July 27, 1948. J. D. BELL 2,445,819

POWER MECHANISM

Filed May 15, 1945

Fig. 1.

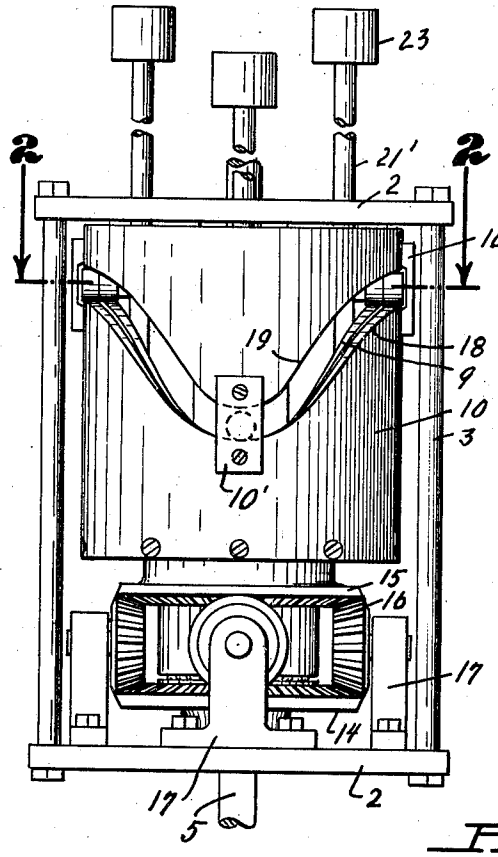


Fig. 3.

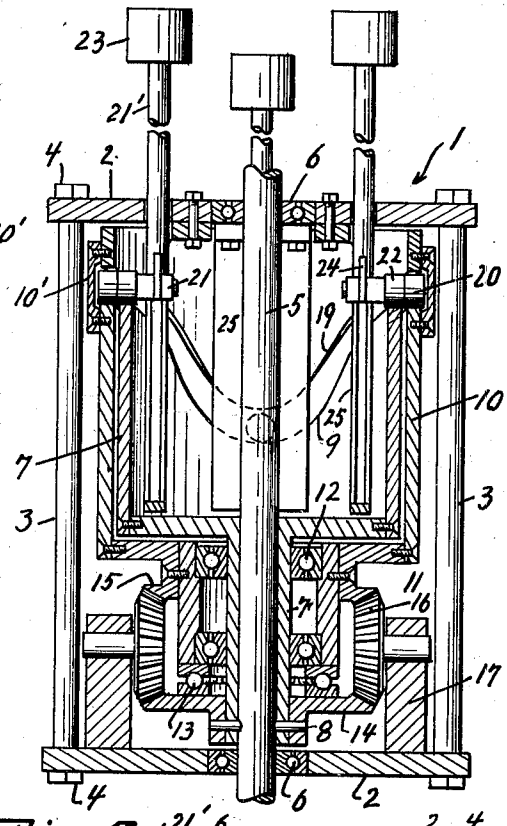


Fig. 4.

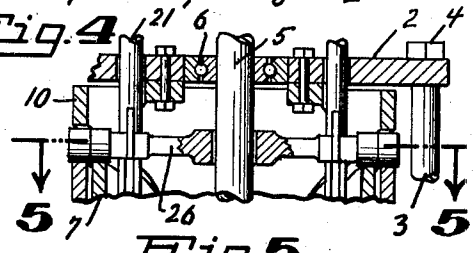


Fig. 2.

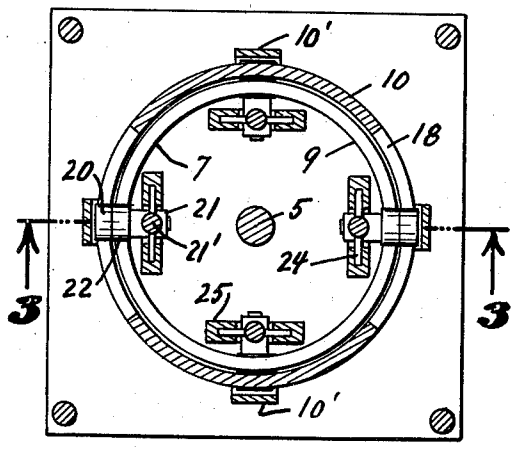
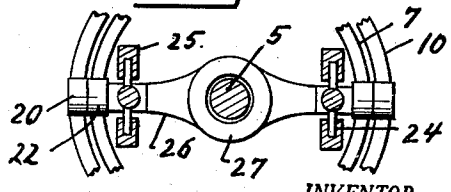


Fig. 5.



