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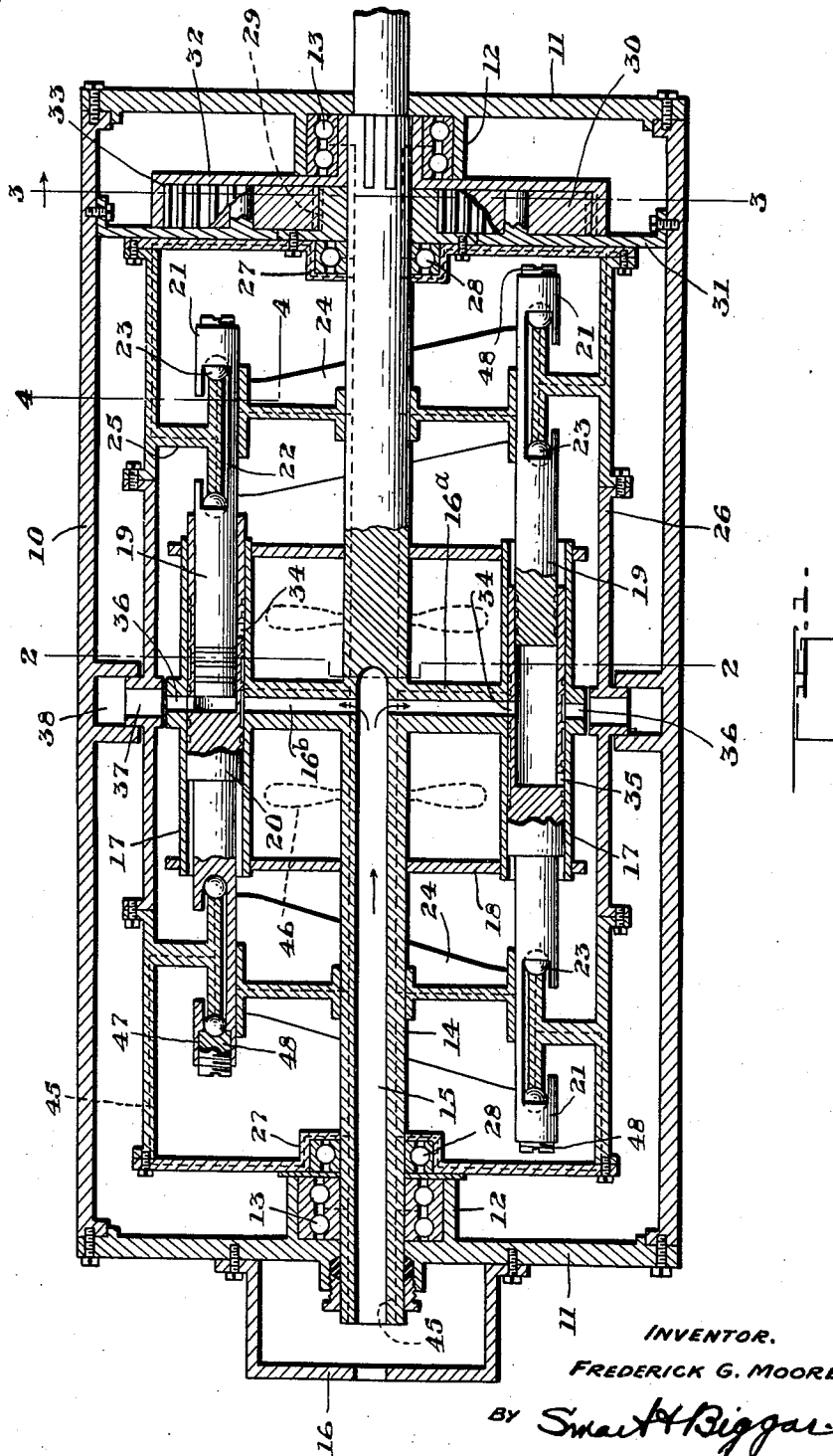
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TURBINE ENGINE

