July 27, 1937. T. NEFF 2,088,115

REACTION MOTOR

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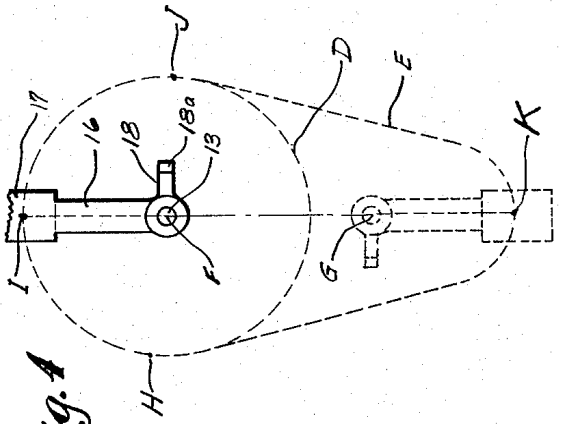

Fig. 4

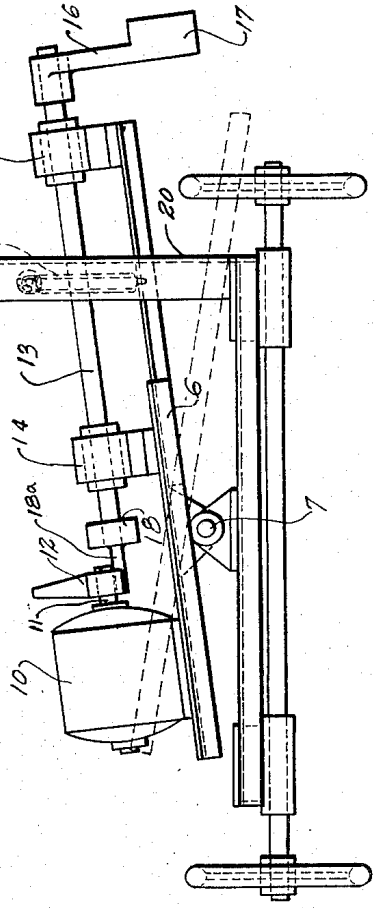

Fig. 2

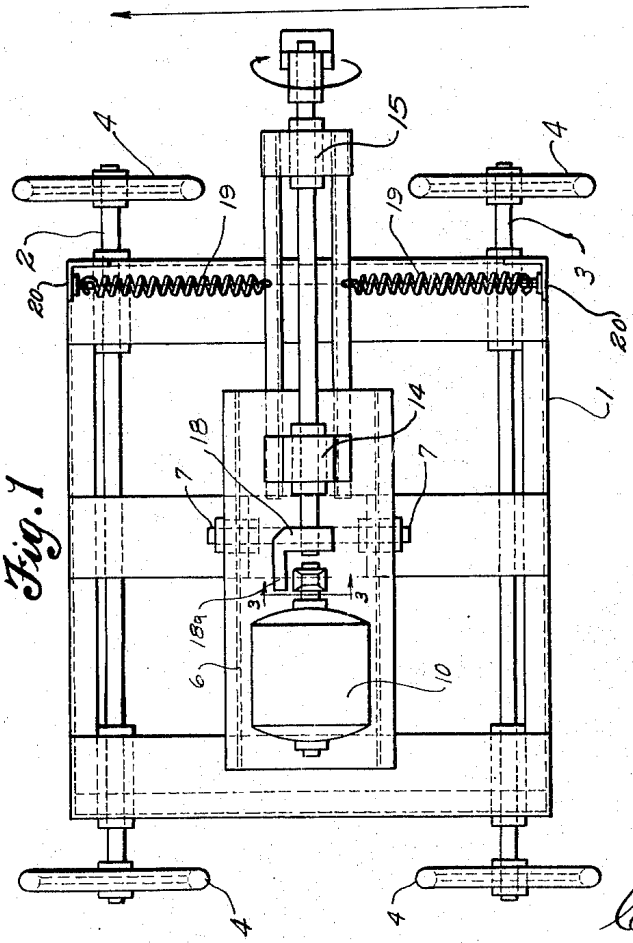

Fig. 1

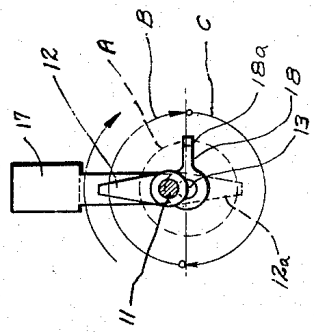

Fig. 3

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REACTION MOTOR

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8 Claims. (Cl. 35—19)

This invention relates to motors and propulsion devices, and it has reference, more particularly, to what may be termed "reaction motors" of that kind wherein energy from a prime mover, such as an electric motor, is pulsatively applied to an eccentrically and rotatively mounted weight, in a manner whereby the centrifugal forces that are incidentally set up in the rotating weight may be expended and utilized as a propulsion force for the vehicle with which the motor is utilized.

