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W. NOBLE

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SHOCK ABSORBING DEVICE

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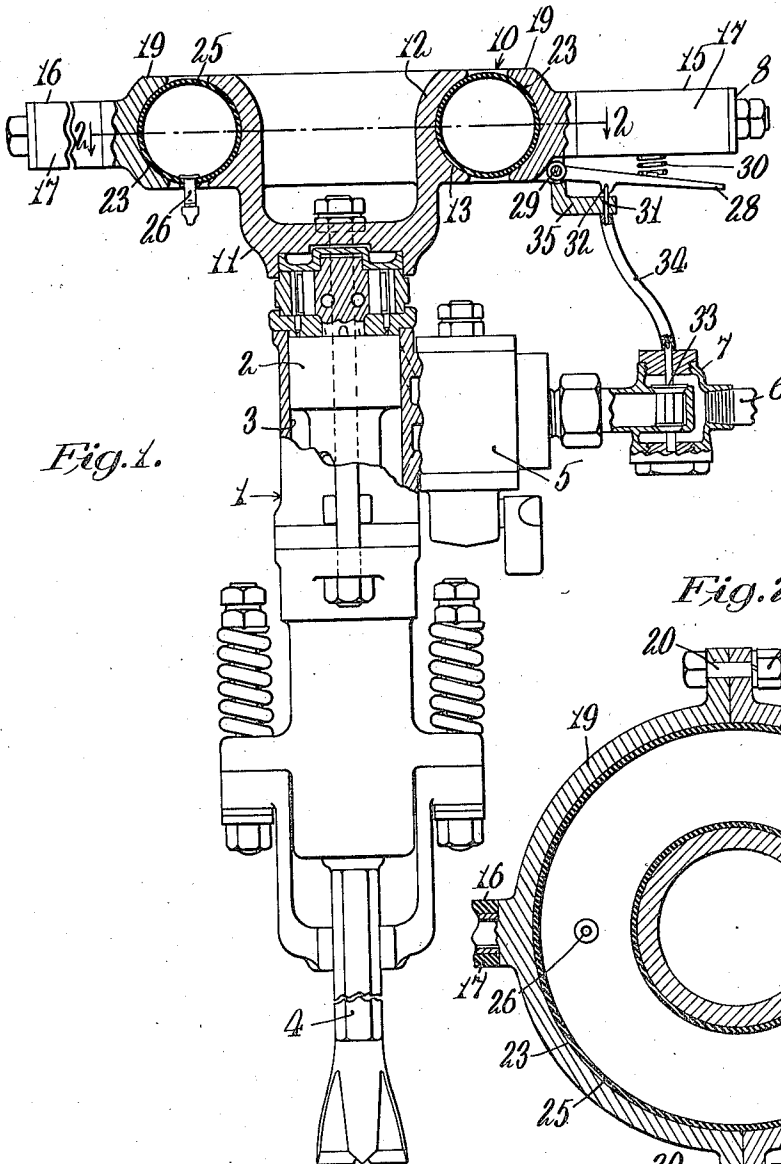


Fig. 1.

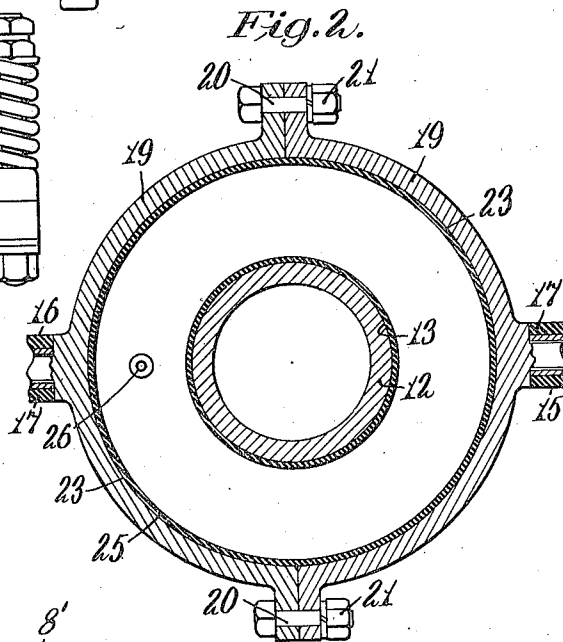


Fig. 2.

