June 26, 1962 T. HAHN 3,040,716

PISTON ENGINES

Filed June 15, 1959 3 Sheets-Sheet 1

FIG. 1

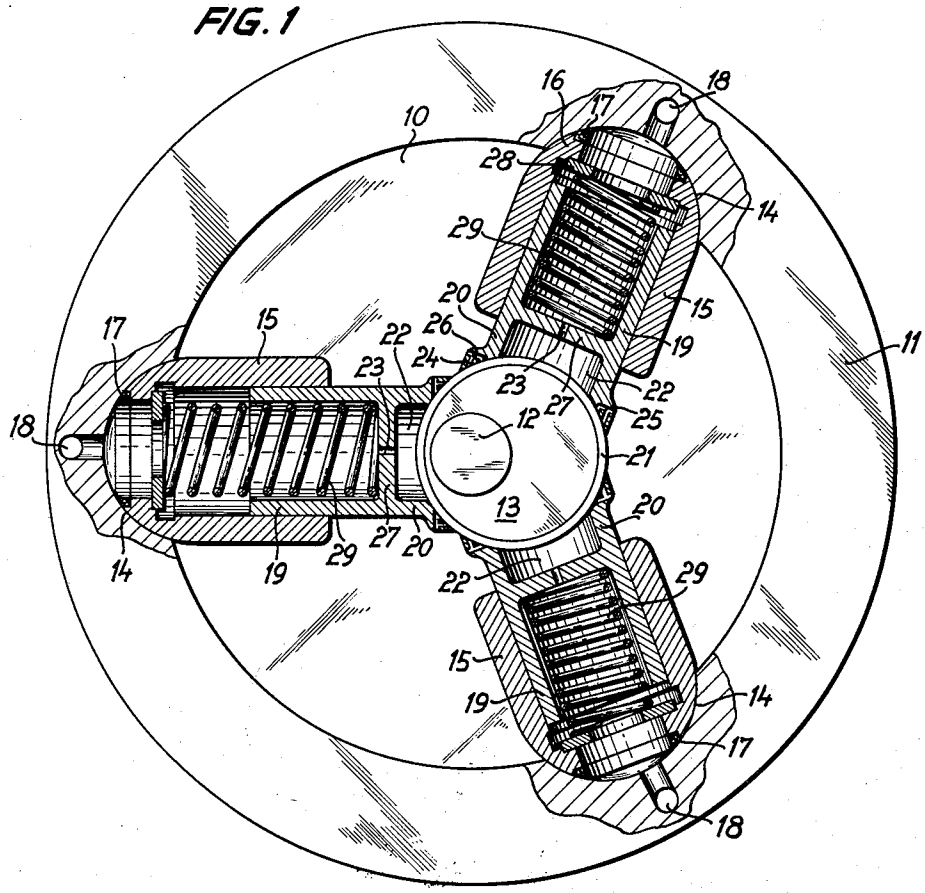
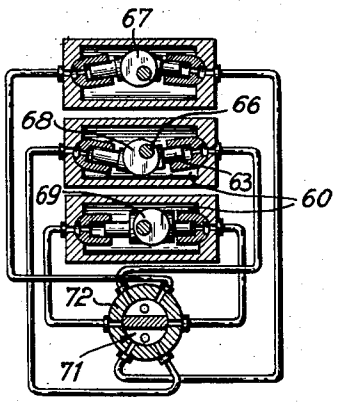