INVENTOR,

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POWER MECHANISM

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11 Claims. (Cl. 74—57)

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The present invention relates to improvements in a power mechanism, and has particular reference to a cam drive such as has been described in my co-pending applications Serial Numbers 518,466, now Patent 2,440,674, issued May 4, 1948; 566,765 and 584,876.

In the first one of the above applications it was proposed to provide two concentric helical cam tracks interlocked for rotary movement in opposite directions, and a rectilinearly movable drive pin engaging over both cam tracks at their intersections for rotating the cam tracks on the power stroke and for being lifted by the cams on the return stroke. An additional cam was provided to exert pull on the pin on the suction stroke of the engine.

In the second application it was proposed to provide two cam tracks for the suction stroke as well as for the drive stroke of an engine, and a specific arrangement was shown for solving certain structural problems, inasmuch as the pin was arranged to project over the cam tracks from the outside, which made it necessary for the outer cam, at least, to extend through the entire thickness of the cylinder carrying the cam.

In the third application I provided a different arrangement of at least two cams for the drive and lifting strokes and two cams for the suction stroke, particularly with the view of rendering the entire drive more compact and also with the view of providing for a certain fly wheel effect, which would eliminate the necessity of providing a special fly wheel.

In the present invention it is proposed to still further exploit the idea of the fly wheel effect by placing all the cams on the outside of the drive pins whereby naturally the diameters of the cams are increased and a greater fly wheel effect is produced.

It is further proposed to simplify the construction of the mechanism by arranging the drive members within the cams and by causing the drive pins to project over the cams from within the cams.

It is a further object of the invention to provide novel structural arrangements for effecting driving relation between the cams.

And finally it is proposed, in a modified form of the invention, to provide rigid connections between oppositely arranged drive pins moving in the same direction.

Further objects and advantages of my invention will appear as the specification proceeds and the novel features of the invention will be defined in the attached claims.

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The preferred forms of the present invention are illustrated in the accompanying drawing in which

Figure 1 shows a side elevation of my power mechanism,

Figure 2, a horizontal section taken along line 2—2 of Figure 1,

Figure 3, a central vertical section through my power mechanism taken along line 3—3 of Figure 2,

Figure 4, a fragmentary view, in axial section, of a modified form of the invention, and

Figure 5, a horizontal section taken along line 5—5 of Figure 4.

While I have shown only the preferred forms of the invention I wish to have it understood that various changes or modifications may be made within the scope of the claims attached hereto without departing from the spirit of the invention.

Referring to the drawing in detail, the frame 1 comprises a pair of plates 2 held in spaced and parallel relation by means of a plurality of posts 3 and nuts 4. A main shaft 5 is centrally supported in the plates through bearings 6.

A cylindrical cup 7 is mounted concentrically on the shaft, and has a hub 7' projecting downward from the bottom, the hub being made to have a close fit upon the shaft and being secured thereon by means of a cross-pin 8. The upper end of the cup is made in the form of a helical cam track 9. This track may be made of any suitable shape, and is here shown as having two peaks and two depressions, which is the preferred form, where the engine employed is of the four-cycle type, involving a power stroke, an exhaust stroke, an intake stroke and a compression stroke.

A second cup 10 is telescoped over the first cup from the bottom and has a hub 11 projecting from its bottom, which latter hub is concentric with the hub of the first cup and is spaced therefrom to accommodate bearings 12. The second cup is supported, through bearings 13, on a ring gear 14 fixed upon the hub of the first cup by means of the cross-pin 8.

The hub of the second cup has a ring gear 15 in juxtaposition to ring gear 13. The two ring gears are made to rotate in opposite directions by means of a series of pinions 16 supported in bearings 17 mounted upon the bottom plate 2. This arrangement causes rotative power exerted on the second cup to be transmitted to the main shaft.