Filed Oct. 16, 1930

3 Sheets-Sheet 1



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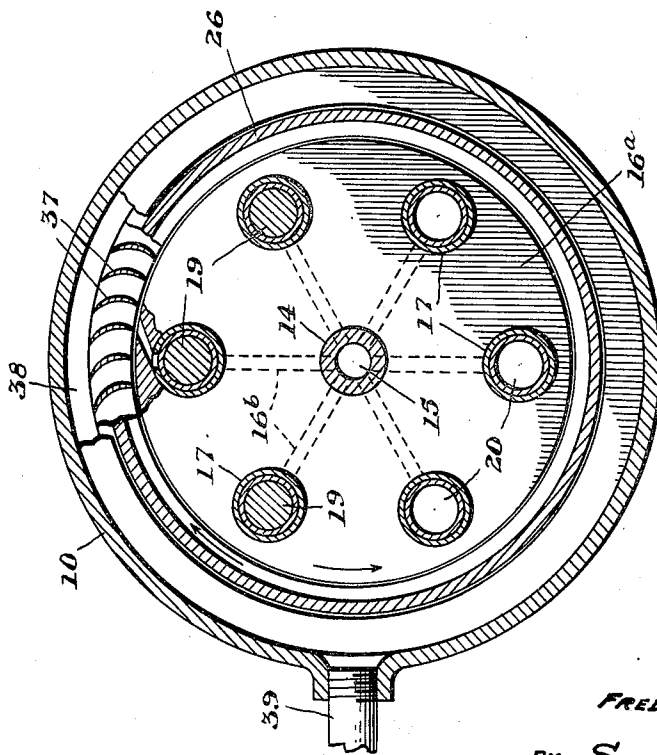
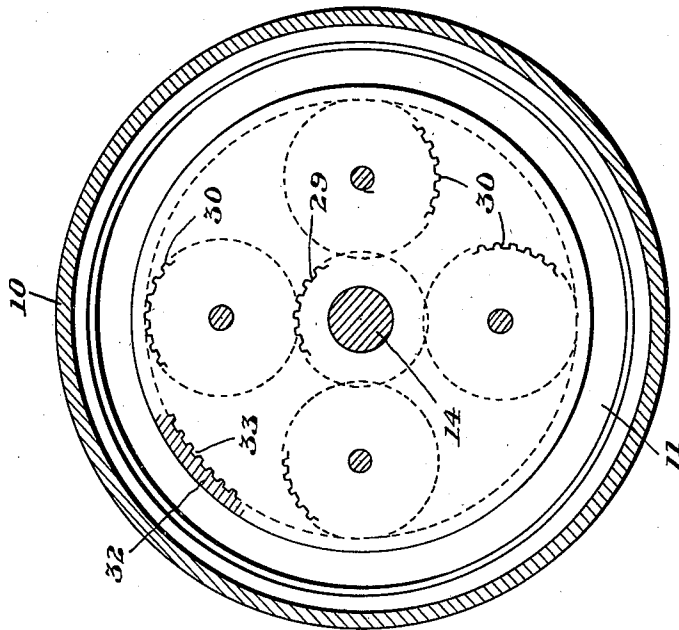
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UNITED STATES PATENT OFFICE

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TURBINE ENGINE

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Application October 16, 1930, Serial No. 489,016

12 Claims. (Cl. 60—41)

This invention relates to turbine engines, and an object of the invention is to provide an engine of this character comparatively simple in construction, formed with a minimum of working parts which will require a minimum of lubrication and which will yield a maximum of power through utilization of combustion gases as a power inducing medium.

A further object of the invention is to provide an engine of this character which will provide a larger cylinder volume and only requiring a minimum of cooling surface, by reason of the small area subjected to high temperature.

A further object of the invention is to provide a structure of this character which will provide for the highest possible speed with low gas consumption, a maximum expansion of combustion elements and a maximum compression at the beginning of expansion.

A still further object of the invention is to provide a structure which will be easy to start on any fuel, due to reduction of the power required to overcome compression.