FIG. 4



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PISTON ENGINES

Filed June 15, 1959 3 Sheets-Sheet 2

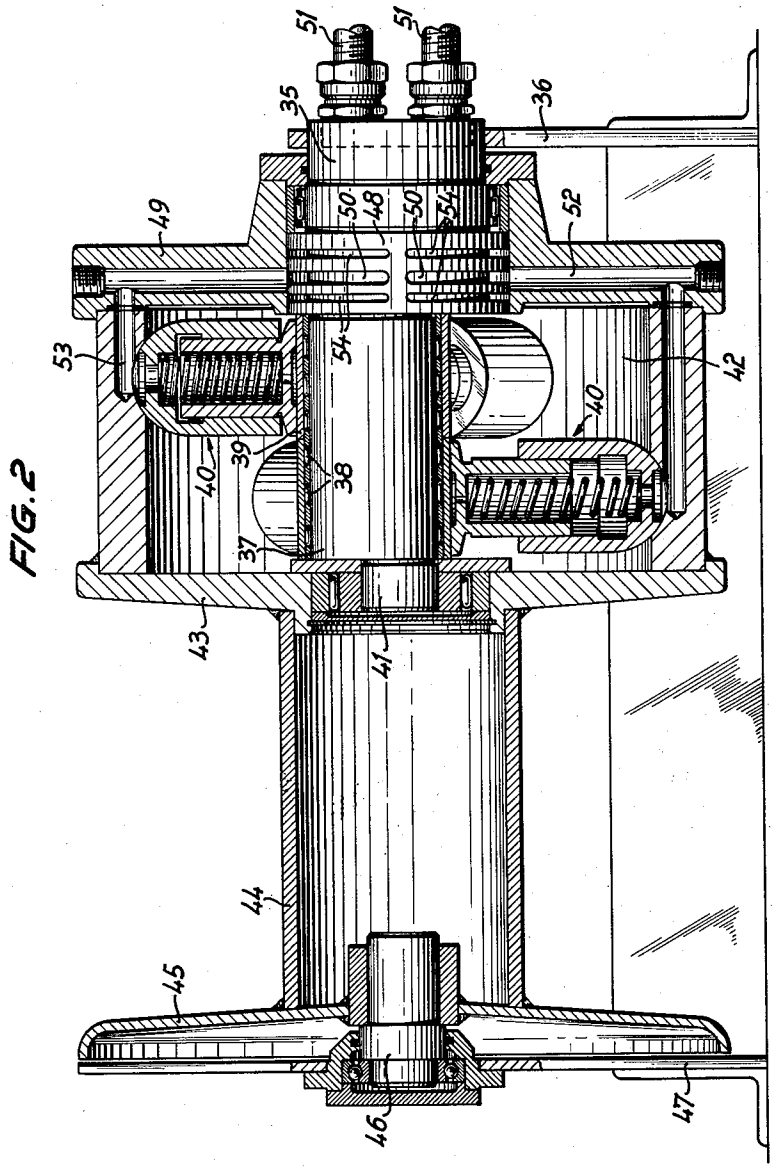

FIG. 2

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PISTON ENGINES

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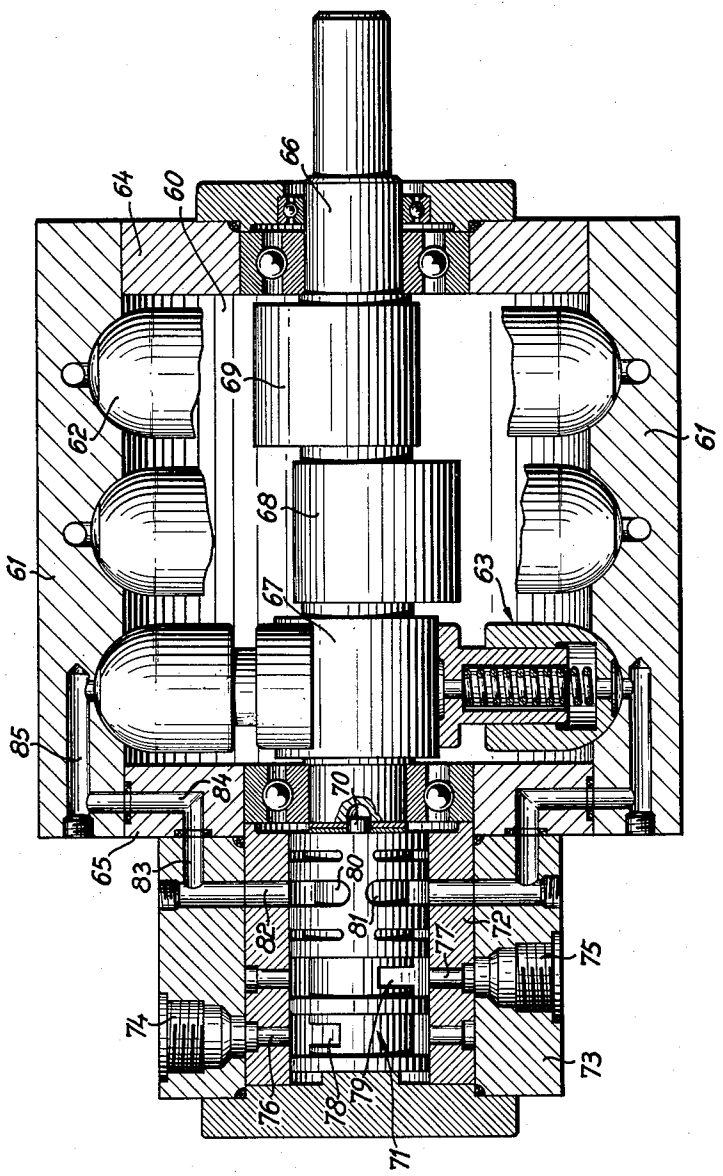
FIG. 3



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United States Patent Office 3,040,716
Patented June 26, 1962

3,040,716

PISTON ENGINES

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Filed June 15, 1959, Ser. No. 820,164
Claims priority, application Germany June 28, 1958
22 Claims. (Cl. 121—59)

This invention relates to a piston engine, which is particularly suitable for use as a hydraulic motor and which has a plurality of piston-cylinder arrangements, which are constructed as telescopically extensible hollow bodies and which each independently bear by a pressure shoe against a crank with the interposition of a force and are at the other end supported so as to be capable of swinging.