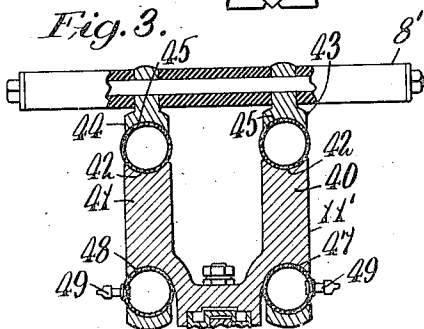


Fig. 3.

Inventor:
Warren Noble.
by Louis A. Maxson.
att'y.

UNITED STATES PATENT OFFICE

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SHOCK ABSORBING DEVICE

Warren Noble, Michigan City, Ind., assignor to
Sullivan Machinery Company, a corporation of
Massachusetts

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12 Claims. (Cl. 121—36)

My invention relates to shock absorbing devices, and more particularly to shock absorbing devices for preventing the transmission of the vibrations of rock drilling motors to the operator or drill runner.

Numerous attempts have been made to provide shock absorbing connections between hammer motors and the handles therefor, such as spring cushions, air cushions and the like, but because of the guided relation ordinarily provided in at least some planes and involving direct metal to metal surface contacts between motor elements and handle or handle mounting elements, successful elimination of the transmission of vibration has not been fully attained.

It is an object of the present invention to provide an improved resilient supporting means between a drill motor handle and the drill motor proper, and, by the use of supporting means of very small mass and the elimination of all metal to metal contact, to eliminate the transmission of substantial vibration.

It is a further object of the invention to provide, in a drilling motor having a resiliently mounted handle, and between the throttle valve on the drill motor proper and the primary operating means for the throttle valve arranged on the handle, a flexible connection which shall not be affected by the relative movements between the drilling motor and the handle.

Another object of my invention is to provide an improved air cushion type of resilient connection between a handle and the drilling motor to which the same is connected.

Still another object of the invention is to provide an improved annular pneumatic cushion adapted for arrangement either in transverse or in longitudinal planes with respect to the drilling motor, for the purpose of absorbing the vibrations of the latter and relieving the drill runner of fatigue and shock. Other objects of the invention will hereafter appear.

In the accompanying drawing, in which I have shown for purposes of illustration one illustrative embodiment of the invention, together with a modification,

Fig. 1 is a view, partially in central vertical section and partially in elevation, of a drilling motor in which an illustrative embodiment of the invention is incorporated.

Fig. 2 is a transverse section on a plane corresponding to the plane of the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary view showing the upper end of a drill and the handle therefor, showing a modified form of construction.

Referring now to the drawing, it will be observed that a rock drilling motor, generally designated 1, has a hammer piston 2 reciprocable in its cylinder 3 and adapted to actuate a drill steel 4. Fluid distribution to the motor is effected under the control of any suitable valve mechanism enclosed within a valve chest 5, and fluid is supplied to the valve chest from any suitable supply line 6 under the control of a throttle mechanism 7 which I shall shortly describe.

As is well known, hammer motors of the character illustrated cannot be made free from vibration, and for the purpose of preventing the transmission of the vibrations of the motor to the handle mechanism 8 I have provided improved vibration absorbing and shock eliminating means generally designated 10. To the rear end of the motor there is secured, in the form shown in Fig. 1, a member 11 providing a rearwardly extending support 12, which provides a circumferential, annular, concave seat 13 disposed in planes transverse to the drilling motor. The handle 8 is of special form, including grasping portions 15, 16, each having the usual rubber, or fabric, or combined rubber and fabric, grip portions 17, and each herein provided with a semicircular portion 19 of larger internal diameter than the maximum external diameter of the portion 12 in which the concave rim-like seat 13 is formed. The semicircular portions 19 are suitably held together by bolts 20 and nuts 21, and form together a circular member having an annular internal concave rim-like seat portion 23.

