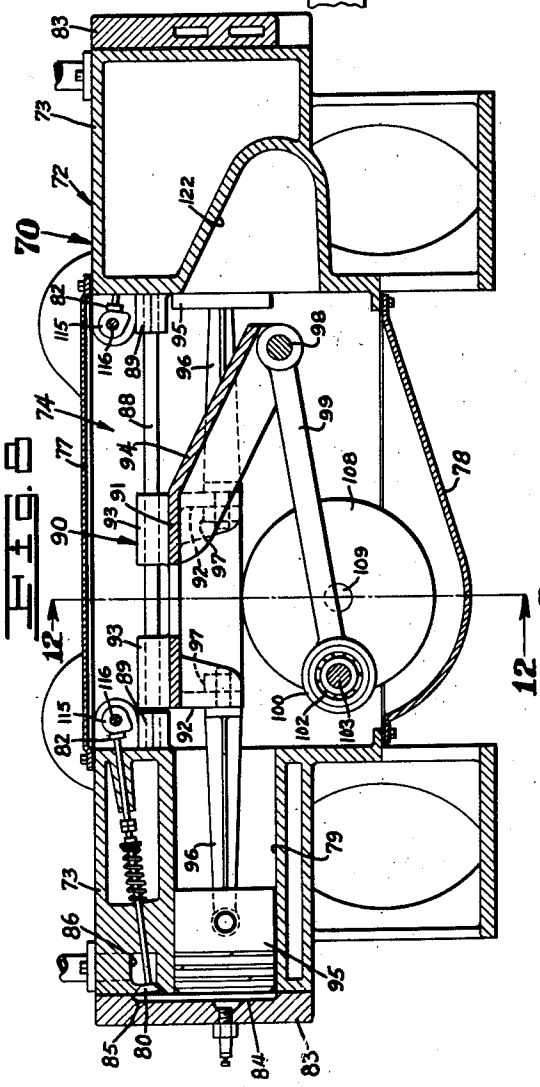


Fig. 8

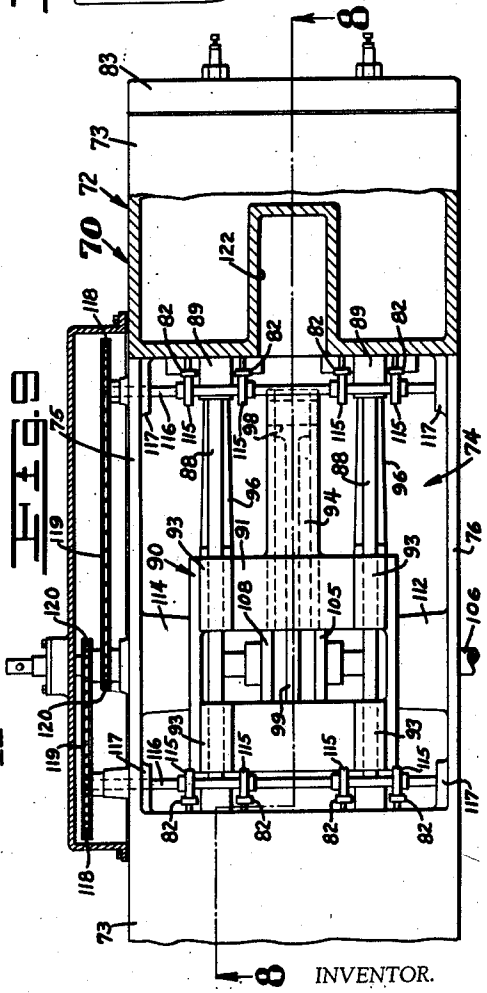


Fig. 9

INVENTOR.
CLYDE E. SOUTHWICK.
BY
ATTORNEY.

Patented May 16, 1933 1,909,729

UNITED STATES PATENT OFFICE

CLYDE E. SOUTHWICK, OF ALHAMBRA, CALIFORNIA

ENGINE

Application filed June 20, 1931. Serial No. 545,685.

This invention relates to improvements in reciprocating engines.

The general object of the invention is to provide an engine including cylinders and pistons and a crank shaft, and wherein the pistons are connected in a novel manner to the crank shaft to rotate the same.

A further object of the invention is to provide a reciprocating engine including opposing cylinders with a carrier member having the piston rods rigidly connected thereto, together with novel means for connecting the carrier member to the crank shaft.

An additional object of the invention is to provide an engine including a reciprocating carrier member and a crank shaft and wherein an arm is pivotally mounted on the carrier and connected to the crank shaft in such manner that upon reciprocating movement of the carrier the crank shaft will be rotated.