A further object of the invention is to provide a structure which may be economically constructed in a great range of sizes and corresponding power delivery speeds.

With these and other objects in view the invention consists in the novel engine structure hereinafter described in the present specification and illustrated in the accompanying drawings which form part of the same.

In the drawings:

Figure 1 is a longitudinal section taken through the engine.

Figure 2 is a transverse section on the line 2—2 of Figure 1 with parts broken away to show the vanes and their relation with the cylinders.

Figure 3 is a section on the line 3—3 of Figure 1 illustrating the gear train.

Figure 4 is a fragmentary section on the line 4—4 of Figure 1 illustrating the arrangement of the pistons with the cam track.

Figure 5 is a detailed perspective of one of the sleeve pistons,

Figure 6 is a detail view of one form of ignition arrangement, and

Figure 7 is a sectional detail of one form of construction for minutely adjusting the position of the cam tracks.

Referring more particularly to the drawings, A indicates the engine as a whole including the stationary casing 10 which is of cylindrical form and closed at each end by the end plates 11. The end plates are formed with a circular flange 12

forming a housing for the main shaft bearing 13 which may be of the ball or roller type. The shaft 14 is journaled in these bearings and is bored part of its length as at 15 to conduct the fuel to the cylinders.

A cage 16 of any desirable form may be mounted on one end of the end plates 11 and any suitable form of carburetor and supercharger may be connected with the bore 15 of the shaft 14 to supply a combustible mixture. Centrally of the shaft 14 a disc 16a is secured, provided with a plurality of radially extending passages 16b communicating with the cylinders 17 which are supported in their position by the disc 16a and discs 18 secured on the shaft on each side of the disc 16a.

One salient feature of my invention is apparent in the formation of the pistons which are mounted in the cylinders opposed to one another in the form of a plunger piston 19 and a sleeve piston 20, the plunger piston working within the sleeve of the sleeve piston. These pistons are provided with extensions 21 which are recessed at a given point to form a channel 22 therein. In each end of the channel, ball bearings or the like 23 are suitably mounted and the channel is adapted to extend around circular cam tracks 24, the ball bearings 23 bearing on the edges of said tracks. The tracks are supported in inclined relation to the cylinders by a web 25 from a cylindrical cage or supporting structure 26. This cage may be of any desirable form and functions throughout as an operating member for the engine in that it serves to control the operation of the pistons and the rotation of the drive shaft, as more fully referred to hereinafter. It is preferably assembled in sections as illustrated. In the ends of this cage or control member a suitable housing 27 is preferably formed adapted to house the radial shaft bearings 28 which are positioned adjacent the bearings 13. To the end of the cage or control member 26 and loosely extending around the shaft 14, is secured the pinion 29 which is adapted to mesh with the gears 30 (see Fig. 3) supported from the stationary casing 10 by means of the attached supports 31. These gears are housed by the end drum 32 which is formed with the internal gear 33, the drum being attached through a spline hub to the shaft 14 and adapted to rotate therewith. This gear arrangement will serve to stabilize the motion of the rotating parts and gear ratio is such as to produce a drive shaft speed desired according to the purpose for which the engine is constructed.

The sleeve pistons are provided with ports 34 which are designed during operation to form inlet ports to the cylinders and register at a pre-determined period of operation with the radial fuel delivery passageway 16b. In the lower portion of Fig. 1 the cylinder is illustrated as being in the intake position and the port 34 registers with its corresponding radial fuel delivery passageway 16b.

In the opposite side of the sleeve pistons, ports 35 are positioned which constitute the exhaust ports for the cylinders. These ports register with the discharge nozzles 36 formed in the cylinder walls upon exhaust and discharge the exhaust gases through the nozzles 36. These nozzles are formed with inclined discharge passages clearly illustrated in Figure 2 designed to forcibly discharge the exhaust gases immediately combustion takes place so that they directly impinge upon a series of vanes 37 which are circumferentially arranged around the cage or control member 26. This causes rotation of the cage 26.