Between the seats, 13 and 23, there is mounted a suitable pneumatic cushion member, herein in the shape of a small inner tire-tube, having walls of rubber or the like of suitable thickness to permit the maintenance of a substantial pressure therein, the precise pressure to be maintained varying with the weight of the drill, the intensity of the vibration, etc. This member, which is designated 25, may be placed in position between the approximately properly positioned members 12 and 19 and then inflated, or may be seated upon the seat 13, then inflated, and the two handle parts may be assembled around the member 25, and held together by the bolt and nut means described. In either case, through a suitable inflating device 26 a suitable pressure will be provided in the doughnut-like member 25, and its pressure and the thickness of the walls of this member will be minimized, as far as possible, to meet the conditions which must be overcome, so that the total mass of the connection may be kept as small as possible.

A suitable operating lever 28 is pivotally connected at 29 to one of the semicircular members 13, and extends in general in the direction of one of the handle portions 15. A spring 30 extends between the lever 28 and the handle portion 15, and a Bowden wire 31 extends from a point 32 upon the lever to an approximately balanced throttle valve 33 which is of the double seat type. It will be evident that gripping of the handle element 15 and the lever 28 to cause approach of the lever 28 to the handle will pull upon the Bowden wire and upon the throttle valve. Release of the lever 28 will allow the spring 30 to cause the lever to push upon the Bowden wire and close the throttle valve. Because of the length of the Bowden wire and the presence of its sheath 34, suitably positioned by an elbow-like portion 35 integral with one of the parts 19 and by engagement with a closure element 36 for the throttle valve chamber, positive valve actuation can be effected without the transmission of vibration through the operating connection or disturbance of valve adjustment due to vibration of the parts.

In Fig. 3, the disposition of the annular air cushions is shown in longitudinal planes, and two are used at opposite sides of the axis of the drill motor for balance. In this form the member 11' is provided with a pair of rearwardly extending earlike portions, 40, 41, each having a peripheral concave seat portion 42. The handle structure 3' includes a pair of circular elements 43 and 44 having internal concave rim-like seats 45, surrounding and facing the concave seats 42. Separate pneumatic cushion elements of doughnut-like or inner tube tire-like form, respectively numbered 47 and 48, surround the ears 40 and 41 respectively. Appropriate inflating connections, as at 43, are provided for these elements. The mode of operation for this element will be very clear, for the action can be compared in a measure with the tires of an automobile in the shock absorbing function. Obviously there is a difference, however, in the specific mode of operation.

It will be evident that a single annulus arranged in the axial plane of the motor would also function, provided dimensions and pressures are properly selected.

In both forms, it will be observed that there is a balanced support for the drilling motor by the handle. In both forms it will be evident that the transmission of vibrations from the motor to the handle will be largely eliminated. In both forms it will be evident that the mass of the connecting means between the handle and the drilling motor is very small. In both cases, it will be evident that metal to metal contact between the parts of the handle and the drill is eliminated, under any normal working conditions. While the throttle control is not shown in Fig. 3, it will be evident that it might be the same as that in Fig. 1 or might be of a hydraulic type if preferred, and that the throttle control is possible from the handle, notwithstanding the flexible mounting, and is capable of that graduated fineness which is frequently necessary in the operation of spotting or other special conditions.

While there is in this application specifically described one form which the invention may assume, in practice, together with a modification, it will be understood that these forms are shown for purposes of illustration and that the invention may be modified and embodied in various other

forms without departing from its spirit or the scope of the appended claims.

What I claim and desire to secure by Letters Patent is:

1. In combination, in a percussive tool, an impact motor, a supporting handle therefor, shock absorbing means between said handle and said impact motor including a pneumatic cushion of annular tire-like form, and supporting means on said handle and motor respectively for securing said annular cushion in position therebetween, one supporting means projecting within the open center of said annular cushion and said supporting means having concentric surfaces engaging the inner and outer surfaces of said annular cushion.