In a prior construction of piston engine of the above kind intended for the direct hydraulic drive of for example a tractor running wheel, cylinders are mounted in the wheel body radially so as to be swingable about axes parallel with the wheel axis, and in these cylinders are disposed hydraulically operable pistons which bear by pressure shoes against partial regions of the surface of a supporting member disposed eccentrically in relation to the wheel, a sleeve mounted on rollers being inserted between the pressure surfaces of the pressure shoes and the supporting member. The working chambers of the piston-cylinder arrangements are supplied with the working medium through pasages provided on the one hand in the supporting member and on the other hand on the piston-cylinder arrangements. In this construction the piston-cylinder arrangements are mounted positively on pins extending in parallel relationship to the axis of rotation of the arrangement and in addition to a complicated assembly this means that the arrangement requires a great deal of space and permits only low power output. In addition, the operational dependability leaves much to be desired, since the supply system for the working medium provided in these circumstances causes difficulty and also results in a poor efficiency.

It has also been proposed to mount a star-shaped cylinder block on a crank positively so as to be rotatable, the bores which carry the pistons in the said cylinder block extending continuously to the crank. At the outer end, the pistons are supported on a housing through the medium of piston rods. It has not been possible for such arrangements to gain any practical importance, since the sealing of the working chambers on the crank side is not satisfactory and does not last a sufficiently long time. In addition, assembly is also difficult with such arrangements. Moreover, very unfavourable stresses, which restrict the power output, occur at the joints connecting the pistons to the piston rods.

The object of the invention is to provide a piston engine of the above-described kind which, while having a simple and compact construction, has a long life and can be subjected to heavy loads, and, while requiring little space, gives high power output and also takes overloads without subjecting the bearing surfaces to unfavourably high stresses. To this end, according to the invention, the piston-cylinder arrangements are loaded by a force acting in the direction of extending, and are held at both ends in supporting bearings with the interposition of a force. This gives a very simple and compact construction of the arrangement with only a few simple parts. The piston-cylinder arrangements associated with the engine form independent structural groups which can be installed and removed independently of one another without further assembly work. The operative position of the piston-cylinder arrangements is maintained by the force acting on them in the extending direction. This force can be produced in various ways. It is, for example, possible to keep the working medium of the machine always under a certain positive pressure which produces the force acting in the extending direction which is necessary for the securing of the piston-cylinder arrangements with the interposition of a force. As a rule, however, it is simpler to provide between the piston and the cylinder of the piston-cylinder arrangement a spring arrangement acting in the extending direction. A helical compression spring could, for example, be used for this purpose. Instead of this, however, other elastic members or arrangements could also be provided.

The accommodation with the interposition of a force of the ends of the piston-cylinder arrangements remote from the crank can also be effected in various ways. For example, the ends of the piston-cylinder arrangements remote from the crank can be mounted in knife-edge bearings or the like. It has proved particularly advantageous, however, to allow each of the piston-cylinder arrangements to rest by their end faces remote from the crank on a supporting surface permitting a tipping movement. The supporting surfaces may be curved, for example, in the form of cylindrical surfaces. Instead of this, it is in some cases more advantageous to make the supporting surfaces and the associated end faces of the piston-cylinder arrangements spherical. The greater freedom of adjustment then existing enables any deviations in the dimensions of the parts to be equalised more easily, so that greater machining tolerances for the parts are permissible.

The force-effected supporting of the end of the piston cylinder arrangement remote from the crank as proposed according to the invention also offers the advantageous possibility of considerably reducing the bearing pressure in this region, the said bearing pressure governing the life and capacity of the arrangement to take load. For this purpose it is advisable to provide the end face of the piston-cylinder arrangement remote from the crank and forming a bearing surface, with an aperture communicating with the working chamber and leading to a direct support of the working medium at the supporting surface and enclosed by the bearing surface. In the region of this aperture the working medium then presses directly on the supporting surface, that is to say no mechanical friction occurs which might lead to wear and tear. The aperture is bounded by the bearing surface, so that sealing satisfying all requirements is automatically obtained. In further development of this principle, the end of the piston-cylinder arrangement remote from the crank and the associated supporting surface may have recesses which jointly form a part of a passage carrying the working medium. This enables the working medium to be fed to the piston-cylinder arrangement in a very simple and economical manner, while the supporting pressure is utilised directly for the purpose of sealing off the movable connection.