During operation in this manner, the peripheral velocity of the vanes added to the peripheral velocity of the nozzles results as nearly as practicable in the vane velocity required (working out normally at about 50% of jet velocity) according to the nozzle design and depending upon the type of fuel used.

The gases finally discharge into the annular ring passageway 38 and to the exhaust manifold in usual manner via the conduit 39 illustrated in Fig. 2.

With the foregoing description it will be realized that, upon combustion taking place within the cylinders, the cage 26 will be caused to rotate through the medium of the discharging gases acting upon the vanes 37. This will cause rotation of the drive shaft and attached parts, mainly the cylinders, and, due to the formation of the cam tracks 24 and the bearing engagement of the piston extensions 21 therewith, the operation of the pistons is directly controlled. The cage upon rotation, through the medium of the gear train described, will cause rotation of the shaft in the opposite direction thus effecting smooth operation of the cam tracks in relation to the pistons and accurately controlling their operation.

The ignition system may be of any desired well known form either electrical or through temperature due to compression. In Fig. 6 I have illustrated one form of arrangement for the ignition consisting of an electric conductor 40 which is carried upon one end of the cage 26 adapted to contact with a carbon or brush mounted on the casing 10, the contact being made in well known manner. The end of the conductor 41 which is of course insulated from its mounting is designed to extend within the cage 26 and adjacent one of the cam tracks 24 at a point corresponding to maximum compression within the cylinders.

A brush 42 is mounted on one end of the extensions 21 of the pistons and adapted to make high tension electric contact with the end 41 of the conductor without mechanical shock. A conductor 43 extends through the extension of the pistons to terminate within the cylinders in the spark terminal 44.

Thus the charge is fired at the correct moment, namely maximum compression and due to the fact that the mounting of the conductor 40, namely the casing 10, also supports the cam tracks 24, the relative position of the conductor with respect to the cam track is never changed so that the firing of the charge will always be constant.

Lubrication of the engine may be effected in any desired manner not shown. This of course is a factor to be determined in the actual construction of the engine and I have not attempted to illustrate the complete lubrication system to meet requirements.

It will be understood that various changes throughout the construction may be effected to suit constructional requirements and that I am not attempting to anticipate such requirements in the present disclosure.

In the operation of the cylinders it will be apparent that it may be necessary to adjust the pressure of the ball bearings 23 within the piston extension channels 22 and to this end I have formed one end of the extensions with the threaded orifice 47 communicating with the channels 22. A correspondingly threaded plug 48 is adapted to be screwed into the orifice 27 and to bear upon the adjacent ball bearing so that the pressure of these bearings upon the track may be adjusted.

Likewise it will be found desirable to adjust the cam tracks to provide for fine adjustment of the combustion controlling area of the tracks to range for combustion within the cylinders in accordance with climatic variations or variations in fuel elements. In other words by providing for adjustment of the tracks the moment of combustion can be determined with certainty under all conditions, the adjustment of course being virtually an alteration of the compression ratio. In Figure 7 of the drawings one suitable manner of adjustment for the cam tracks is illustrated which includes the serrated formation 49 on the interior of the cage adapted to co-operate with a corresponding formation 50 on the separately constructed cam tracks, the cam tracks being secured to the cage by means of the bolt 51 which projects through a slot 52 in the cage to enter into a threaded orifice in the cam track. To adjust the track it is only necessary to loosen the bolt 51 and move the track in either direction in accordance with the adjustment required.

In general operation fuel is supplied to cylinders 17 through the conduit 15 in shaft 14, and radial fuel passages 16b. In Fig. 1 the lower cylinder is illustrated at the end of the intake stroke about to start the compression stroke, the opposite cylinder being at the end of its compression stroke and at the point of ignition upon communication of the exhaust passageway 35 in the sleeve pistons with the nozzle 36. Upon explosion of the charge, the exhaust gases are very forcibly discharged through the nozzles 36 immediately striking the vanes 37 causing the control member or cage 26 to rotate in one direction and through the train of gears 29, 30 and internal gear 33, operated by the cage, effect rotation of the drive shaft 14 and attached parts in an opposite direction. The remaining cylinders, of course, operate successively in similar manner, ignition taking place in each cylinder upon maximum compression, the rotating cam tracks accurately controlling the operation of the oppositely rotating pistons. The ignition is also directly controlled by the cam tracks, so that the operation throughout is always entirely uniform.

