H. D. CHURCH.

HYDROCARBON MOTOR.

APPLICATION FILED SEPT. 14, 1916.

**1,382,953.**

**Patented June 28, 1921.**

2 SHEETS—SHEET 1.

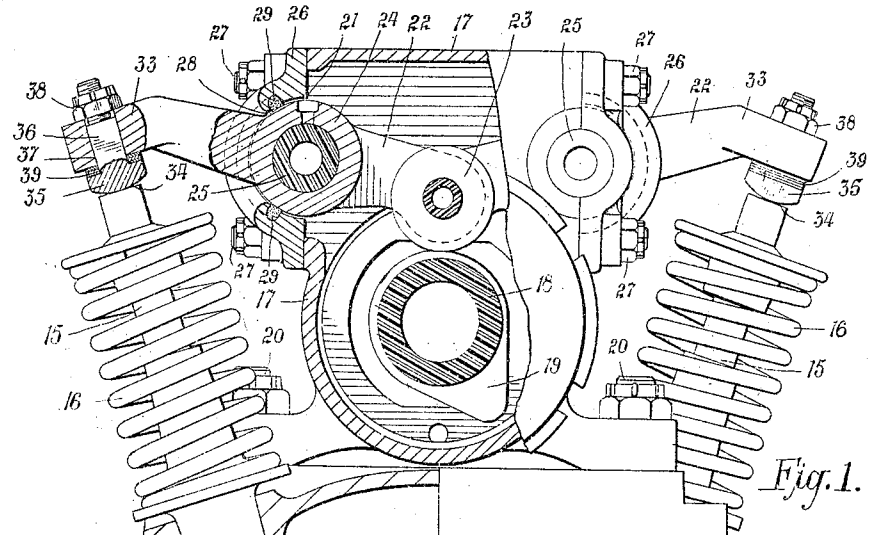



*Fig. 1.*

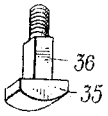



*Fig. 3.*

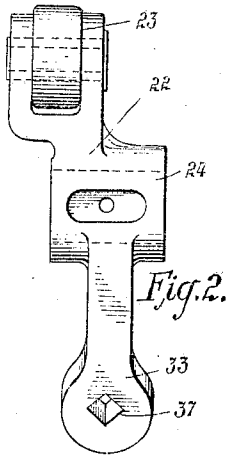
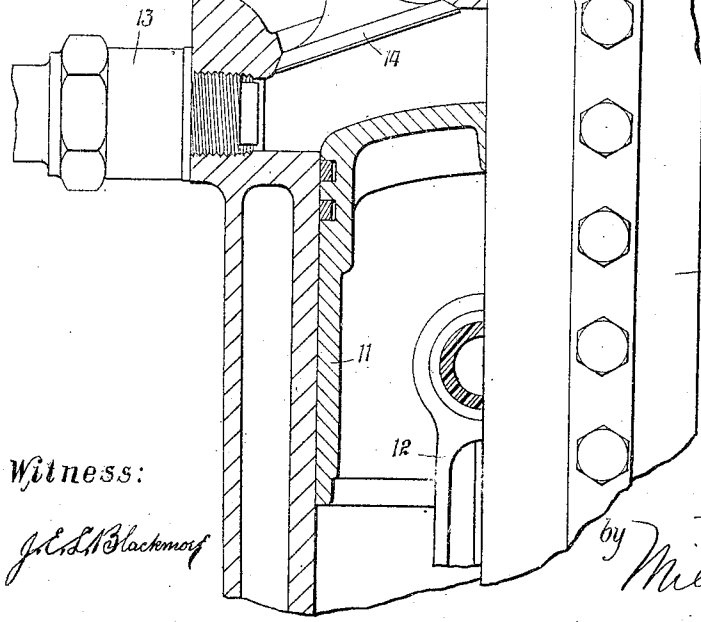



*Fig. 2.*




*Witness:*

J. E. L. Blackmore

*Inventor:*

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2 SHEETS—SHEET 2.