Moreover, the pressure shoe of the piston-cylinder arrangement may equivalently have an aperture communicating with the working chamber and leading to a direct support of the working medium on the crank and enclosed by the bearing surface of the pressure shoe. In this way, a direct supporting of the working medium on the crank or a sleeve mounted rotatably on the latter in manner known per se is also obtained at this end of the piston-cylinder arrangement and reduces the mechanical surface pressure and hence the wear occurring during operation. This is particularly important in the region of the supporting of the piston-cylinder arrangement on the crank side, since in this region considerable speeds occur during the operation of the arrangement and in the comparable previously known piston engines result either in unfavourable limitation of the working pressure or rapid wear. These difficulties are fundamentally ob-

viated by the direct supporting of the working medium according to the invention. With such arrangements it may, of course, be advisable to provide a cross-sectional constriction between the working chamber of the piston-cylinder arrangement and the aperture provided in the bearing surface of the pressure shoe. The effect thereby achieved is that in the event of any unintentional lifting of the pressure shoe from the crank, for example as the result of faulty operation of the arrangement or through a fault in the supply of the working medium, the positive pressure present in the working chamber and acting on the piston-cylinder arrangement in the stretching direction cannot completely collapse. The operational dependability is thus maintained even in unfavourable circumstances.

The size of the apertures in the bearing surfaces of the piston-cylinder arrangement respectively facing and remote from the crank can be adapted to the size of the appertaining axial projection surface of the working chamber so as to produce a surface pressure sufficient for sealing purposes and originating primarily from the pressure of the working medium. This enables the mechanical pressure always to be limited independently of the working pressure of the arrangement in such manner that while adequate sealing occurs the mechanical friction nevertheless remains below the permissible limits. The specific loading can be made particularly low when the end face bearing surfaces also have elastic packings inserted. Very low pressures are then sufficient for dependable sealing. In addition to or instead of this the sealing can also be improved by contriving grooves enclosing the apertures in the end face bearing surfaces of the piston-cylinder arrangements. The groove spaces are advantageously connected to the pressure-free space by conduits. In this way cushions of pressure oil or the like, which might impair the sealing, are prevented from forming at the slide surfaces. Such constructions are advantageous especially for the running surface of the pressure shoe.

The invention can successfully be embodied in piston engines of various types of construction. According to one preferred embodiment it is proposed to allow at least two piston-cylinder arrangements supported with the interposition of a force at the outer end in a fixed housing and lying in a common radial plane to co-operate jointly with a crank of the shaft. When in such arrangements at least three piston-cylinder arrangements are provided for a crank, a machine is obtained having a very uniform reception for the working medium and capable of starting automatically from any position. It is, however, also possible to dispose one behind the other a plurality of groups of piston-cylinder arrangements. In this way, while the complete arrangement requires little space, high torques can be produced when the machine is constructed as a motor and high deliveries when constructed as a pump.

Piston engines of the kind according to the invention which have at least three piston-cylinder arrangements lying jointly in a radial plane, are advantageously constructed with a housing in the form of a body of rotation. It is possible, however, to allow the piston-cylinder arrangements to co-operate in each case by pairs with one crank, their ends remote from the crank being situated diametrically opposite to one another with respect to the shaft. It is then more favourable to make the housing flat, this giving extremely small overall dimensions. In such arrangements, a plurality of pairs of piston-cylinder arrangements are advantageously disposed with the same basic longitudinal direction one after the other which co-operate with cranks offset in relation to one another in the direction of rotation. A preferred embodiment of such a machine provides three cranks, which are each offset by 120° in relation to one another and are each subject to the action of two piston-cylinder arrangements which are directed in opposition, and the supports of which, remote from the cranks, all lie in an axial plane in relation to the shaft. This gives the decisive advantage that the stresses on the bearings of the machine shaft remain extremely low.

The piston machines according to the invention may also be constructed differently inasmuch as it is possible either to drive in relation to a stationary housing a shaft carrying the crank or cranks or else to allow the facing ends of the piston-cylinder arrangements to rest on a stationary bearing member and to guide the supporting body enclosing the piston-cylinder arrangements and securing their outer ends so as to be rotatable eccentrically in relation to the axis of the bearing member. This latter construction is advantageous in so far as the supporting body constructed as a body of rotation can directly form a part of an energy-transmitting structural part, such as a rope drum or the like. Clutches and the like may thus be dispensed with so that the complete arrangement, while giving high performance, remains light and compact and has a good efficiency.

It has already been stated that it is advantageous in the arrangement according to the invention to supply the working medium to the piston-cylinder arrangement at the outer end which is supported so as to be capable of swinging. The control may be effected by a rotary valve rigidly coupled directly to the rotating part of the machine. Instead of this, however, it is also possible to use a separate valve arrangement rotating synchronously with the machine. A rotary valve arrangement coupled directly to the rotating part of the machine is preferable as a rule, since it enables the arrangement to be made particularly compact. To this end, the rotary valve arrangement and the housing supporting the piston-cylinder arrangement at the outer end may have passages therein for the working medium, the inlets of which passages, lying in side faces, coincide with one another after the coupling of the housing parts. In this way, exposed pipelines or the like can as a rule be completely dispensed with, so that the machine has an untrammelled appearance and damage rarely occurs even with unusual stresses.

