This invention relates to vibrators, and more particularly to an improvement in a vibrator for use in loosening a core box from a mold, as is required in a certain phase of casting operations in foundry work.

In drawing a core box from a mold, especially of complicated or large design, it is desirable to apply rapping or vibratory blows to the core box so that the mold sand is freed from the core box, thus providing a well formed mold. Various methods have been used for such operations ranging from manual means, such as rapping the core box or the supporting bench with a mallet, to the use of some mechanical means, as pneumatic hammers, or vibrators. This invention relates to an improvement on the latter type device namely vibrators.

Briefly, the invention comprises a combination of a pneumatically operated vibrator unit, an integrally arranged pneumatically operated clamping means, and a valve arrangement which allows pneumatic medium to be initially directed to the clamping means for operation thereof, followed by direction of pneumatic medium to the vibrator unit, while the clamping means is still under pneumatic pressure. The invention provides a convenient and rapid means for applying a vibratory action to a core box, since all that is required is that the clamping means be brought into gripping relation with the core box, and the valve operated to provide pneumatic medium for clamping vibratory action. The independent operation of the clamping means also makes it possible to raise the core box by attaching a cable of hoisting means to a handle or bail of the vibrator unit.

The main object of this invention is to provide a pneumatically operated vibrator which can be used for loosening a core box from a mold in foundry casting operations, and which can be rapidly and conveniently attached to a core box.

A further object is to provide a vibrator which has an integral pneumatically-operated clamping unit which can be operated prior to, and during vibrating action.

Another object is to provide a pneumatically operated vibrator which has an integrally arranged clamping unit which can be maintained in position upon a core box for removal of the latter from a mold, after the core box has been freed from the mold.

These and further objects and features of the invention will be apparent from an understanding of the following disclosure, when considered with the accompanying drawings wherein:

Fig. 1 is a schematic diagram illustrating an embodiment of the invention, and showing the relationship of various operative parts;

Fig. 2 is a side view of the device of the invention, with parts of the clamping unit shown in longitudinal section;

Fig. 3 is a partially broken side view as seen from line 3—3 in Fig. 2, and illustrating certain parts of the vibrator and valve arrangement in section;

Fig. 4 is a section view as seen from line 4—4 in Fig. 3;

Fig. 5 is a section view as seen generally from line 5—5 in Fig. 3;

Fig. 6 is a section view similar to Fig. 5, but showing a control valve in slightly different position of rotation;

Figs. 4a, 5a and 6a are schematic views showing the control valve in different positions of operation indicating non-operative condition, clamp-operating condition and clamp-and-vibrator-operating condition respectively;

Fig. 7 is a cross-section of the vibrator unit taken on line 7—7 of Fig. 3, and

Fig. 8 is a cross-section of the vibrator unit, and particularly the air motor thereof, taken on line 8—8 of Fig. 3.

Referring now to Fig. 1, numeral 11 indicates a vibrator assembly embodying the principles of the invention, which vibrator assembly includes in combination a vibrator unit 12, an integrally affixed clamping means 13, and a valve arrangement 14 adapted for operative control of the vibrator unit 12 and the clamping means 13, in a manner which will be explained hereinafter.

The vibrator unit 12 includes an elongated shell 69 supported in a bracket portion 16 of a casting 17. The shell houses an off-balanced rotor 71, and a pneumatically powered motor 72 having a suitable driving connection with the rotor. When the motor is operating, a consequent rapid rotation of the off-balanced rotor imparts a vibratory action to the casting 17.

Off-balanced rotors are well-known. Here, the off-balanced rotor 71 is illustrated as a cylindrical mass 73 cut away in its central area 74. The motor 72 is of the pneumatically powered slidable blade type. The structure and mode of operation of such motors are well-known. Briefly, however, the motor 72 includes an outer casing 75, an end section of which is shown at 76 supported by the shell 69. Arranged within the casing 75 is an inner member 77 which provides an eccentric camshaft per 78 to which pneumatic pressure fluid is supplied through a port 79. The latter has communication with an intake passage 81 connected to external piping 64. Mounted for rotation in chamber 78 is a slidable blade type rotor 82 which is driven by pressure of air entering through exhaust ports 83, 84 to the space 85 between the casing and the shell from where it flows to end passages 86, communicating with a vent 87 to atmosphere.

Casting 17 includes a cylinder section 18, a jaw section 19, and a handle grip 21, all as best seen in Fig. 3. Portably arranged within the cylinder section 18, is a piston 22 which is affixed to a hollow piston rod 23, slidably arranged in a cylinder head 24 enclosing the open end of the cylinder section. A rod 26, one end of which is seated in the cylinder section, projects into the piston rod 23, and is surrounded by a spring 27 compressively arranged within the piston rod. A clamping head 28 having a jaw section 29 is attached to the piston rod 23 upon the end extending beyond the cylinder head 24. It will be seen that when pressurized pneumatic medium is admitted to the cylinder section 18 near the cylinder head 24, the piston 22 will be moved in the direction of the vibrator unit 12, causing movement of the piston rod 23 and attached clamping head 28, so that the jaw section 29 approaches the jaw section 19, whereby a portion of a core box 31, is firmly gripped. When the pneumatic medium is released from the cylinder section 18, the spring 27 is free to expand, and cause movement of the piston rod 23 and attached clamping head 28, in an outwardly direction, so that the jaw section 29 moves away from the jaw section 19, whereby gripping action is terminated.