It is the principal object of this invention to provide a machine, or motor, of the above stated kind that may be utilized as a propulsion device for various types of vehicles and which is particularly adapted to be used for experimental purposes in class rooms, schools and educational institutions as a means of demonstrating the action and reaction of forces set up in rotating bodies.

More specifically stated, the objects of the present invention are to be found in the provision of a machine of the above stated kind in combination with a movable carriage, or vehicle, comprising an electric motor, equipped with means for pulsatively applying a driving force to a rotatively mounted shaft, on which is fixed a weighted arm; and wherein the motor, shaft and the weighted arm are mounted upon a platform that has a supporting axis upon which the platform will oscillate incident to rotation of the shaft and weight; the said shaft being arranged transversely of the direction of travel of the vehicle, and the axis of oscillation being horizontal and extending in the direction of travel.

Other objects of the invention reside in the details of construction; in the combination of parts and in their mode of operation, as will hereinafter be fully described.

In accomplishing the above and other objects of the present invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawing wherein—

Fig. 1 is a plan, or top view of a reaction motor embodying the present invention.

Fig. 2 is an elevation of the machine and indicating in dotted lines the oscillation of the pivotally supported platform.

Fig. 3 is a cross-section, on the line 3—3 in Fig. 1.

Fig. 4 is a diagrammatical illustration of the rotation of the weight and oscillation of the platform.

Referring more in detail to the drawing—

The machine herein illustrated comprises a horizontal frame structure of rectangular form, designated in its entirety by reference numeral 1. This frame structure is supported at its opposite ends upon cross axles 2 and 3, and these are equipped at their ends with suitable ground wheels 4. Also, the axle mounting bearings 2a and 3a so contain the axles as to permit the frame a certain amount of slippage longitudinally on the axles.

Supported centrally upon the frame structure 1 is a platform, or base 6, which is adapted to vertically oscillate, through a limited arc, upon a horizontal supporting shaft 7 which is mounted by brackets 7x on the frame 1 and alined in the direction of travel of the vehicle, as provided for by the supporting wheels.

Mounted upon the platform 6 is an electric motor 10 which is fixed upon one end of the platform and at one side of the axis of oscillation and this motor has its drive-shaft 11 extending substantially horizontally and at a right angle relative to the direction of the axis of oscillation and direction of travel, and has a radial arm 12 fixed to its end. Mounted also on the platform 6, and extended to the opposite side of the axis of oscillation with reference to the motor, is a shaft 13. This extends transversely of the direction of travel of the vehicle and in the vertical axial plane of the motor shaft, but is located at a lower horizontal level, as will be understood by reference to Figs. 2 and 3. The shaft 13 is revolubly supported in bearings 14 and 15, fixed on the platform, and it extends at one end beyond the side edge of the frame structure, as shown in Fig. 2, and at that end is equipped with a radial arm 16 on which a weight 17 is carried. This weight may be made either adjustable along or as an integral part of the arm.

It will here be explained that the shaft 7 which acts as a fulcrum or axis is shiftable, relative to the platform, so that the motor supporting end thereof may be overbalanced by the weight of the motor or that the other end of the platform 6 may be the overbalanced end. This is of consequence, as will be understood later. For the operation now being described, the motor end of platform 6, by reason of position of the fulcrum or axis of oscillation 7, is somewhat lighter than the opposite end of the platform; however, the over-weight of that end of the platform is here shown as being counter-balanced by the tension of two coiled springs 19

having ends attached to the platform and their other ends attached to standards or uprights **20** fixed upon the frame structure, as will be understood by reference to Figs. 1 and 2.

At the inner end of the shaft **13**, there is a crank arm **18**, and the crank end **18a** of this arm extends into a position to be engaged by the radial arm **12** that is fixed on the motor shaft **11**; the arrangement of the arm **12** and the crank arm **18** being such that they will engage in driving contact. It will further be explained that in the present construction, the crank arm **18** is placed 90° in advance of the weight **17** and its suspending arm **16** on the axis of the shaft **13**.

