

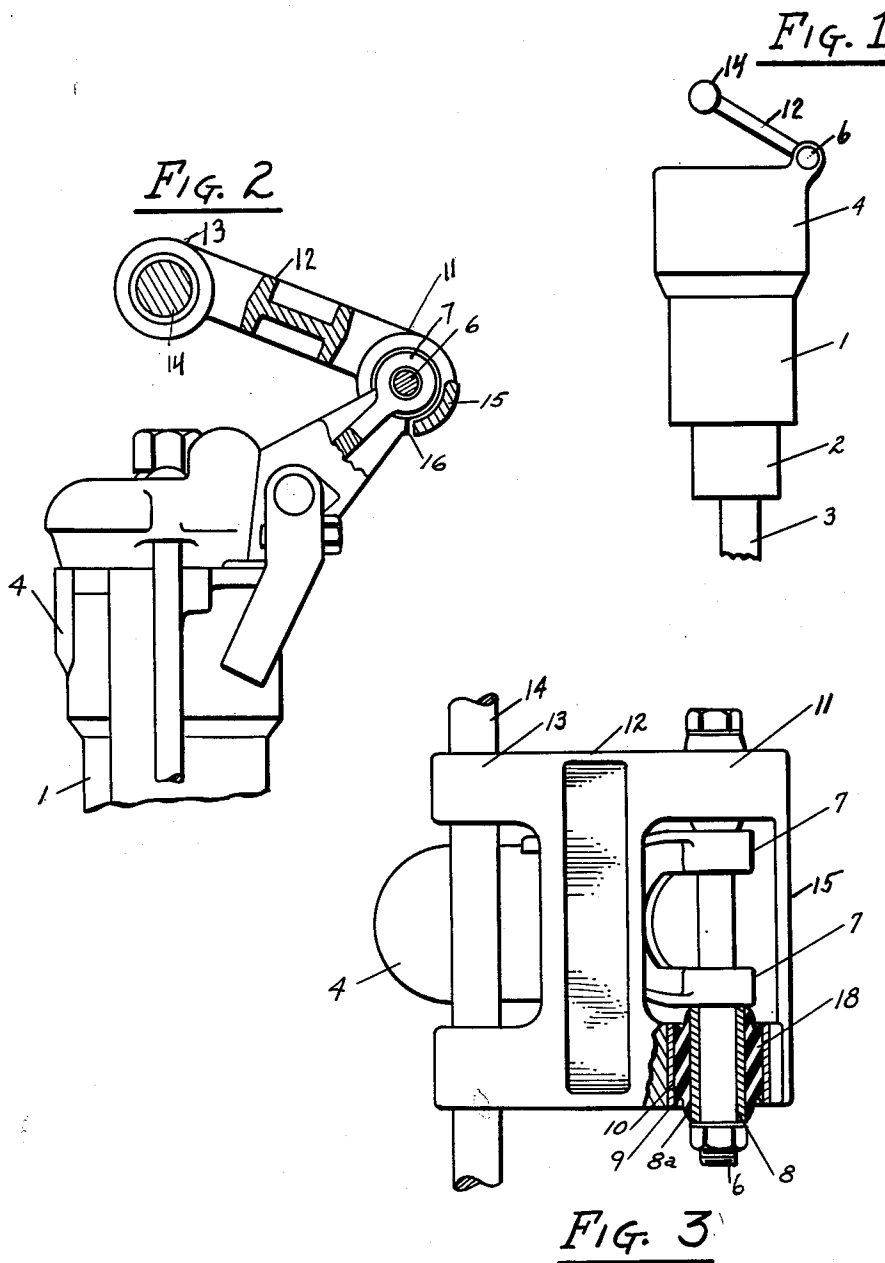
March 10, 1953

L. WALLERSTEIN, JR

2,630,784

CUSHION HANDLE FOR PERCUSSIVE TOOLS

Filed June 20, 1949



INVENTOR.

Leon Wallerstein Jr

BY

Ralph Hammas
Attorney

UNITED STATES PATENT OFFICE

2,630,784

CUSHION HANDLE FOR PERCUSSIVE TOOLS

Leon Wallerstein, Jr., Erie, Pa., assignor to Lord Manufacturing Company, Erie, Pa., a corporation of Pennsylvania

Application June 20, 1949, Serial No. 100,218

3 Claims. (Cl. 121—36)

1

In jack hammers and similar percussive tools the operator, while exerting the necessary hold-down pressure, feels an objectionable vibration. This invention is intended to support the tool handle resiliently so that the handle has a natural frequency on the tool less than $\frac{1}{2}\sqrt{2}$ times the disturbing frequency created in the tool so the handle tends to stay normally fixed in space and the sensible vibration transmitted to the operator is decreased. Advantages include pre-loading so the operator must exert the proper hold-down force in order to obtain any benefit from the vibration isolating support, a torsion spring support in which the handle support is resiliently hinged about an axis transverse to the direction of the operating force so advantage can be taken of the moment of inertia of the handle to obtain a low natural frequency of the handle, and a handle mounting which provides a stable connection so that the tool can be handled as though the handle were firmly connected. Further objects and advantages appear in the specification and claims.

In the drawing, Fig. 1 is a side elevation of a jack hammer; Fig. 2 is an enlarged section; and Fig. 3 is a top view partly broken away.