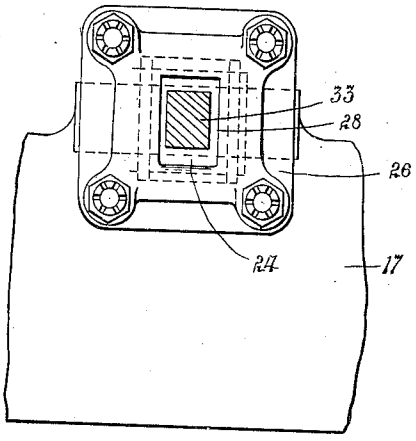


Fig. 4.

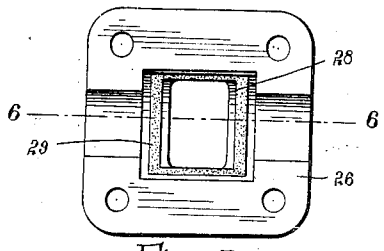


Fig. 5.

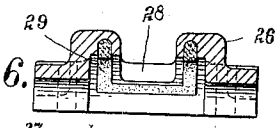


Fig. 6.

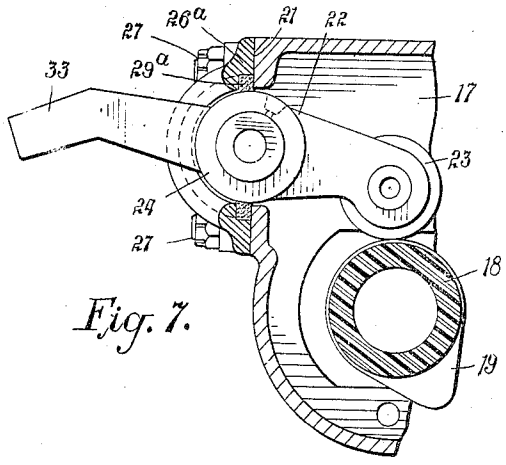


Fig. 7.

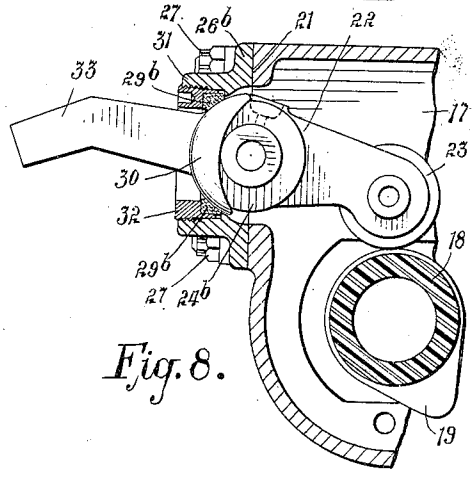


Fig. 8.

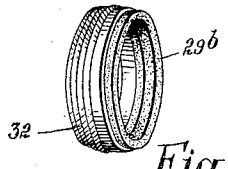


Fig. 9.

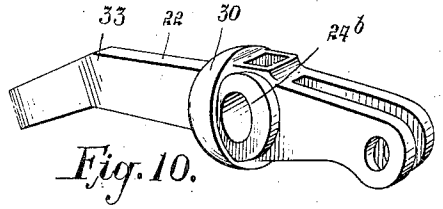


Fig. 10.

Witness:

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Atty.

# UNITED STATES PATENT OFFICE.

HAROLD D. CHURCH, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

## HYDROCARBON-MOTOR.

1,382,953. Specification of Letters Patent. Patented June 28, 1921.

Application filed September 14, 1916. Serial No. 120,107.

*To all whom it may concern:*

Be it known that I, HAROLD D. CHURCH, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Hydrocarbon-Motors, of which the following is a specification.

This invention relates to hydrocarbon motors and particularly to the valve operating mechanism of such motors.

