May 12, 1942. H. B. COLESTOCK 2,283,047

FLUID MACHINE AND HAMMER

Filed March 8, 1940

Fig. 1

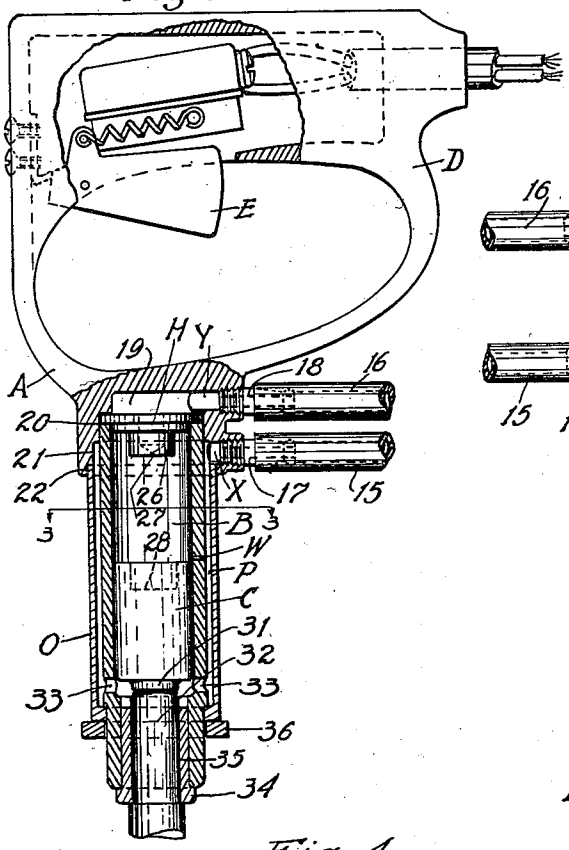


Fig. 2

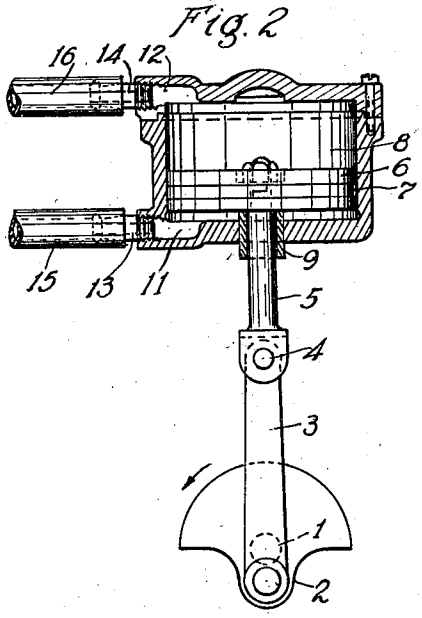


Fig. 3

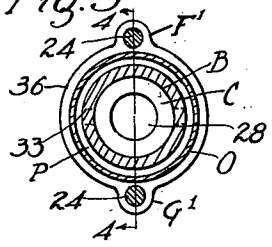
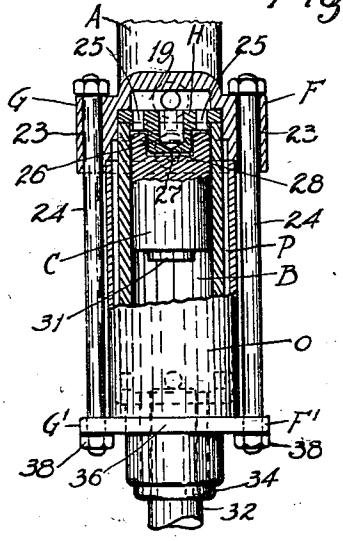


Fig. 4



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FLUID MACHINE AND HAMMER

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5 Claims. (Cl. 125—34)

This invention relates to a remote controlled pressure fluid hammer and more particularly to a pulsating hammer of the impact type. Its construction provides a means in which the operative pressure is reinforced by a partial vacuum or suction on the side opposite the compression power side of the stroke of the hammer piston.

An object of this invention is to provide an improved valveless type of pulsating hammer of the pressure fluid type in which the pulsations act alternately to energize the hammer piston on the operating tool and operative only through pulsated remote controlled pressure fluid. It relates best to a type wherein a pneumatic pressure and suction driver or pump supplies both the pressure and suction.

A still further object is to provide an improved valveless remote controlled pressure fluid hammer of extreme simplicity and ruggedness that with a gained efficiency of power through a suction reinforcement for said compressed power, affords the construction of a unit that can deliver work with dispatch and dexterity even through its small size.