In order that the invention may clearly be understood and carried into effect the same will now be described by aid of the accompanying drawings in which:

FIGURE 1 is a side elevation, in partial section, of a piston engine which can be used particularly as a hydraulic motor.

FIGURE 2 shows in longitudinal section, a rope winch with directly connected hydraulic motor,

FIGURE 3 is sectional view of a piston engine according to a further embodiment,

FIGURE 4 is a diagrammatic view of the control of the piston engine shown in FIGURE 3.

The piston engine shown in FIGURE 1 has a shaft **12**, which is mounted rotatably in side walls **10** of a substantially annular housing or abutment means **11** and which carries a crank **13** constructed as an eccentric. The casing of the housing **11** has on the inside three dome-shaped depressions **14**, which are arranged uniformly around the periphery and in each of which is located a cylinder **15** by its spherically shaped outer end **16**. Each cylinder end **16** is bored longitudinally to form a hollow body and carries an elastic packing **17** which surrounds the bore and which bears against the dome **14** so as to seal. The housing **11** contains for each piston-cylinder arrangement a working medium supply passage **18** which is formed by bores and which leads into the dome **14**. In the cylinder **15** a piston in the form of a hollow body **19** is guided to be longitudinally slidable and its free end is supported by a pressure shoe **20** against a bush **21** rotatable on the eccentric **13** preferably with the interposition of anti-friction bodies such as needle bearings. The bearing face of the pressure shoe **20** surrounds in the form of a ring a central aperture **22** which communicates with the working chamber of the piston-cylinder arrangement through a relatively narrow passage **23**. Moreover, annular grooves **24**, **25** are pro-

vided in the slide face of the pressure shoe 20 and communicate with the interior of the housing through passages 26. Between an end 27 of the piston 19 containing the passage 23 and an annular disc 28 inserted in the cylinder is interposed a compression coil spring 29 which is prestressed in the direction of extending of the piston-cylinder arrangement and maintains the operative position of the piston-cylinder arrangement which is supported at both ends solely with the interposition of a force, the said position being maintained even when the working chamber of said arrangement is pressureless. A spring of this kind could be dispensed with if the arrangement can always be kept under a positive pressure. The ratio of the size of the bearing faces to the apertures or recesses giving a direct support of the working medium is selected, taking into account the size of the piston surfaces exposed to the pressure of the working medium on the one hand, and of the cylinder on the other hand in such manner that mechanical friction is kept below the permissible limit but dependable sealing is still obtained. The sealing pressure in these circumstances rises with the working pressure so that a dependable sealing is obtained under all operating conditions. The cross-sectional constriction 23 provided between the working chamber of the piston-cylinder arrangement and the recess 22 is intended to prevent collapse of the working pressure in the cylinder-piston arrangement in the event of any lifting of the pressure shoe 20 away from the bush 21 in consequence of faulty operation or damage, the flow of working medium through the passage 23 being limited.

By means of a rotary valve (not shown in detail in the drawing), which may be coupled to the shaft 12, the piston-cylinder arrangements are successively connected alternately to the supply of pressure fluid and the discharge line, so that the shaft 12 is driven continually. For this mode of operation it is not absolutely necessary for the end face of the cylinder to have a bore which renders possible direct support of the working medium in the dome 14. Nor is it necessary to provide an aperture 22 in the pressure shoe 20. These constructions afford considerable advantages, however, inasmuch as they enable very high pressures of the working medium to be used, that is to say high powers to be obtained with small dimensions for the arrangement. Moreover, packings 17 or grooves 24, 25 may be dispensed with.

In the arrangement of FIGURE 2 which shows a combined unit consisting of a winch and hydraulic motor a shaft 35 is held in a bearing bracket 36 so as to be rigid in respect of rotation. Bushes 39 are mounted rotatably on an eccentric 37 of the shaft 35 through the medium of needle rollers 38 and co-operate in each case with three piston-cylinder arrangements 40 of the type already described in connection with FIGURE 1, the said piston-cylinder arrangements lying in the form of stars in two parallel radial planes. The free end of the shaft 35 is constructed as a spigot 41 which represents a bearing member for a housing or abutment means 42 which is constructed substantially as a body of rotation and which is mounted on the other hand on the part of the shaft 35 facing the bearing bracket 36. In this housing the outer ends of the piston-cylinder arrangements 40 are accommodated with the interposition of a force so as to be capable of swinging in the manner already described in connection with FIGURE 1. Rigidly connected to the side wall 43 of the housing 42 centrally in relation to the axis of the spigot 41 is a drum 44 which is provided with a side disc 45 at its free end and is mounted rotatably on a stub shaft 46 carried by a bearing bracket 47. The stationary shaft 35 carries a directly attached member 48, which in co-operation with an appropriate construction of the side wall 49 of the housing forms a rotary valve controlling the distribution of the working medium. To this end, two grooves 50 extending in a common radial plane in the peripheral direction are provided in the member 48 of the shaft 35. Said grooves are each connected by means of longitudinal bores passing through the shaft end, to a conduit 51 supplying the working medium. In the region of the grooves 50 radially extending bores 52 are provided in the housing wall 49 and in dependency on the rotary position supply and discharge the working medium for the individual piston-cylinder arrangements through further bores 53. Associated with the grooves 50 are relief grooves 54 which are connected to the passages carrying the working medium in such manner that the pressure difference of the said working medium between the supply and discharge sides cannot produce any unilateral bearing pressures.