1 indicates the cylinder which houses the actuating parts, 2 indicates the front head which applies the percussive force, for example to a drill steel 3 carried thereby, and 4 indicates the back head at the upper end of the cylinder. The foregoing sufficiently identifies the jack hammer which is, or may be, of common construction.

At one side of the axis or line of action of the percussive force is a transverse hinge pin 6 fixed in ears 7 projecting from the back head. The projecting ends of the hinge pin are locked to center pins 8 of tube form rubber mountings 8a having outer shells 9 locked in sockets 10 in spaced arms 11 at one end of a handle 12. The handle has at its other end spaced arms 13 receiving a handle bar 14 which projects on each side to provide hand grips.

When the jack hammer is not in use, a cross bar 15 connecting the ends of the arms 11 is urged against a stop surface 16 on the ears 7 with a force determined by the original pre-loading of the rubber bushings 18 bonded or locked to the center pins and outer shells of the tube form mountings 8a. The pre-loading is effected by relative rotation of the center pins and outer shells so that the rubber exerts a force tending to pivot the handle upward, or in a clockwise direction as viewed in Fig. 2. The stop surface 16 prevents upward movement of the handle. The handle is therefore held against the stop surface with a force equal to the pre-loading force. This provides an effectively rigid connection between the handle and tool when the tool is not in use. Preferably the pre-loading is such that it can

2

be overcome only after the operator exerts the proper hold-down force on the handle necessary to secure proper operation of the tool. For example, in a typical jack hammer which weighs 70 pounds and operates at 1800 strokes a minute, it is desirable that the drill steel 3 be held against the work with a force of from 100 to 150 pounds. For such a tool, the pre-loading will require a hold-down force of from 100 to 150 pounds on the handle bar 14 to move the cross bar 15 clear of the stop surface 16.

Once the cross bar 15 is clear of the stop surface 16, the handle is resiliently supported on the jack hammer by the tube form mountings 8a. Unless the resilient support of the handle is such that the natural frequency of vibration of the handle relative to the tool is less than $\frac{1}{2}\sqrt{2}$ times the frequency of the disturbing vibration from the percussive forces, the operator will obtain no reduction in the sensible vibration at the handle grips. For the typical jack hammer mentioned above, a handle natural frequency of 720 cycles per minute results in isolation of about 75% of the sensible vibration which would otherwise reach the hand grips. A handle natural frequency of 1272 cycles per minute would result in no reduction in the sensible vibration transmitted to the handle grips.

The natural frequency of the handle relative to the tool is not dependent upon the weight of the tool nor the hold-down force required to hold the tool against the work. The natural frequency is determined by the mass or moment of inertia of the handle and by the spring rate of the handle mountings. For the mountings shown where the handle support uses torsion springs, the natural frequency depends upon the moment of inertia of the handle about the hinge pin 6 and the spring rate in pound inches per radian. Since the moment of inertia of the handle increases as the square of the length of the handle and as the first power of the weight of the handle, the offset hinge pin 6 results in a lighter handle. This decreases the dead weight.

If the operator relaxes the hold-down force on the hand grips to less than the pre-loading, the cross bar 15 engages the stop surface 16 and all of the vibration comes through the hand grips. The pre-loading accordingly serves as a warning to the operator that too little hold-down force is being applied.

The reduction in sensible vibration at the hand grips is important. Vibration in time produces fatigue and a marked reduction in the efficiency of the operator. Elimination of vibration not only is more comfortable but it is essential if the tool is to be used for extended periods of time.

What I claim as new is:

1. In a jack hammer or similar percussive tool, a handle for applying a hold-down force to the

3

tool, a resilient mounting for supporting the handle on the tool comprising a spring on the tool exerting a pre-loading force on the handle opposing the hold-down force, and a stop limiting the movement of the handle under the preloading force, the stiffness of the spring when pre-loaded being such that the natural frequency of the handle on the tool is less than $\frac{1}{2}\sqrt{2}$ times the frequency of the vibration from the percussive forces.

2. In a jack hammer or similar percussive tool, a handle for applying a hold-down force to the tool along the axis of the percussive forces, a torsion spring mounting for the handle offset to one side and crosswise of the axis of the hold-down force, the spring being preloaded to exert a force on the handle opposing the hold-down force, and a stop against which the handle is held by the preloading force until overcome by the hold-down force, the stiffness of the spring when pre-loaded being such that the natural frequency of the handle relative to the tool is less than $\frac{1}{2}\sqrt{2}$ times the frequency of the vibration from the percussive forces.

3. In a jack hammer or similar percussive tool, a handle for applying a hold-down force to the tool along the axis of the percussive forces, a torsion spring mounting for the handle offset to

4

one side and crosswise of the axis of the hold-down force, the spring being preloaded to exert a force on the handle opposing the hold-down force, and a stop against which the handle is held by the preloading force until overcome by the hold-down force, the stiffness of the spring when pre-loaded being such that the natural frequency of the handle relative to the tool is less than $\frac{1}{2}\sqrt{2}$ times the frequency of the vibration from the percussive forces, said torsion spring mounting comprising a bushing of rubber surrounding the torsion axis and having inner and outer surfaces, one locked to the tool and the other locked to the handle.

LEON WALLERSTEIN, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,649,730	Prellwitz	Nov. 15, 1927
2,062,817	Noble	Dec. 1, 1936

FOREIGN PATENTS

Number	Country	Date
122,752	Austria	May 11, 1931