A. KREBS.

BRAKING MEANS FOR AUTOMOBILE VEHICLES.

APPLICATION FILED FEB. 15, 1908.

934,547.

Patented Sept. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 1

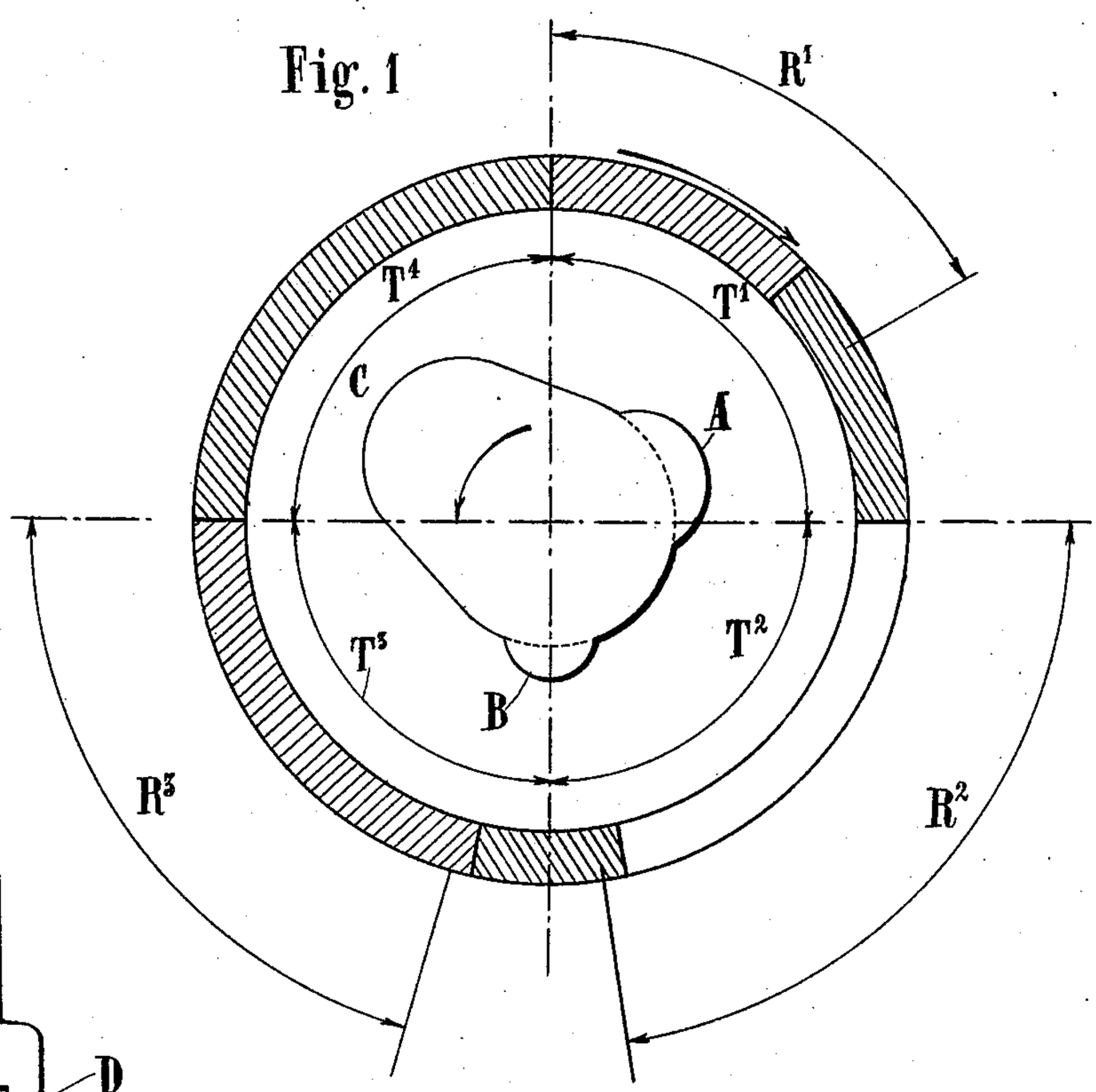

Fig. 2

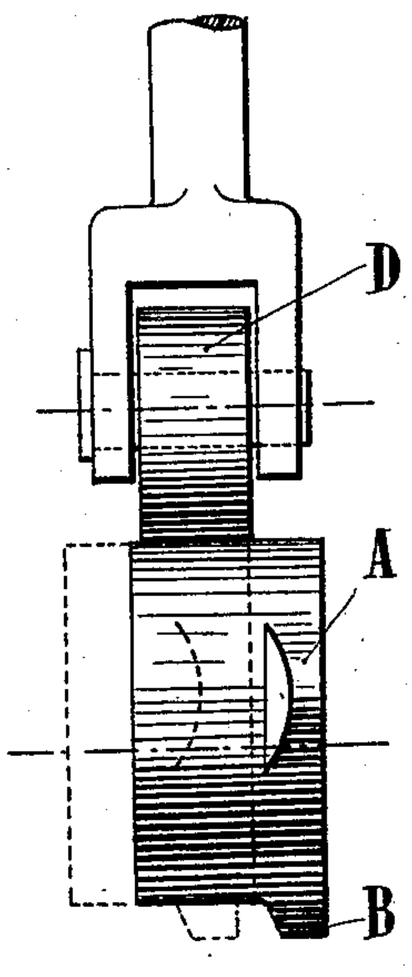