The upper end of the second cup 10 is made

to form a helical cam track 18 substantially similar in shape to that of the inner cam track 9. An inverted cam track 19 of the same shape is superimposed on the cam track 18, by means of brackets 10' and in spaced relation to accommodate therebetween the rollers 20 on the drive pins or push members 21 projecting laterally from the connecting rods 21'. Similar rollers 22 are provided, for engagement with the inner cam track, on the drive pins inside of the outer rollers.

The engine (not shown in full) is mounted above the upper plate 2 and is here contemplated as a four cylinder internal combustion engine operating on the Otto cycle. The four cylinders are grouped annularly about the axis of the main shaft 5 over the inside space of the inner cup and fairly close to the wall thereof. Only the pistons 23 are shown in the drawing. The connecting rods 21' are preferably fixed with respect to the pistons and carry the drive pins 21 at their lower ends. The connecting rods are also equipped, at their lower ends, with wings 24 riding in fixed channels 25 suspended from the upper plate 2 and extending into the inner cup 7.

In operation, assuming that the parts are in motion due to momentum or due to operation of the conventional starter mechanism, and taking the left hand piston, which is at the beginning of the power stroke, it is apparent that its drive pin will split the two lower cam tracks 9 and 18 to form a crotch and will drive down the crotch to rotate the two cups in opposite directions. After the depressions of the cam tracks have reached the drive pin, the ascending grades will force the piston upward for the exhaust stroke, until the second peaks reach the pin. Thereafter the downward grade of the upper cam 19 will pull down the pin for the suction stroke, whereupon the ascending grades of the two lower cams 9 and 18 will again force the piston upward for the compression stroke.

It will be noted that the drive pins extend over both cams of the lower tracks from the inside of the inner track. This calls for an arrangement of the pistons over the inside of the inner cup, and since the piston and cylinder assembly calls for considerable space, it is apparent that the cups must be of considerable diameter, sufficient to produce a fly wheel effect of substantial force.

The cups with their hubs of reduced diameter resemble in shape the upper half of a bottle which has been inverted, and have been referred to in certain claims as being bottle-shaped.

Since opposing pins, in a four cylinder arrangement, travel up and down in unison, it is possible to brace the same against one another, and for the purpose of steadying their movement, a cross-member 26 has been introduced in the modified form of Figures 4 and 5, the cross-member connecting opposing drive pins and being provided with a central hub section 27 riding on the main shaft 5.

I claim:

1. In a power mechanism, a frame, two spirally tracked cams supported thereon for independent rotation, one telescoped over the other, and a push member extending from the inside of the inner cam over the tracks of both cams, the said member being operable to rotate the cams in opposite directions by applying pressure on the two tracks.

2. In a power mechanism, a main frame having a shaft journaled therein, two bottle shaped spirally tracked cams one of said cams being telescoped over the other and being revolvable with respect thereto, and one of said cams being fastened to the shaft, and a push member, said member projecting from the inside of the inner cam over the tracks of both cams and being operable for rotating the said cams in opposite directions by pressure in the said tracks.

3. In a power mechanism, a main frame having a shaft journaled therein, two bottle shaped spirally tracked cams one of said cams being telescoped over the other, and one of said cams being fastened to the shaft, a push member, said member projecting from the inside of the main cam over the tracks of both cams and being operable for rotating the said cams in opposite directions by pressure on the said tracks, the neck of the outer cam being spaced from the neck of the inner cam for housing bearings therebetween.

4. In a power mechanism, a frame having a shaft revolvable therein, a cup having a bottom hub fixed upon the shaft, a second cup telescoped on the first cup and having a bottom hub concentric with the first hub and spaced therefrom, gearing interposed between the hubs for transmitting rotary motion from one to the other in opposite directions, and means operative on the cups for revolving the latter in opposite directions.

5. In a power mechanism, a frame having a shaft revolvable therein, a cup secured upon the shaft and having a helical cam formed thereon with opposing peaks and depressions, opposed push members active on the cam at opposite points for rotating the cup, and a rigid connection between the push members extending across the cup, the rigid connection being apertured for sliding on the shaft.

6. In a power mechanism, a plate having an annular series of pistons reciprocably above the same and having an annular series of holes underneath the pistons and having guides suspended therefrom on opposite sides of the holes, connecting rods secured to the pistons and extending through the holes and having vanes slidable in the guides, a cylinder having a cam track thereon and being revolvable around the connecting rods, a second cylinder mounted on the outside of the first cylinder and in concentric relation thereto and having a cam track operable for rotation in the opposite direction and for forming crotches with the first cam track, and drive pins projecting from the connecting rods over the crotches for wedging the cam tracks apart when the pistons are made to descend.