Other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a longitudinal vertical section through my improved engine taken on line 1—1 of Fig. 6.

Fig. 2 is an end view of the engine with the cylinder head removed.

Fig. 3 is an end view of the inside face of one of the cylinder heads.

Fig. 4 is a section taken on line 4—4 of Fig. 1.

Fig. 5 is an enlarged side view of the valve actuating mechanism.

Fig. 6 is a section taken on line 6—6 of Fig. 1.

Fig. 7 is an enlarged section taken on line 7—7 of Fig. 1.

Fig. 8 is a longitudinal vertical section through a modified form of engine taken on line 8—8 of Fig. 9.

Fig. 9 is a top plan view of the engine shown in Fig. 8 with portions thereof broken away and with the cover plate removed.

Fig. 10 is an end view of the engine shown in Fig. 8 with the cylinder head removed.

Fig. 11 is an end view of the inside face of one of the cylinder heads of the modified form of engine and

Fig. 12 is an enlarged section taken on line 12—12 of Fig. 8.

Referring to the drawings by reference characters I have indicated my improved engine generally at 10.

As shown, this engine comprises a housing 12, having a cylinder block 13 at each end, with a chamber 14 between the cylinder blocks. The rear of the chamber 14 is shown as closed by a wall 15 of the housing while the front of the chamber is open except for a vertical bearing support or web 16 (see Fig. 7) which is integral with the housing. The front of the chamber 14 is adapted to be closed by cover plates 17, which are secured to the housing by bolts 18.

In each of the cylinder blocks 13, I provide a pair of cylinder bores 19, which are arranged one above the other and those in opposed cylinder blocks are preferably coaxial. Although I show two cylinders at each end it will be understood that the number of cylinders may be varied to suit the requirements in each case.

For each of the cylinders 19 I provide an inlet valve mechanism 20 and an outlet valve mechanism 21. These valve mechanisms may be of the usual construction and may include valve tappets 22 which extend into the working chamber 14.

Each cylinder block is provided with a head 23 which includes a pair of combustion recesses 24, coaxial with their associated cylinders and valve clearance recesses 25 which communicate with their respective combustion recesses 24.

The inlet valve mechanisms 20 in each of the cylinder blocks are adapted to control the passageway from a valve chamber 26 to

the associated valve recesses 25 in the cylinder head and the exhaust valve mechanisms in each cylinder block are adapted to control the passageway from a valve chamber 27 to the associated valve recesses 25 in the cylinder head.

Positioned in the chamber 14 I provide a pair of spaced upper guide rails 28 which are supported in bearings 29 and a pair of lower guide rails 30 which are supported in bearings 31.

Mounted on the guide rails 28 and 30, I provide a carrier or cross head 32 which includes side members 33, top and bottom members 34 and apertured bearing members 35, in which the guide rails 28 and 30 are positioned. At each end of the cross head adjacent the top and bottom thereof I provide short flange members 36.

Positioned in each of the cylinder bores 19, I provide a piston 37 which may be of any desired construction and which includes a connecting rod 38.

The connecting rods 38 of the pair of pistons at one end of the engine are rigidly secured to the flanges 36 of the cross head 32 as by nuts 39 and the connecting rods of the pair of pistons at the opposite end of the engine are similarly secured to the flanges 36 at the opposite end of the cross head.

Positioned between the side walls of the cross head I provide an arm 40 which at one end is pivotally connected to the cross head as at 41. The opposite end of the arm 40 is provided with a housing 42 in which an anti-friction bearing member 43 is positioned. The anti-friction bearing 43 is mounted on a stud pin 44 which extends through apertures 45 in each of the side walls 33 of the cross head 32.

One end of the stud pin 44 is positioned in an aperture 46 of a disk member 47 which is secured to a drive shaft 48 as by a key and a pin as shown in Fig. 7. The other end of the stud pin 44 is positioned in an aperture 49 of a disk member 50 which is secured to a shaft 51 as by a key and a pin.

The drive shaft 48 is mounted in an anti-friction bearing member 52 in the bearing web 16 and the shaft 51 is mounted in an anti-friction bearing member 53 in the rear wall 15 of the engine housing 12.

For operating each set of the valve mechanisms 20 and 21 I provide a pair of cam members 55 which are mounted on a cam shaft 56 supported in bearings 57 on the engine housing 12. The cam members 55 are adapted to act directly on the tappets 22 of the lower valve mechanisms and indirectly on the upper valve mechanisms through the medium of rocker arms 58.