The hydraulic motor forming the basis of FIGURES 3 and 4 of the drawing has a flat box-shaped housing or abutment means 60, which has preferably detachable side walls 61. Formed in the latter, lying in a row in each case, are dome-shaped depressions 62, each of which accommodates the outer end of a piston-cylinder arrangement 63 of the type already described, with the interposition of a force. In the housing side walls 64 and 65 a shaft 66 is mounted rotatably which carries eccentrics 67, 68 and 69 which form cranks and which are offset in relation to one another by 120° in each case in the peripheral direction. Against these eccentrics bear the pressure shoes of the cylinder-piston arrangements 63 which each co-operate by pairs with an eccentric and the outer ends of which are situated diametrically opposite one another with respect to the axis of the shaft 66, while in addition all the dome-shaped depressions 62 of the housing are disposed in a common plane passing through the axis of the shaft 66. This gives a very compact construction, since the housing 60 requires only a small height. Rigidly coupled to the shaft 66 by a coupling projection 70 is a rotary valve 71 rotatable in a bush 72 mounted rigidly in a housing 73. Connected to the housing 73 in unions 74 and 75 are the conduits carrying the working medium. The latter flows through bores 76 and 77 respectively passing through the bush 72 into annular passages 78 and 79 respectively of the rotary valve, which are connected, by longitudinal bores, not shown, to approximately semi-circular grooves 80 and 81 and relief grooves of the type already described associated with these. In the common plane of rotation of the grooves 80 and 81 bores 82 are provided in the bush 72, being distributed over the periphery, and are connected to the inlet apertures of the cylinder-piston arrangements through further passages 83, 84, 85. The passage 83–85 are so disposed that they directly complement one another when the housing part 73 is connected to the housing 61. The control of the arrangement is shown in FIGURE 4 in particular. On the rotation of the rotary valve 71 in the bush 72 the individual piston-cylinder arrangements are successively connected alternately to the pressure fluid line and the discharge line. The overlaps of the conduits, which will be seen in FIGURE 4 and which could be directly contrived in the housing parts only with difficulty, are according to FIGURE 3 avoided by grooves appropriately disposed on the outer surface of the bush 72 and extending between the bores 82 and the corresponding housing bores, so that the provision of the passages within the housing parts affords no difficulty.

As already stated, the constructions illustrated are only particular embodiments of the invention. The latter is not restricted thereto. On the contrary, many other constructions and applications are possible. The invention can be equivalently embodied for pumps serving for hydraulic purposes especially, although the application to hydraulic motors offers special advantages. Modifications are possible, for example by supporting the cylinders of the piston-cylinder arrangement on the crank pin or the supporting member associated with the facing ends of the piston-cylinder arrangements, while the pistons are directed towards the outsides. The cross-

sectional constrictions or passages 23, which are variable if required, of the kind shown in FIGURE 1, could be dispensed with, that is to say it would be possible to allow the working chambers of the piston-cylinder arrangements to extend unthrottled as far as the bush 21 or the crank pin 13. On the other hand, the pistons could also be closed in the region of their pressure shoes 20. In equivalent manner, the cross-section of the bores passing through the cylinder ends could be limited in such manner that only a regular supply and discharge of the pressure medium takes place. In arrangements according to FIGURES 1 and 2, it would be possible for a greater or lesser number of piston-cylinder arrangements than three lying in a radial plane to co-operate with the shaft or the supporting member. Moreover, it is possible to connect successively in each case as many groups of piston-cylinder arrangements as required to achieve the desired power. The piston-cylinder arrangements may in these circumstances co-operate with one or more crank pins. The devices controlling the distribution of the working medium may be modified in many ways and, if required, be accommodated outside the actual engine.

What I claim is:

1. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies and each having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said arrangements; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and the second ends of said arrangements against said abutment means, said arrangements retained between said crank means and said abutment means solely by the action of said biasing means.

2. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a hollow cylinder and a hollow piston telescopically received in said cylinder, each piston-cylinder arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said piston-cylinder arrangements; and spring means inserted between the cylinder and piston of each arrangement for respectively biasing said pressure shoes against said crank means and the second ends of said arrangements against said abutment means, said arrangements retained between said crank means and said abutment means solely by the action of said springs.

3. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies and each having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said arrangements; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and the second ends of said arrangements against said abutmeans, said abutment means formed with supporting surface means permitting tipping movements of said arrangements with respect thereto, said arrangements retained between said crank means and said abutment means solely by the action of said biasing means.

4. A piston engine comprising in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies and each having a first end and a curved second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said arrangements; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and the second ends of said arrangements against said abutment means, said abutment means formed with curved supporting surface means engaging with the curved ends of said arrangements, said arangements retained between said crank means and said abutment means solely by the action of said biasing means.

5. The piston engine as set forth in claim 4, wherein the second ends of said arrangements and said supporting surfaces are spherical.

6. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber and each arrangement having a first and a second end, each said second end formed with aperture means communicating with the respective chamber; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said arrangements and formed with passages for a working medium in communication with the respective aperture; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to sealingly press the second ends of said arrangements against said abutment means, said arrangements retained between said crank means and said abutment means solely by the action of said biasing means.

7. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber and each piston-cylinder arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said arrangements, said abutment means and said second ends formed with recesses constituting passages for a working medium to said working chambers; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to sealingly press the second ends of said arrangements against said abutment means, said arrangements retained between said crank means and said abutment means solely by the action of said biasing means.

8. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber and each piston-cylinder arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement, each pressure shoe formed with aperture means communicating with the respective working chamber and each pressure shoe also having a bearing surface surrounding the respective aperture means; abutment means adjacent the second ends of said arrangements, said abutment means and said second ends formed with recesses constituting passages for a working medium to said working chambers; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press the bearing surfaces of said shoes into sealing engagement with said crank means to prevent discharge of working medium between the pressure shoes and the crank means and to sealingly press the second ends of said arrangements against said abutment means, said aperture means permitting direct contact of the working medium with said crank means and the ratio between the cross-sectional areas of the aperture means and of the respective working chambers being such that a surface pressure sufficient for sealing purposes is produced between said shoes and said crank means, said surface pres-

sure originating primarily rfom the pressure of the working medium.

9. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber and each piston-cylinder arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; abutment means adjacent the second ends of said arrangements, said abutment means and said second ends formed with recesses constituting passages for a working medium to said working chambers; elastic packing means mounted in and surrounding the recesses of the second ends of said piston-cylinder arrangements; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to sealingly press said packing means against said abutment means.

10. The piston engine as set forth in claim 7, wherein said pressure shoes are formed with apertures communicating with the respective working chambers and with bearing surfaces surrounding said apertures and sealingly engaging with said crank means to prevent discharge of working medium between the pressure shoes and the crank means, said apertures permitting direct contact of the working medium with said crank means.

11. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber and each piston-cyinder arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement, each pressure shoe formed with aperture means communicating with the respective working chamber and each pressure shoe having a bearing surface surrounding the respective aperture means; means defining a cross-sectional constriction for the working medium between the aperture means of each pressure shoe and the respective working chamber; abutment means adjacent the second ends of said arrangements, said abutment means and said second ends formed with recesses constituting passages for a working medium to said working chambers; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press the bearing surfaces of said shoes into sealing engagement with said crank means to prevent discharge of working medium between the pressure shoes and the crank means and to sealingly press the second ends of said arrangements against said abutment means, said aperture means permitting direct contact of the working medium with said crank means.

12. A piston engine comprising, in combination, shaft means including eccentric crank means; a plurality of piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber and each piston-cylinder arrangement having a first end and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement, each pressure shoe formed with aperture means communicating with the respective working chamber and having a bearing surface surrounding said aperture means, said bearing surfaces formed with grooves surrounding the respective aperture means; abutment means adjacent the second ends of said arrangements, said abutment means and said second ends formed with recesses constituting passages for a working medium to said working chambers; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press the bearing surfaces of said shoes into sealing engagement with said crank means to prevent discharge of working medium between the pressure shoes and the crank means and to sealingly press the second ends of said arrangements against said abutment means, said aperture means permitting direct contact of the working medium with said crank means.

13. A piston engine as set forth in claim 12, wherein said shoes are formed with passages connecting said grooves with the atmosphere.

14. A piston engine comprising, in combination, a stationary housing; shaft means including eccentric crank means rotatably mounted in said housing; at least two floating piston-cylinder arrangements disposed in a common plane radial with respect to said shaft means, each arrangement comprising a pair of telescopically extensible hollow bodies and each having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; and means for permanently biasing the bodies of said piston-cylinder arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to press the second ends of said arrangements into abutment with said stationary housing, said arrangements retained between said crank means and said housing solely by the action of said biasing means.