7. In a power mechanism, a plate having an annular series of pistons reciprocably above the same and having an annular series of holes underneath the pistons and having guides suspended therefrom on opposite sides of the holes, connecting rods secured to the pistons and extending through the holes and having vanes slidable in the guides, a cylinder having a cam track thereon and being revolvable around the connecting rods, a second cylinder mounted on the outside of the first cylinder and in concentric relation thereto and having a cam track operable for rotation in the opposite direction and for forming crotches with the first cam track, and drive pins projecting from the connecting rods over the crotches for wedging the cam tracks apart when the pistons are made to descend, the cylinders having interconnecting means for transmitting motion from one of the cylinders to the other in the opposite direction.

8. In a power mechanism, a plate having an

annular series of pistons reciprocably above the same and having an annular series of holes underneath the pistons and having guides suspended therefrom on opposite sides of the holes, connecting rods secured to the pistons and extending through the holes and having vanes slidable in the guides, a cylinder having a cam track thereon and being revolvable around the connecting rods, a second cylinder mounted on the outside of the first cylinder and in concentric relation thereto and having a cam track operable for rotation in the opposite direction and for forming crotches with the first cam track, drive pins projecting from the connecting rods over the crotches for wedging the cam tracks apart when the pistons are made to descend, a second plate mounted in spaced and parallel relation to the first plate, a shaft revolvable in the two plates centrally of the connecting rods and having one of the cylinders fixed thereto, and means between the plates and underneath the cylinders for transmitting motion from the other cylinder to the shaft in the opposite direction.

9. In a power mechanism, a plate having an annular series of pistons reciprocably above the same and having an annular series of holes underneath the pistons and having guides suspended therefrom on opposite sides of the holes, connecting rods secured to the pistons and extending through the holes and having vanes slidable in the guides, a cylinder having a cam track thereon and being revolvable around the connecting rods, a second cylinder mounted on the outside of the first cylinder and in concentric relation thereto and having a cam track operable for rotation in the opposite direction and for forming crotches with the first cam track, drive pins projecting from the connecting rods over the crotches for wedging the cam tracks apart when the pistons are made to descend, a second plate mounted in spaced and parallel relation to the first plate, a shaft revolvable in the two plates centrally of the connecting rods and having one of the cylinders fixed thereto, and means between the plates and underneath the cylinders for transmitting motion from the other cylinder to the shaft in the opposite direction, the latter means comprising bearing members mounted upon the second plate, stub shafts revolvable therein and having pinions thereon, and ring gears mounted with respect to the two cylinders and meshing with the pinions.

10. In a power mechanism, an upper and a lower plate, means for mounting the two plates

in spaced and parallel relation, a shaft having bearing in the two plates, a cylinder having a cam track thereon and having a hub secured upon the shaft and a ring gear on the lower end of the hub, a second cylinder mounted outside the first cylinder and concentric therewith and having a cam track in cooperative relation to the first cam track and a hub surrounding the first hub, bearings interposed between the hubs and between the second hub and the ring gear, a ring gear on the second cylinder in opposing relation to the first ring gear, bearing members supported on the lower plate, stub shafts revolvable in the latter members and having pinions meshing with the two ring gears, and means operative on the cam tracks for revolving the same in opposite directions.

11. In a power mechanism, an upper and a lower plate, means for mounting the two plates in spaced and parallel relation, a shaft having bearing in the two plates, a cylinder having a cam track thereon and having a hub secured upon the shaft and a ring gear on the lower end of the hub, a second cylinder mounted outside the first cylinder and concentric therewith and having a cam track in cooperative relation to the first cam track and a hub surrounding the first hub, bearings interposed between the hubs and between the second hub and the ring gear, a ring gear on the second cylinder in opposing relation to the first ring gear, bearing members supported on the lower plate, stub shafts revolvable in the latter members and having pinions meshing with the two ring gears, and means operative on the cam tracks for revolving the same in opposite directions, the latter means including piston rods reciprocable on the inside of the cylinders and drive pins projecting from the piston rods over both cam tracks.

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