As an aid to a better understanding of the operation of the machine, it will be stated that in the present instance the vehicle frame **1** is supported by the four wheels which are spaced approximately 30 inches apart across the machine, and approximately 18 inches between the front and rear axles. The platform **6** which mounts the motor and driven shaft is pivotally supported at an intermediate point upon the frame **1**. The right hand end of the platform, **6**, as shown in Fig. 1, in the present instance, is heavier than the motor end to the amount that there is a supporting pull of approximately 10 pounds divided between the two springs **19**. The arm **16** is approximately seven inches long and the weight is approximately nine and one-half pounds.

Referring to Fig. 3, which is a view on line **3—3** in Fig. 1, it will be seen that the shaft **11** of the motor **10** is above the shaft **13**, and that the arm **12** on motor shaft **11** will be engaged against crank end **18a** in its revolution, as indicated by dotted circle A. When the arm **12** is in an upward position, as shown in Fig. 3, the length thereof acting as a lever against crank end **18a** in its revolution is shorter than the length thereof that will be acting as a lever when in a downward position, as indicated at **12a**. Referring to these lengths as levers, the lower lever position is longer than the upward lever position, and hence is of a greater power transmitting magnitude.

Referring now to Fig. 4, it is indicated that in its revolution the weight **17** travels in a circular path D, relative to shaft **13**, but travels a path as indicated by E relative to frame **1** of the machine, caused by oscillation of the platform **6** and movement of shaft **13** from position F to position G. Since the lever arm acting in arc A designated in Fig. 3 is the shorter, the most speed will be attained in the traveling of crank end **18a** through this arc and the greatest effectiveness of the power arm **16** is during the upward travel of weight **17**. The centrifugal force in the revolving weight **17** operates to rock the platform **6** downwardly.

In its downward movement platform **6** is propelled by the centrifugal force of the revolving weight **17**. These forces act against springs **19**.

The maximum power is exerted by arm **12** when it is at the bottom of the arc C by reason of its longer effective leverage. This being the case, arm **12** acting against crank **18a** causes an equal reaction in the opposite direction on shaft **11** and from there to the bearings of the motor pushing the motor in a direction corresponding to that of the arrow in Fig. 1. At the same time arm **18** is pushed in the opposite direction by an equal force. This force is transmitted to bearing **14** pushing it in a direction opposite that of the arrow. These forces ordinarily would cause a turning movement of the vehicle about a vertical axis through the center of gravity of the machine, but this tendency to turn is changed to movement in a forward direction for the reason that when the revolving weight **17** is in approximately a horizontal position going down it receives an impulse from the motor that increases its speed and centrifugal force and the reaction from this impulse is vertical and up, on bearing **15**, and is counteracted by the over balance weight of the end of the platform **6** that mounts the bearing **15**.

As the revolving weight **17** travels down the arc, centrifugal force and overbalance weight propels the platform **6** in a downward movement. This takes energy and as there is no contact with the motor at this time this energy is taken from the revolving weight reducing its speed and centrifugal force. This downward movement is allowed to continue until approximately 50% of the energy is lost, then it is checked by the springs **19** at point G.

As the revolving weight **17** starts its upward swing, platform **6** starts its upward movement. As centrifugal force is still acting downward, this centrifugal force retards the movement of platform **6** upward, so not as much energy is returned to the revolving weight **17** by the pull of the axis on the revolving weight **17** during its upward movement as it received during its downward movement, hence the revolving weight **17** has less speed and less centrifugal force at point H than at point J. This difference in forces propels the vehicle in the direction of the arrow.

The effect of the overbalance of the outer end of the platform **6** with weight **17** exerting a force on the bearing **15** end is graphically illustrated by Figure 4.

The falling weight and centrifugal force are acting in the same direction during the downward course of revolving weight **17** oscillating the end of the platform **6** and making the distance of travel of the weight **17** longer, as H—K—J as compared with J—M—H. During this latter course of the revolving weight **17**, centrifugal force and the weight are acting in opposite directions making the distance traveled by the weight **17** less.

The movement of the revolving weight **17** from H to M to J is as near circular motion as possible so that there is small change in speed and centrifugal force and in action and reaction.

Should it be desired to cause the vehicle to travel in a circular path then motor end of platform **6** should be made heavier than the opposite end by moving axis **7**. This becomes more effective by decreasing the length of the arm **16** and arm **12** is changed 180°. This causes the reversing of the oscillation of the platform **6** and propels the vehicle in a circular path. It is more effective if placed on a platform that will revolve.