2. In a drilling apparatus, in combination, a drilling motor, a handle, said motor and handle providing oppositely facing concave rim-like seats, and pneumatic annular cushion means of tire-like form supported by said seats and spacing said motor and handle.

3. In a drilling apparatus, in combination, a drilling motor, a handle resiliently and movably mounted with respect to said motor, a throttle valve for said motor and mounted on the latter, and a connection between said handle and throttle valve for operating the latter from the handle including an operating member mounted on said handle and a flexible operating connection between said operating member and said valve.

4. In a drilling apparatus, in combination, a drilling motor having an external rim-like seat, an annular tire-like cushion member mounted on said seat, and a handle having an oppositely facing, circular internal seat engaging and surrounding said cushion member in spaced relation to the first mentioned seat.

5. In a drilling apparatus, in combination, a drilling motor having at the rear end thereof at least one element providing a circumferential external concave rim-like seat disposed generally in planes extending axially of the motor, circular pneumatic cushion means of tire-like form surrounding said seat, and a handle having oppositely-facing internal rim-like seat means surrounding and engaging said cushion means.

6. In a drilling apparatus, in combination, a drilling motor having at opposite sides of its axis a pair of members providing concave annular external rim-like seats, a handle having elements providing a pair of concave annular internal rim-like seats in the same planes extending longitudinally of the motor as said first mentioned seats, and an annular pneumatic cushion of tire-like form between each pair of cooperating seats afforded by said member and said handle and seated on said seats.

7. In combination, in a percussive tool, an impact motor, a manual supporting handle therefor, a shock absorbing cushion between said motor and handle including an annular pneumatic yieldable means of tire-like form, and supporting means on said handle and motor respectively for securing said annular pneumatic means in position therebetween, one supporting means projecting within the open center of said yieldable means and said supporting means having concentric surfaces engaging the inner and outer surfaces of said annular means.

8. In combination, in a percussive tool, an impact motor, a manual supporting handle therefor, a shock absorbing cushion between said motor and handle including an inflated resilient annular pressure fluid receptacle of tire-like form, and

supporting means on said handle and motor respectively for securing said annular receptacle in position therebetween, one supporting means projecting within the open center of said annular receptacle and said supporting means having concentric surfaces for engaging the inner and outer surfaces of said annular receptacle.

9. In a drilling apparatus, in combination, a drilling motor having an external seat, an annular pneumatic cushion member mounted thereon, the inner portion of the exterior periphery of said cushion member engaging said seat, and a handle having an oppositely facing, circular internal seat engaging and surrounding said cushion member in spaced relation to the first mentioned seat, the outer portion of the exterior periphery of said cushion member engaging said oppositely facing seat.

10. In a drilling apparatus, in combination, a drilling motor having at the rear end thereof at least one element providing a circumferential external concave rim-like seat disposed generally in planes extending axially of the motor, circular pneumatic cushion means of tire-like form surrounding and seated on said seat, and a handle having oppositely-facing internal rim-like seat means surrounding said cushion means and on which the latter is seated.

11. In combination, in a percussive tool, an impact motor, a manual supporting handle therefor, shock absorbing means between said handle and motor for preventing metal to metal contact therebetween including an annular low pressure air shock absorbing cushion of tire-like form, and supporting means on said handle and motor respectively for securing said annular cushion in position therebetween, one supporting means projecting within the open center of said annular cushion and said supporting means having concentric surfaces engaging the inner and outer surfaces of said annular cushion.

12. In combination, in a percussive tool, an impact motor, a manual supporting handle therefor, a pneumatic shock absorbing cushion between said motor and handle and forming the sole connection between said motor and handle, said cushion including an inflated resilient receptacle of annular tire-like form, and supporting means on said handle and motor respectively for securing said annular receptacle in position therebetween, one supporting means projecting within the open center of said annular receptacle and said supporting means having concentric surfaces engaging the inner and outer surfaces of said annular receptacle.

WARREN NOBLE.