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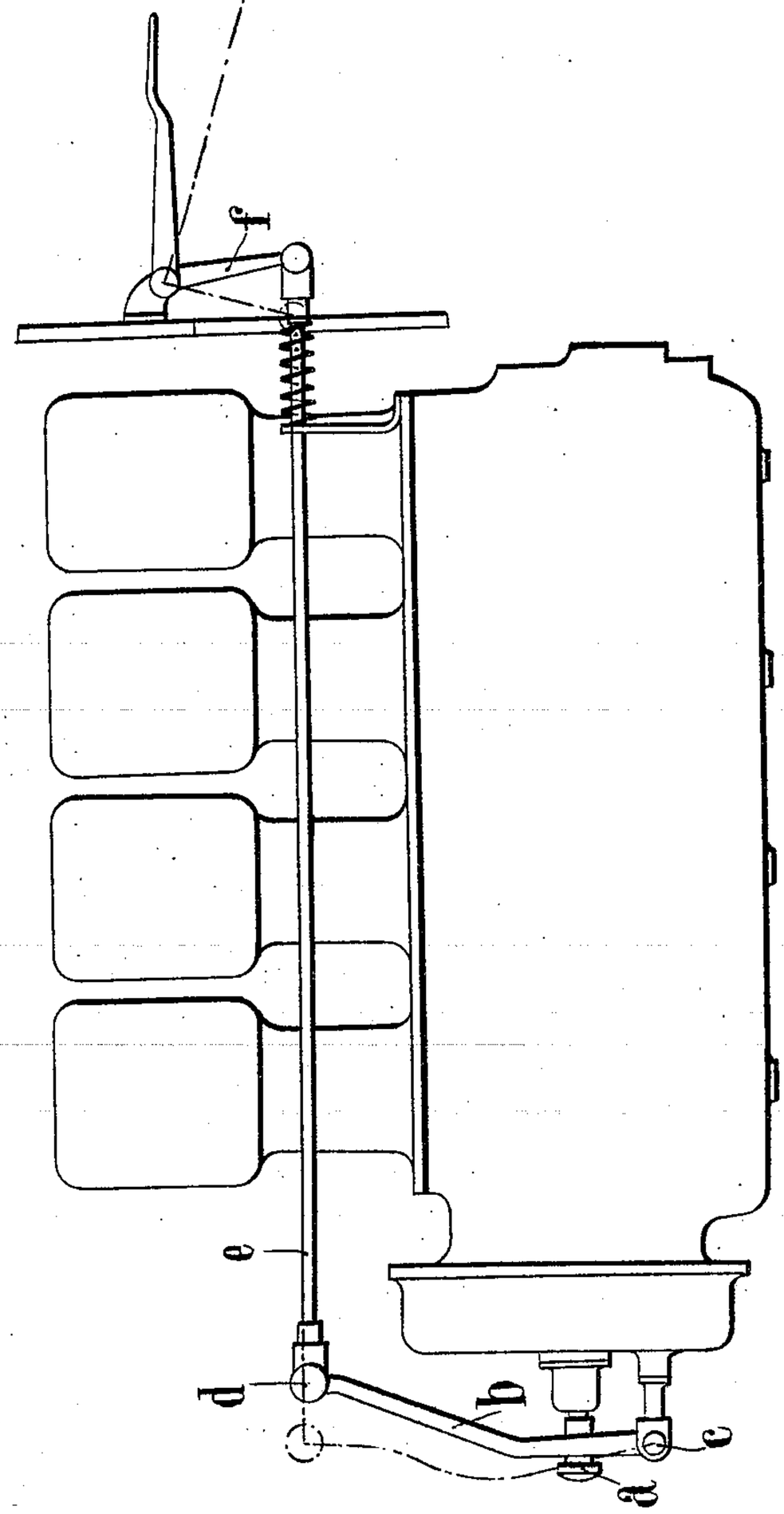
Fig. 3



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ARTHUR KREBS, OF PARIS, FRANCE, ASSIGNOR TO LA SOCIÉTÉ ANONYME DES ANCIENS ETABLISSEMENTS PANHARD ET LEVASSOR, OF PARIS, FRANCE.

BRAKING MEANS FOR AUTOMOBILE VEHICLES.