Each of the rocker arms 58 is pivotally connected as at 59 to bearing members 60 and includes a finger 61 which is adapted to engage the cam 55 and a finger 62 which is adapted to engage the tappet 22 of the upper valve mechanism. Thus it will be seen that when the cam shaft 56 is rotated the cam 55 will operate the lower valve tappet and will rock the arm 58 which in turn will operate the tappets of the upper valve mechanisms.

On each of the cam shafts 56 I provide a gear 63. The gear 63 on the cam shaft nearest to the engine shaft 51 meshes with a gear 64 which is secured to the shaft 51 while the gear 63 farthest from the shaft 51 is driven by the gear 64 through the medium of a gear train including idler gears 65 and 66.

The ignition system of the engine may be of any desired type and the distributor may be driven in any desired manner or by a shaft 67 having a bevel gear 68 thereon which meshes with a bevel gear 69 on the shaft 51.

When the engine 10 is operating the explosion of the fuel in one of the cylinders at one end forces the piston towards the opposite end which, through the medium of its associated connecting rod, moves the cross head 32. As the cross head moves the arm 40 is moved with it and exerts a pressure on the stud pin 44. As the stud pin cannot move in a straight line it moves in an arc and rotates the disk members 47 and 50. As the disk member 47 rotates it rotates the drive shaft 48 and as the disk member 50 rotates it rotates the shaft 51.

When the cross head reaches approximately the limit of its movement from its initial position an explosion of fuel occurs in one of the cylinders at the end of the engine toward which the cross head has moved and through the medium of the piston and its associated connecting rod moves the cross head in the reverse direction, whereupon the arm 40 and the pin 44 continue to rotate the disk members 47 and 50 in the same direction to complete one revolution.

In Figs. 8 to 12 inclusive I have indicated a modified form of my invention generally at 70. This engine operates on the same principle as the engine 10 but is slightly different in construction.

As shown the engine 70 comprises a housing 72 having a cylinder block 73 at each end with chamber 74 between the cylinder blocks. The rear of the chamber 74 is closed by a wall 75 of the housing and the front is closed by a similar wall 76. The top of the chamber is shown as adapted to be closed by a plate 77 and the bottom is shown as closed by a casing 78.

In each of the cylinder blocks 73 I provide a pair of spaced cylinder bores 79 which are arranged side by side and those in opposed cylinder blocks are preferably coaxial.

For each of the cylinder bores 79 I provide an inlet valve mechanism 80 and an outlet valve mechanism 81. These valve mechanisms may be of the usual construction and include valve tappets 82 which extend into the working chamber 74.

Each cylinder block is provided with a head 83 which includes a pair of combustion recesses 84 coaxial with their associated cylinders and valve clearance recesses 85 which communicate with their respective combustion recesses 84.

The inlet valve mechanisms 80 in each of the cylinder blocks are adapted to control the passageway from a valve chamber 86 to the associated valve recesses 85 in the cylinder head, and the exhaust valve mechanisms in each cylinder block are adapted to control the passageway from the valve chambers 87 to the associated valve recesses 85 in the cylinder head.

Positioned in chamber 74 I provide a pair of spaced guide rails 88 which are positioned above the cylinders 79 and supported in bearings 89. Mounted on the guide rails 88 I provide a carrier or cross head 90 which includes a top plate 91 having spaced downwardly extending flanges 92 at each end and apertured, upwardly extending, bearing members 93 in which the guide rails 88 are positioned. The cross head further includes a tail member 94 which extends outwardly and downwardly from one end of the plate 91.

Positioned in each of the cylinder bores 79 I provide a piston 95 which may be of any desired construction and which includes a connecting rod 96. The connecting rods 96 of the pair of pistons at one end of the engine are rigidly secured to the adjacent flanges 92 of the cross head 90 as by nuts 97 and the connecting rods of the pair of pistons at the opposite end of the engine are similarly secured to the flanges 92 at the opposite end of the cross head.

Pivotally secured to the tail member 94 of the cross head as at 98 I provide an arm 99 which at the end opposite the pivot includes a housing 100 in which is positioned an anti-friction bearing member 102. The anti-friction bearing member 102 is mounted on a stud shaft 103. One end of the stud shaft 103 is positioned in an aperture 104 of a disk 105 which is secured to a drive shaft 106 as by a key and a pin as shown in Fig. 12. The other end of the stud shaft 103 is positioned in an aperture 107 of a disk member 108 which is secured to a shaft 109 as by a key and pin.

The drive shaft 106 is journaled in an anti-friction bearing 110 which is mounted in a boss 112 on the front wall 76 and the shaft 109 is journaled in an anti-friction bearing 113 which is mounted in a boss 14 on the rear wall 75.