One of the objects of the invention is to provide an oil tight casing for the cam shaft and valve operating rock arms.

Another object of the invention is to provide a suitable packed joint around the rock arms of the valve mechanism of a hydrocarbon motor.

Another object of the invention is to provide a novel and durable operating connection between the valves and rock arms of a hydrocarbon motor.

Other objects of the invention will appear from the following description taken in connection with the drawings which form a part of this specification, and in which:

Figure 1 is an end elevation and part transverse vertical section of the upper part of a hydrocarbon motor embodying this invention;

Fig. 2 is a detail view of one of the rock arms;

Fig. 3 is a perspective view of one of the tappets in the ends of the rock arms;

Fig. 4 is a side elevation of a section of the cam shaft casing;

Fig. 5 is a view of the inside face of one of the caps covering the openings in the cam shaft casing;

Fig. 6 is a section on the line 6—6 of Fig. 5;

Fig. 7 illustrates a slightly modified form of packing joint around the rock arm;

Fig. 8 is a transverse section through a cam shaft casing similar to that of Fig. 1 and illustrating another form of the invention;

Fig. 9 is a perspective view of the adjusting ring illustrated in Fig. 8; and

Fig. 10 is a perspective view of the rock arm shown in Fig. 8.

Referring to the drawings, 10 illustrates a cylinder of a hydrocarbon motor in which there is a piston 11, a connecting rod 12, spark plug 13, and valves 14. The puppet valves 14 extend diagonally upward and their stems 15 are surrounded by springs 16 for yieldingly retaining them closed in the usual way.

Mounted on top of the motor cylinder between the valve stems is a cam shaft casing 17 in which is a cam shaft 18 having cams 19. This casing is shown as removably secured to the motor cylinder as by the bolts 20. It will be understood that the cam shaft is operated by the motor through suitable 2 to 1 gearing, not shown.

The casing 17 has side openings 21 opposite the valve stems and rock arms 22 are arranged in these openings with their inner ends 23 in contact with the cam shaft 18 for operation by the cams 19. If desired the inner ends 23 of these rock arms may be in the form of rollers as shown.

A plan view of one of these rock arms 22 is shown in Fig. 2. It is formed with a hub 24 of substantially cylindrical form and this hub is mounted to oscillate on a short shaft 25 which extends through it and is secured to the casing 17 by a cap 26 which surrounds the rock arm. This cap 26 is detachably secured to the casing as by the bolts 27. Thus the cap retains the shaft 25 in place and the latter forms the sole pivotal support for the rock arm.

The cap 26 is illustrated in Figs. 1, 5 and 6 and it will be seen that it is formed with a semi-cylindrical recess which fits with slight clearance around the hub 24 of the rock arm 22, the hub being larger than the arm at this point. The rock arm extends through an opening 28 large enough to permit oscillation of the arm and a channel is formed in the recess adjacent the edges of the opening 28, and suitable packing material 29 is placed in this channel so that it comes in direct contact with the cylindrical hub 24 of the rock arm. Thus is formed a continuous packed joint around the rock arm between the casing and a movable part of the rock arm, and independent of the mounting or bearing for the rock arm, so that the oil which is necessarily used in the casing is prevented from leaking out around the arm. At the same time no appreciable amount of friction is placed on the arm to interfere with its free operation.

In Fig. 7 part of the packing $29^a$ is arranged between the cap $26^a$ and the casing 17, thus permitting part of the packing material to be retained under pressure between the cap and the casing.

In the form shown in Figs. 8, 9 and 10 the hub $24^b$ of the rock arm 22 has its outer part of hemispherical form, as shown at 30. The cap $26^b$ is formed with a cylindrical boss 31 which surrounds the spherical part 30 of the rock arm 22 and a packing ring $29^b$ is pressed against the spherical part 30 by an adjustable ring 32 threaded into the boss 31. Thus the joint may always be kept tight by screwing in the ring 32 as wear takes place.