934,547. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed February 15, 1908. Serial No. 416,086.

To all whom it may concern:

Be it known that I, ARTHUR KREBS, a citizen of the Republic of France, and resident of Paris, France, have invented new and useful Improvements in and Relating to Braking Means for Automobile Vehicles, which improvements are fully set forth in the following specification.

The present invention has for its object a means for effecting the braking of an automobile vehicle by converting the driving effort into a resistant effort.

When a four-phase motor is running, if the suction pipe be obturated, the two phases—suction and compression—will balance each other as efforts and will not give rise to any resistant effort apart from passive resistances. The two following phases, corresponding to the explosion followed by expansion and to the exhaust, give rise to a resistant effort resulting from the partial vacuum produced by the descent of the piston, which vacuum is filled as soon as the piston rises again by the establishment of atmospheric pressure at the moment at which the exhaust valve is opened. This arrangement, which has been indicated in a prior patent dated the 9th. July 1900 No. 302027, proves to be a very real braking effort but one which is generally speaking insufficient. In order to increase it, it is preferable to resort to an arrangement which consists in providing two additional cams A and B upon the exhaust cam shaft; these two cams are arranged as shown in Figure 1 of the accompanying drawing, relatively to the exhaust cam C. The two cams A and B become operative owing to the longitudinal displacement, along its axis, of the exhaust cam shaft, the angular position of this cam shaft relatively to the crank shaft not being modified.

The object of the cam A is to lift the exhaust valve at the moment at which the piston reaches the end of the suction period and to close it subsequently when the piston has begun to ascend for the compression period.

The cam B serves for lifting the exhaust valve at the moment at which the piston reaches the end of the compression period and to close it when the piston has passed beyond the upper dead point and the expansion period begins.

In order to apply braking, communication with the carbureter is completely cut off and the exhaust cam shaft is displaced longitudinally so as to cause the additional cams A and B to pass beneath the roller D of the rod for lifting the exhaust valve (Fig. 2). Taking the piston at the moment at which, when at the top of its stroke, it is about to begin the suction period or first phase T′ (Fig. 1). During this period, as communication with the carbureter is cut off, a partial vacuum is established above the piston and creates a certain resistance R′ during this first phase. When it has reached the end of its travel the cam A lifts the exhaust valve during the passage of the bottom dead point, and through this valve inert gases enter the cylinder and fill it. When the piston again ascends, that is to say at the second phase T^2, as soon as the exhaust valve is closed, the piston has to overcome the work of compressing the gases introduced, so that it experiences a second resistance R^2. At the end of this compression stroke, the cam B lifts the exhaust valve through which the compressed gases escape and then closes it at the moment at which the piston descends for the third or expansion phase T^3. These compressed gases being expelled and communication with the exterior being still cut off, a partial vacuum is established as at the first phase and opposes a third resistance R^3 to the movement of the piston. When the piston has reached the bottom of its stroke the exhaust valve opens normally under the influence of the ordinary cam and enables the gases contained in the exhaust pipe to fill the void produced above the piston. When the piston again ascends, that is to say at the fourth phase T^4, the piston is not acted upon by any force tending to raise and force in front of it, through the open exhaust valve, the gases which have entered the cylinder. The succession of the phenomena which have just been analyzed therefore, during four semi-revolutions of the crank, produce important resistance during three semi-revolutions in addition to the ordinary passive resistances. Experience has demonstrated that the resistant work of a motor operating in

this manner is greater by fifty per cent. than the motor effort of the same motor acting at its full power.

The longitudinal displacement of the exhaust cam shaft for the purpose of bringing it into the operative conditions described above may be obtained in various ways. In Fig. 3 a method is shown which consists in providing on the extremity of the cam shaft a sleeve *a* controlled by a lever *b* pivoted at *c*. At its other extremity *d*, this lever is provided with a rod *e* connected with the bent pedal lever *f*. In the normal position springs keep the pedals raised so that the cam shaft remains in the proper position for preventing the additional cams from lifting the exhaust valves. If, however, the pedal be depressed, the cam shaft is displaced toward the front and the additional cams come into the plane of the roller of the rod for lifting each of the exhaust valves. At the same time, communication with the carbureter may be cut off by means of an appropriate device, if it has not been closed otherwise.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. The combination, with an explosive engine, of a cam shaft, an exhaust cam and two additional cams attached to the exhaust cam shaft, the two additional cams being so spaced circumferentially that they will produce within the engine cylinder three resistant phases to the motor piston whereby in the body of the cylinder itself a greatly increased braking action is obtained.

2. In a four cycle explosive engine, in combination an exhaust cam, two additional cams mounted in the same plane with the exhaust cam, and a longitudinally displaceable exhaust cam shaft, adapted to produce at predetermined intervals three resistant periods in the four cycles.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ARTHUR KREBS.

GASTON DEMOGET,
H. C. COXE.