15. A piston engine comprising, in combination, a stationary housing; shaft means including eccentric crank means rotatably mounted in said housing; at least two groups of floating piston-cylinder arrangements, each group disposed in a common plane radial with respect to said shaft means, each arrangement comprising a pair of telescopically extensible hollow bodies and each having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; and means for permanently biasing the bodies of said piston-cylinder arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to press the second ends of said arrangements into abutment with said stationary housing, said arrangements retained between said crank means and said housing solely by the action of said biasing means.

16. A piston engine comprising, in combination, a stationary housing; shaft means including eccentric crank means and rotatably mounted in said housing; at least one group of floating piston-cylinder arrangements, each said group comprising two arrangements disposed diametrically opposite with respect to said shaft means in a common radial plane, each piston-cylinder arrangement comprising a pair of telescopically extensible hollow bodies and each arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; and means for permanently biasing the bodies of said piston-cylinder arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to press the second ends of said arrangements into abutment with said stationary housing, said arrangements retained between said crank means and said housing solely by the action of said biasing means.

17. A piston engine comprising, in combination, a stationary housing; shaft means including a plurality of eccentric cranks and rotatably mounted in said housing; a plurality of groups of floating piston-cylinder arrangements, one for each of said cranks, each said group comprising two arrangements disposed diametrically opposite with respect to said shaft means in a common radial plane, each piston-cylinder arrangement comprising a pair of telescopically extensible hollow bodies and each arrangement having a first and a second end; a pressure shoe provided at the first end of each piston-cylinder arrangement; and means for permanently biasing the bodies of said piston-cylinder arrangements in a direction away from each other to thereby respectively press said shoes against the respective cranks and to press the second ends of said arrangements into abutment with said stationary housing, said arrangements retained between said housing and the respective cranks solely by the action of said biasing means.

18. A piston engine comprising, in combination, a sta-

tionary housing; shaft means including three cranks and rotatably mounted in said housing, said cranks offset by 120° in relation to each other; three groups of floating piston-cylinder arrangements, one for each of said cranks, each group comprising two oppositely directed piston-cylinder arrangements disposed diametrically opposite with respect to said shaft means in a common radial plane, each said arrangement comprising a pair of telescopically extensible hollow bodies and each arrangement having a first and a second end with said second ends located in a common axial plane in relation to said shaft means; a pressure shoe provided at the first end of each piston-cylinder arrangement; and means for permanently biasing the bodies of said piston-cylinder arrangements in a direction away from each other to thereby respectively press said shoes against the respective cranks and to press the second ends of said arrangements into abutment with said stationary housing, said arrangements retained between said housing and the respective cranks solely by the action of said biasing means.

19. A piston engine comprising, in combination, stationary shaft means including eccentric crank means; a supporting body surrounding said crank means and rotatable coaxially about said shaft means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies and each having a first and a second end; a pressure shoe provided at the first end of each said ararngement; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to press the second ends of said arrangements into abutment with said supporting body, said arrangements retained between said supporting body and said crank means solely by the action of said biasing means.

20. A piston engine comprising, in combination, stationary shaft means including eccentric crank means; an energy transmitting member including a supporting body of rotation, said body surrounding said crank means and rotatable coaxially about said shaft means; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies and each having a first and a second end; a pressure shoe provided at the first end of each said arrangement; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank means and to press the second ends of said arrangements into abutment with said supporting body, said arrangements retained between said supporting body and said crank means solely by the action of said biasing means.

21. A piston engine comprising, in combination, shaft

means including at least one eccentric crank; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber therebetween, each said arrangement having a first end and a second end; a pressure shoe provided at the first end of each said arrangement; abutment means adjacent the second ends of said arrangements, one of said means rotatable with respect to the other means; valve means for controlling the supply and discharge of a working medium to said chambers, said valve means coupled with said rotatable means; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank and to press the second ends of said arrangements against said abutment means, said arrangements retained between said crank and said abutment means solely by the action of said biasing means.

22. A piston engine comprising, in combination, shaft means including at least one eccentric crank; a plurality of floating piston-cylinder arrangements each comprising a pair of telescopically extensible hollow bodies defining a working chamber therebetween, each said arrangement having a first end and a second end; a pressure shoe provided at the first end of each said arrangement; multi-section housing means adjacent the second ends of said arrangements, one of said means rotatable with respect to the other means and said housing means formed with passages for conveying a working medium to and from said working chambers, said passages formed between the sections of said housing means; valve means for controlling the supply and discharge of a working medium to said chambers, said valve means coupled with said rotatable means; and means for biasing the bodies of said arrangements in a direction away from each other to thereby respectively press said shoes against said crank and to press the second ends of said arrangements into abutment with said housing means, said arrangements retained between said housing means and said crank solely by the action of said biasing means.

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