It will be understood that there is a rock arm for each of the valve stems 15, and the outer end 33 of each rock arm is arranged adjacent the upper end of its respective valve stem. As shown, the valve stem 15 has a flat contact end 34 and a tappet 35 is mounted in the adjacent rock arm end and is formed with a cylindrical contact part which provides line contact between the tappet and the flat end of the valve stem. The tappet 35 is prevented from turning in the end 33 of the rock arm by having its shank 36 squared and retained in a squared opening 37 by the nut 38 as shown in Figs. 1 and 2. The tappet is also adjustable longitudinally of its shank by means of shims 39 arranged between the head of the tappet 35 and the end 33 of the rock arm.

In addition to the forms herein shown, other forms may be used without departing from the spirit or scope of the invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm mounted in and extended through said casing, said rocker arm being operable by said cam shaft, and a packed joint between said casing and a movable part of said arm independent of the arm mounting.

2. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm mounted in and extended through said casing, said rocker arm being operable by said cam shaft and having a cylindrical hub, and a continuous packed joint around part of said hub.

3. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm mounted in and extended through said casing, said rocker arm being operable by said cam shaft and having a cylindrical hub, and a continuous packed joint between the casing and the hub of said arm.

4. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm mounted in and extended through said casing, said rocker arm being operable by said cam shaft, a removable cap having means for retaining said arm in place, and a packed joint between said cap and said arm independent of said retaining means.

5. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm mounted in and extended through said casing, said rocker arm being operable by said cam shaft and having a cylindrical hub, a removable cap having means for retaining said arm in place, and a packed joint between said cap and said hub independent of said means.

6. In a hydrocarbon motor, in combination, a casing, a cam shaft therein, a rocker arm operated by said cam shaft and mounted in said casing, said arm having a cylindrical hub, a cap detachably secured to the casing and surrounding said arm, and a continuous packing in said cap around part of said hub.

7. In a hydrocarbon motor, in combination, a casing, a cam shaft therein, a rocker arm operated by said cam shaft and mounted in said casing, said arm having a cylindrical hub, a cap detachably secured to the casing and surrounding said arm, and a continuous packing between the cap and casing in contact with said hub.

8. In a hydrocarbon motor, in combination, a cam shaft therein, a rocker arm operated by said cam shaft and mounted in said casing, said arm having a hub, a cap detachably secured to the casing, and adjustable packing in said cap against said hub independent of the arm mounting.

9. In a hydrocarbon motor, the combination with the motor cylinder of a cam shaft casing at the top thereof and having side openings, a cam shaft mounted in the casing, rock arms mounted on shafts in said casing and operated by said cam shaft and extending through said openings, caps surrounding said arms and securing said shafts in place and continuous packings carried by said caps and surrounding said arms for preventing leakage of oil from said casing through said openings.

10. In a hydrocarbon motor, the combination with the motor cylinder, of a cam shaft casing at the top thereof and having side openings, a cam shaft mounted in the casing, rock arms mounted in said casing and operated by said cam shaft and extending through said openings, and detachable caps surrounding said arms and holding them in position, said caps having means acting to prevent leakage of oil from the casing around said arms.

11. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm operated by said cam shaft and pivotally supported by, and extended through an opening in said casing, and a

packed joint between said casing and said arm independent of the pivotal support of said arm.

12. In a hydrocarbon motor, in combination, a cam shaft casing, a cam shaft therein, a rocker arm operated by said cam shaft, a shaft forming the sole support of said arm, said arm extending through an opening in said casing, and a packed joint between said casing and said arm.

13. In a hydrocarbon motor, in combination, a casing having an opening, a rock arm mounted in the casing and extending through said opening, said arm having an enlarged hub, and a continuous packing around said arm, independent of the arm mounting, between the casing and said enlarged hub.

In testimony whereof I affix my signature.

HAROLD D. CHURCH.