The speed of rotation of the shaft is of course controlled by the gear ratio of the gear train, the ratio being such as to produce the speed desired in the driving shaft according to the purpose for which the engine is constructed. The cam tracks of course may be designed so as to provide for two strokes of the pistons in one revolution.

It is quite apparent that the salient feature of the present invention is the principle of the conversion into kinetic energy of the forces of exhaust gases and, the utilization of the force of reaction on the nozzles, through the drive shaft. Upon discharge of gases through the nozzles 36, a reaction is consequent upon the discharging gases leaving the nozzles, which is somewhat analogous to the kick imparted to a rifle when fired. Thus the nozzle supporting structure, viz.—the cylinders and supporting structure, will receive a reactionary propulsion in the opposite direction to the movement of the vanes which is chiefly due to the inclination of the nozzles. This will, of course, be transmitted to the drive shaft and supplement its power. It will be readily seen, therefore, that this invention embodies the harnessing of energy exerted through the movement of gases, both through impulse and reaction. The point of unity of these two forces acting in opposite directions is at the gear train 29, 30 and internal gear 33 where both impulse and reaction are harnessed to the rotating shaft.

It will be apparent that a great many advantages are provided by this type of engine. The construction is of comparatively simple type with a small number of parts in the total assemblage which enhances maintenance and repair operations. Various types of fuel may be used with this engine such as crude oil or any of its derivatives, also producer or natural gas. Regardless of the fuel, the engine may be started with comparative ease by reason of the cam track principle involved which reduces to a minimum the power required to overcome compression.

Due to the manner in which compression is overcome, viz.—through the simple cam track principle, the injection into the cylinders of the fuel body in proper volume ratio is practical owing to the elimination entirely of the possibility of back firing if the charge should be pre-ignited. For instance, if the charge is fired when the pistons 19 and 20 are halfway through the compression stroke, that is after the inlet port 34 has been closed and before exhaust port 35 is opened, then the force thus created on the pistons will have no appreciable effect upon the normal operation of the cylinder 17 which is rotated in such a direction as to cause the cam track 24 to bring the exhaust port 35 of the piston 20 into registry with the nozzle 36 and thus allow the exhaust gases to act upon the vanes 37. Thus the operation of the engine simple continues in the normal way.

The structure may be entirely enclosed as illustrated so that all working parts are encased, thereby eliminating a great deal of trouble arising through the presence of dirt and dust. In addition to this it will be realized that a structure of this character may be constructed economically in a great range of sizes, but it will be realized that the illustration in the present application does not necessarily have to be followed but that variations to suit commercial production may be readily effected in the structure when entering into the production stage.

Various modifications may be made in this invention without departing from the spirit thereof or the scope of the claims, and therefore the exact forms shown are to be taken as illustrative only and not in a limiting sense, and it is desired that only such limitations shall be placed thereon as are disclosed in the prior art or are set forth in the accompanying claims.

What I claim as my invention is:—

1. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted in the casing and rigidly connected to the drive shaft, pistons within said cylinders, means for introducing a combustible charge to said cylinders, means for igniting each charge, an operating member rotatably mounted on and operatively connected to said drive shaft, means for directing the combustion gases from said cylinders to rotate said operating member and drive shaft, and means on said operating member for operating said pistons.

2. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted within the casing and rigidly connected to the drive shaft, opposed pistons within said cylinders, means for introducing a combustible charge to the cylinders, means for igniting each charge, means in connection with one of the opposed pistons for controlling inlet and exhaust ports to the cylinders, an operating member rotatably mounted on and operatively connected to the drive shaft, means for directing the combustion gases discharging from said cylinders to rotate said operating member and drive shaft, and means on said operating member for operating said pistons.

3. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted within the casing and rigidly connected to the drive shaft, opposed pistons within said cylinders, means for introducing a combustible charge to the cylinders, means for igniting each charge, a rotatable cage surrounding said cylinders and operatively connected to the drive shaft, means for directing the combustion gases discharging from said cylinders to rotate said cage, and a pair of opposed inclined cam tracks projecting from the interior of said cage in operative connection with said pistons to operate the pistons upon rotation of said cage.

4. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted within the casing and rigidly connected to the drive shaft, opposed pistons within said cylinders, means for introducing a combustible charge to the cylinders, means for igniting each charge, a rotatable cage surrounding said cylinders and operatively connected to the drive shaft, a plurality of vanes carried by the cage, means for forcibly directing combustion gases from the cylinders against said vanes to rotate the cage and drive shaft, and means carried by said cage operatively connected to said pistons for operating said pistons during rotation of the cage.

5. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted within the casing and rigidly connected to the drive shaft, opposed pistons within said cylinders, means for introducing a combustible charge to the cylinders, means for igniting each charge, a rotatable cage surrounding said cylinders and operatively connected to the drive shaft, a plurality of vanes provided on the cage positioned in register with a discharge port in said cylinders, means for forcibly directing exhaust gases from said cylinders against said vanes to rotate said cage and drive shaft, means for stabil-

izing the rotating parts, and means carried by said cage for operating said pistons on rotation of the cage.

6. The device as claimed in claim 1 in which the means for operating said pistons comprise inclined cam tracks supported within and rotated with the operating member and operatively connected to the pistons.

7. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted in the casing and rigidly connected to the drive shaft, pistons within said cylinders, means for introducing a combustible charge to said cylinders, means for igniting each charge, a rotatable cage surrounding said cylinders and operatively connected to the drive shaft, extensions on said pistons, channels formed in said extensions adapted to engage with inclined cam tracks carried by and projecting within the rotatable cage, and means for directing the combustion gases discharging from said cylinders to rotate said operating member and drive shaft.

8. A turbine engine comprising a casing, a drive shaft rotatably mounted in the casing, a plurality of cylinders forming combustion chambers mounted in the casing and rigidly connected to the drive shaft, pistons within said cylinders, means for introducing a combustible charge to said cylinders, means for igniting each charge, a rotatable cage surrounding said cylinders and operatively connected to the drive shaft, a plurality of vanes carried by the cage and positioned in registry with an exhaust port in the cylinders, inclined cam tracks mounted on and projecting within said cage and designed to rotate therewith, extensions on said pistons, channels formed in said extensions and adapted to operatively engage with the inclined cam tracks, and means for directing the combustion gases discharging

from said cylinders onto said vanes to rotate said cage and drive shaft.

9. The device as claimed in claim 5 in which the means for forcibly directing exhaust gases against the vanes comprise nozzles positioned on the cylinders discharging at an incline and communicating with the exhaust ports of the cylinders.

10. The device as claimed in claim 1, in which the pistons are formed with extensions provided with channels cut therein adapted to extend around cam tracks for guiding the movement of the pistons, said cam tracks being carried by the operating member, and means on said extensions for varying the bearing contact of the extensions with the cam tracks.

11. The device as claimed in claim 1, in which the drive shaft is bored to provide a fuel passageway, said drive shaft carrying a disc formed with radial passageways communicating with said bore and with said cylinders.

12. A rotary engine comprising a casing, a drive shaft rotatably mounted within the casing, a plurality of cylinders forming combustion chambers mounted within the casing and rigidly secured to the drive shaft, opposed pistons within said cylinders, means for introducing a combustible charge to said cylinders, means for igniting each charge, a rotatable cage surrounding said cylinders and operatively connected to the drive shaft, a plurality of vanes provided on the cage positioned in register with said cylinders, opposed cam tracks supported within said cage, means for operatively connecting said cam tracks with the pistons and means for forcibly directing exhaust gases from said cylinders against said vanes to cause rotation of the cage and shaft.

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