For operating each set of the valve mechanisms 80 and 81 I provide a cam member 115 for each valve mechanism, which are mounted on a cam shaft 116 supported in bearings 117 on the engine housing. The cam members 115 engage the valve tappets 82 of the inlet and outlet valve mechanisms 80 and 81 and are arranged on the cam shaft 116 in a position to actuate the valve mechanisms in correct relationship.

On each of the cam shafts 116 I provide a sprocket wheel 118 which is connected by a sprocket chain 119 to an associated sprocket wheel 120 secured to the shaft 109.

The ignition system of the engine 70 may be of any desired type and it may be driven in any desired manner.

When the engine 70 is operating the explosion of fuel in one of the cylinders at one end forces the piston towards the opposite end, which in turn through the medium of its associated connecting rod moves the cross head 90. As the cross head moves the arm 99 is moved with it and exerts a pressure on the stud pin 103. As the stud pin cannot move in a straight line it moves in an arc and rotates the disk members 105 and 108. As the disk member 105 rotates it rotates the drive shaft 106, and as the disk member 108 rotates it rotates the shaft 109.

When the cross head reaches approximately the limit of its movement from its initial position, an explosion of fuel occurs in one of the cylinders at the end of the engine toward which the cross head has moved, and through the medium of the piston and its associated connecting rod moves the cross head in the reverse direction, whereupon the arm 99 and the stud shaft 103 continue to rotate the disk members 105 and 108 in the same direction to complete one revolution.

To shorten the length of the engine 70 I provide a chamber 122 in the cylinder block 73 adjacent the tail member 94 of the cross head 90. When the cross head moves towards the chamber 122 the tail member 94 of the cross head enters the chamber 122.

Although I have described my invention as embodied in a four cycle gas engine it will be understood that the invention can be used wherein a two cycle operation is provided or wherein the engine is operated on the Diesel principle or other principles, without departing from the spirit of the invention.

Furthermore, my invention may be used equally as well in a pump or air compressor.

From the foregoing description it will be apparent that I have invented an engine wherein the maximum power can be developed and wherein the engine can be economically manufactured, and wherein the parts are not liable to get out of order.

Having thus described my invention, what I claim is:

1. In a device of the class described, a plurality of cylinders, a piston in each cylinder, a carrier, means connecting each of said pistons to said carrier, a shaft and means connecting said carrier and said shaft to rotate the shaft, said means comprising an arm pivotally mounted on said carrier, a stud pin on said shaft, said arm having one end engaging said stud pin and having one end of the arm connected to said shaft, said carrier having a slot and said stud pin passing through said slot.

2. In a device of the class described, a plurality of cylinders, a second plurality of cylinders disposed in alignment with said first cylinders and spaced therefrom, a chamber arranged between said first and second cylinders, said cylinders opening into said chamber, a piston in each of said cylinders, a piston rod associated with each of said pistons, a carrier member, all of said piston rods being rigidly secured to said carrier, means to mount said carrier for movement in said chamber, an arm pivotally mounted on said carrier, a shaft having an eccentric portion on said crank shaft rotatably supported, said carrier member having a slot therein and said crank shaft passing through said slot, an eccentric crank portion on said crank shaft and means connecting said eccentric crank portion and said arm.

3. In a device of the class described, a block comprising a first pair of cylinders, a second pair of cylinders coaxial with said first pair, a chamber between said pairs of cylinders, a piston in each of said cylinders, a piston rod associated with each of said pistons, a carrier member positioned in said chamber, said piston rods being rigidly connected to said carrier, a plurality of guide rods in said chamber, said carrier being slidably mounted on said guide rods, an arm pivotally mounted on said carrier, a bearing member carried by said arm, a shaft rotatably mounted in said motor block, said shaft having an eccentric pin thereon, said carrier member having a slot therein and said pin passing through said slot, said eccentric pin being positioned in said bearing member of said arm.

4. In a device of the class described, a housing, said housing including spaced cylinder blocks and having a chamber between said blocks, a cylinder bore in each of said cylinder blocks, a carrier in said chamber, means to support said carrier for sliding movement, a piston in each of said cylinder bores, a connecting rod secured to each of said pistons, said connecting rods being secured to said carrier, a pair of spaced shafts rotatably supported in said housing, said shafts having a member thereon supporting a pin offset from the axis of said pair of shafts, said carrier member having a slot therein and said pin passing through said slot, an arm pivotally secured to said cross head and including a bearing portion in which said pin is positioned.

In testimony whereof, I hereunto affix my signature.

CLYDE E. SOUTHWICK.