It is propelled in a circular path because the motor is pushed forward by the reaction from arm **12** in the direction of the arrow and the reaction on bearing **14** and the revolving weight **17** are in the opposite direction.

With the approximate specifications before recited, the vehicle will advance approximately eight inches for each revolution of the shaft **13**.

The direction in which the vehicle travels, naturally, is determined by the direction of rotation of the motor; the relative position of weight **17** to crank arm **18** on shaft **13**, and also the location of the axis of oscillation **7**. The vehicle as herein illustrated travels in the direction of

the arrow adjacent to Fig. 1. When the direction of the motor is reversed and the extended direction of the crank arm 18 is reversed from that illustrated, it is apparent that the vehicle would move in the opposite direction; also when the axis of oscillation is shifted so that the motor over-balances the other end of platform 6, and the crank arm 18 is revolved 180° from its initial position, the vehicle travels in a circular motion. To preserve the plane of rotation of the revolving weight 17, the framework slides on the axles back and forth.

Explanatory to the invention, it will be stated that in an arrangement of this character, where the platform 6 is pivotally supported for oscillating movement upon the axis 7, it would be presumed that during operation of the machine, the extent of oscillating movement would gradually increase. However, there is a limit to the extent of oscillation and this remains constant so long as the motor speed is constant. The reasons for this limit to the extent of oscillation is explained as follows:

The impulses from the motor are only momentarily applied, and they take place when the rotating weight arm 16 is in a horizontal position and push the rotating weight downward. The corresponding reaction pushes the bearing 15 upward. This causes a break in the periodic vibration and causes a loss in energy in the weight.

It is to be understood that various details of construction might be modified, or altered, without departing from the spirit of this invention, and therefore, it is not the intention that the present claims shall be limited to the details herein shown, but that the claims shall be given an interpretation that is commensurate with the invention disclosed.

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

1. A device of the character described, comprising a mobile vehicle, a platform mounted thereon for pivotal movement on a horizontal axis that extends in the general direction of travel of the vehicle, means resiliently supporting the platform for movement on its pivotal mounting, a motor on the platform, a shaft mounted on the platform and alined with the motor to be rotatably driven thereby and a weighted arm fixed to the said shaft extending radially therefrom.

2. A device as in claim 1 wherein the driven shaft is transverse to the direction of travel and extends to one side of the vehicle, and has said weighted arm fixed to its outer end.

3. A device of the character described, comprising a mobile vehicle, a platform mounted on the vehicle for pivotal movement about a supporting axis extending in the direction of travel of the vehicle, a motor mounted on the platform at one side of the supporting axis, a shaft mounted on the platform at the other side of the axis and extending to the side of the vehicle, a weighted arm fixed to the outer end of the said shaft, a lever arm on the motor shaft, a crank arm fixed on the other shaft to be engaged by the lever arm, thereby providing a driving connection between the motor shaft and inner end of said driven shaft to effect a pulsative application of driving power.

4. A device as in claim 3, wherein the weight on the platform at that side of the axis supporting the weighted arm is greater than that at the opposite side and springs are arranged to resiliently support that end and permit vertical oscillation under influence of centrifugal force imparted to the weighted arm.

5. A device of the character described comprising a wheel supported vehicle, a platform mounted thereon for pivotal movement about a supporting axis, extending horizontally in the direction of travel of the vehicle, a motor mounted on the platform with its shaft transversely of the direction of travel, a shaft mounted on the platform offset below, but parallel with the axial line of the motor shaft and extended to the side of the vehicle, a weighted arm fixed to the outer end of said shaft, a crank arm fixed to its inner end, and a radial arm on the motor shaft adapted to engage in driving contact with the said crank arm.

6. A device of the character described, comprising a frame, cross axles supporting the frame, ground wheels mounting said axles; said frame being slidable lengthwise on the axles; a platform mounted on the frame for limited pivotal action about an axis that extends in the direction of travel of the vehicle, a motor mounted on the platform, a driven shaft revolubly mounted on the platform and extended to one side of the vehicle, a weighted arm fixed to the outer end of the shaft, means resiliently supporting the platform and permitting oscillation by reason of centrifugal forces created by the rotation of said weighted arm; said motor having its shaft parallel with the said driven shaft, but offset above its axial line, a crank arm on the motor shaft and an arm on said shaft adapted to be acted on by said crank arm to rotate the shaft.

7. A device as in claim 6 wherein the crank arm and the weighted arm are fixed to the shaft at a right angle to each other.

8. A device as in claim 6 wherein the platform will oscillate under influence of the centrifugal forces applied through the weighted arm.

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