These and other objects and advantages of this invention will however hereinafter more fully appear. In the accompanying drawing there is shown, for the purpose of illustration, a method which this invention may assume in practice. In the drawing,

Figure 1 is a vertical side view of the pulsating remote controlled power hammer partially broken to represent a cross section through the operative parts.

Figure 2 is a diagrammatic sectional view of the powered pneumatic pump supplying the pulsations for the power hammer through its compression and suction strokes.

Figure 3 is a cross sectional view looking downward on the line of 3—3 of Figure 1.

Figure 4 is a partial cross section showing the hammer piston at its top position and taken on the line of 4—4 of Figure 3.

As this invention relates to aerodynamic machines of the kind in which an air pump or driver supplies both the compressed air and suction, it necessarily relies in interconnecting tubing to the machine tool hammer. The connecting tubing of all machines of this kind heretofore known are of the type that have but one tube connecting said power unit and power hammer and wherein a succession of compression phases are generated which correspond to the succession of the compression stroke phases in the driver. That is to say, the air which in the compression phase is forced toward the tool affords the tool the power for the power stroke after which it is expelled.

This has been a serious inconvenience and loss of power because, the power spent through the discharge to atmospheric pressure creates a back pressure and therefore a direct power loss. The driving arrangement for this pneumatic pulsating hammer, according to this invention, fully obviates the former hazards and inconvenience, and entirely eliminates the possibility of dangerous high air pressures generally carried within the flexible tube between the compressor and the power hammer. In short, in my discovery, the pulsative motive power generated and transmitted to the hammer is a balanced pressure fluid, a given pressure balanced by a given suction.

This invention distinguishes itself in the fact that the driver piston is actuated in both directions thereby creating a suction and compression on one stroke and reversing the phases on the return stroke so that the compressed air is assisted by a balanced partial vacuum in each hammer piston stroke with no direct air discharge to the atmosphere.

In referring to the drawing A represents the pulsating hammer of which B is the piston cylinder, C the piston, D the handle and E the remote control switch. The pneumatic pump or driver, diagrammatically illustrated in Figure 2 is operative from an electric motor propelled by an electric force upon the closure of the power circuit by the actuation of the remote control switch. This pneumatic pump or driver is operative by a direct connected shaft 1 to which is secured the crank 2 operating the connecting rod 3. Through the cross head link connection 4 a piston rod 5 connected to a piston 6 is reciprocated within the pump or driver chamber 8. The piston 6 is provided with the usual expanding piston ring 7 to insure better compression and suction. The piston 6 traveling within the piston chamber 8 has its piston rod guided by a piston rod guide 9 through which the piston rod 5 travels.

The pump or driver's piston chamber 8 is provided at both its lower and upper ends with air ports 11 and 12 into which are secured screw connections 13 and 14 respectively connecting to flexible tubes 15 and 16. These tubes 15 and 16 are in turn connected by tube connections 17 and 18 to their respective ports in the power hammer A.

The lower or hammer end of the handle D is provided at its lower extremity with ports X and Y and is likewise further provided with a series of borings 19, 20, 21 and 22 into which the several

cylinders of the pulsating hammer are secured as will be hereinafter more fully described. The handle D of the pulsating hammer A is further provided with two side flanges F and G which are in turn fitted with holes **23** through which assembling rods **24** secure the pulsating hammer cylinder assembly to the handle proper.

The inner hammer cylinder B is inwardly provided with a series of ports **25** through an air cushion pillow block H having a pillow extension **26** which is provided with an orifice **27** for the releasement of the trapped air from within the pocket **28** within the upper face of the piston hammer C. The pillow extension pocket **28** cooperates with the air arresting pillow extension **26** of the cylinder end pillow block H, thus cushioning the return stroke of the hammer piston C. The hammer piston C is further provided at its other extremity with a boss **31** which beats the piston C's pulsations upon the tool **32**. The inner cylinder B is further provided with a second series of piston ports **33** near the power stroke limits of the hammer piston C leading to a peripheral port chamber P.

The piston cylinder B is further provided in its periphery with a pressure balance weep hole W leading from the inner chamber to the outer port chamber P. The port chamber P is formed by the cylindrical chamber B being enclosed by an outer cylinder O so as to form one continuous circular port connecting the piston ports **33** with the chamber X.

Inserted in the tool end of the piston chamber B is the bushing **34** which in turn is provided with a bore **35** of such size, as will freely yet snugly admit the insertion of a tool **32**, thereby making this assembled unit the other cylinder end closure.

The inner and outer cylindrical piston walls are in assembly supported upon a locking yoke **36** which in turn is provided with side flanges F′ and G′ through which the locking bolts **24** are passed and which, when assembled, are secured in place by the locking nuts **38**.

In operation, the pneumatic pulsating pump illustrated in Figure 2 is connected to the pulsating hammer through a series of tube connections **15** and **16** which respectively lead from the chambers **11** and **12** to the chambers X and Y respectively in the pulsating hammer. When the electric trigger switch E in the hammer handle D of the pulsating hammer A is pressed inward, it forms the electrical contact for the electric motor. The motor, not shown in the drawing, being directly connected to the shaft **1** which through crank connection **2**, the connecting rod **3**, the cross head **4**, and the piston rod **5** will cause the piston **6** to travel upward, trapping the air within the said piston chamber **8**, then pushing the trapped air out through the chamber **12** through its intermediate connections **14** into the tube **16** and thence into the chamber Y where it enters the piston chamber B through the ports **25** forcing the piston C downward as best illustrated in Figure 1.

The upstroke of the pneumatic pulsating pump piston **6** creates a partial vacuum in the lower piston chamber to the lower piston side, likewise creating a partial vacuum within the chamber **11** and its intermediate connection **13**. The partial vacuum extends through the tube **15** to the chamber X which is directly connected to the port chamber P and which opens to the inner chamber B on the boss side of the hammer piston C, thus aiding the compressed power by sucking the hammer piston C into the position shown in Figure 1.

Upon the reverse stroke of the pump or driver piston **6**, the entire phase of compression and suction is likewise reversed and thus the hammer piston is retracted into a new striking position. Upon the upstroke of the hammer piston C, the air within the pocket **28** becomes trapped by the pillow extension **26** and obviates or cushions a return blow of the hammer piston C allowing the trapped air to weep out through the weep hole **27**.

Should there at any time at the end of a power stroke during the operation of the hammer arise a moment of unbalanced fluid pressure and suction, there is provided a fluid balance weep hole W open and operable only when there are no active forces playing upon the hammer piston for its operation at the end of a power stroke and thus balancing the fluid pressure and suction to a degree of smooth operating.

I claim:

1. A hammering device comprising a cylinder, a piston slidable within said cylinder, flexible fluid supply conduits communicating with said cylinder at opposite ends of said piston, one end of said cylinder having an opening therein to receive a tool to be hammered, a boss projecting from the other end of the cylinder, a recess in said piston into which said boss extends, an exhaust port relatively small with respect to said supply conduits through said boss for air trapped within said recess by said boss to cushion movement of the piston in one direction.

2. A hammering device comprising a cylinder, a hammering piston slidable within said cylinder between extreme positions, flexible fluid supply conduits communicating with said cylinder at opposite ends of said piston when the same is in said extreme positions, one end of said cylinder having an opening therein to receive a tool to be hammered, the other end of said cylinder having a boss projecting therefrom, a recess in said piston to accommodate said boss, air passage means in communication with one of said flexible fluid supply conduits through said other end of said cylinder adjacent said boss, and said boss having restricted fluid passage means therethrough communicating with said one fluid supply conduit, to restrict the air flow from between said boss and said recess in said piston.

3. A hammering device comprising a cylinder, a piston slidable therein, one end of said cylinder having an opening therein to receive a tool to be hammered, a fluid supply conduit communicating with said one end of said cylinder, a boss projecting from the other end of said cylinder, a recess in said piston to accommodate said boss, said boss and said other cylinder end having passages therethrough, and a second fluid supply conduit communicating with said passages.

4. A hammering device comprising a cylinder, a piston slidable in said cylinder, a pair of flexible fluid supply conduits communicating with said cylinder at opposite ends of said piston, one end of said cylinder having an opening therein to receive a tool to be hammered, piston cushioning means at the other end of said cylinder, said cylinder having a fluid opening therethrough connecting one end of said cylinder with the fluid supply conduit communicating with the other end of said cylinder when said piston is in one extreme position of its movement.

5. A hammering device comprising a cylinder,

a piston slidable therein, flexible fluid supply conduits communicating with said cylinder at opposite ends of said piston and one end of said cylinder having an opening therein to receive a tool to be hammered, and said cylinder having an opening in the wall thereof closed by said piston throughout the greater part of its movement connecting the other end of said cylinder with the supply conduit extending to said one end of said cylinder to equalize pressure on both sides of said piston at one point of the stroke of said piston.

HARRY BARNES COLESTOCK.