The valve arrangement 14 is attached to the bracket portion 16, by any suitable means, such as bolts 32, the valve arrangement having a valve body 30, including a threaded opening 33 for receipt of pipe, or hose 34, which delivers pressurized pneumatic medium to the assembly,
The opening 33 leads to a vertically disposed elongated chamber 36, Fig. 3, the lower end of which is closed by a threaded plug 37, the upper end of which has a presses fitted valve bushing 38, in which is guidedly supported a valve stem 39, of a plug valve 41. A spring 42, compressively arranged between the head of valve 41 and the plug 37, is adapted to urge the valve into seated engagement with a rubber ring 43 placed at the end of the bushing 38.

The valve bushing 38 has a plurality of radial holes 44, which are located in alignment with a circular recess 46, formed in the body 30. Extending upwardly from the recess 46, is a passageway 47, which eventually terminates in a threaded opening 48 (Fig. 5) on the side of the hollow body 30, arranged for the receipt of a pipe or hose 49. The hose 49 connects at the other end, with a port 51 in the forward part of the cylinder section 18, as shown diagrammatically in Fig. 2.

Rotatably positioned within the valve body 30, is a control valve 52, having a handle 53, for the rotation thereof. An end plate 54 is affixed to the side of the valve body by any suitable means, such as bolts 56, to maintain the control valve 52 in position. The valve handle 53 has an extension 57 (Fig. 2) which is arranged to engage stop lugs 58 formed on the end plate 54, whereby the angle of rotation of the control valve 52 is limited to 90°. A passageway 59 (Fig. 6) is formed in the control valve, and is so arranged as to connect passageway 47 with passageway 60, formed in the valve body 30. Passageway 60 terminates in a threaded opening 61, arranged for the receipt of a pipe or hose 62 (shown diagrammatically in Fig. 3), which is connected at the other end with a pressure regulator 63 and pipe coupling 64 affixed to the end of the vibrator unit 12.

Control valve 52 has three operative positions; "off-position" as indicated in Figs. 4 and 4a, "clamp-on position" as indicated in Figs. 5 and 5a, and "clamp-vibrator on position" as indicated in Figs. 6 and 6a. The control valve 52 has a flat portion 65 arranged on its surface, which allows sufficient clearance, for the end of the valve stem 39 so that the valve 41 is seated on the ring 43, when the control valve is in "off-position." As the control valve is rotated, the valve stem 39 is engaged by the curved portion 66 of the control valve, and is forced downwardly, whereby the valve 41 is unseated, and moved away from the ring 43. A spring loaded ball 66 (Fig. 3) in the valve body 30, is arranged to engage any one of three detents formed on the end of the control valve, whereby the latter is held in any one of its three operative positions. Inlet opening 67 is arranged in the valve body, for connection with control valve passageway 59, when the control valve is in "off-position," for purpose of venting to atmosphere the pneumatic medium in the clamping means 13, and incidentally the vibrator unit 12. Hook means 68 may be affixed to the handle 21, as shown, for purpose of using a cable hoist for lifting the vibrator assembly and the core box during core box removal operation.

The operation of the vibrator assembly 11 of the invention is as follows. The operator places the vibrator assembly next to or in gripping relation upon a core box, so that the jaws 19 and 29 are on opposite sides of a rib portion 31 of the core box. The valve handle 53 is rotated from the Fig. 4 to the Fig. 5 position, thereby unseating valve 41 from the ring 43. Pneumatic medium, such as compressed air, is thus able to flow from hose 34 (Fig. 3), about valve 41 (Fig. 5) and valve stem 39, into recess 46 and passageway 47, to hose 49, and finally through port 51 into the cylinder section 18 (Fig. 2), to move the piston 22 so that the jaw 29 is brought into gripping engagement with the core box portion 31. By rotating the handle 53 from the Fig. 5 to the Fig. 4 position, it will be seen that flow of compressed air into the clamping means 13 is uninterred and in addition, flow of compressed air passes through control valve passageway 59 into passageway 60, opening 61 and through hose 62 (Fig. 3), through pressure regulator 63 and pipe coupling 64, into the vibrator unit 12, to cause the latter to operate and produce vibratory action. Such vibratory action is applied as long as the operator desires, or feels is necessary, to free the core box from the mold.

To terminate the vibratory action, the operator rotates the handle 53 from the Fig. 6 to the Fig. 5 position, whereupon air flow into the hose 62 is stopped, resulting in cessation of the operation of the vibrator unit 12. The core box may then be removed by manual means, or by the use of a hoist cable (not shown) attached to hooks 68, the vibrator unit 11 being still attached to the core box by reason of gripping jaws 19 and 29. When it is desired to release gripping action of the jaws from the core box rib 31, the operator rotates the handle 53 from the Fig. 5 to the Fig. 4 position. In such position, the valve 41, under action of spring 42, is again seated upon ring 43, thereby cutting off flow of compressed air to the clamping means 13. In such position of the control valve 52, the compressed air in the cylinder section 18 is released to atmosphere via port 51, hose 49, control valve passageway 59, and opening 67, thereby allowing spring 27 to move the piston 22 and clamping head 28 away from gripping position.

By the use of pressure regulator 63, it is possible to provide any degree of vibratory action within the range of the vibratory unit 12, as will be understood. It will also allow the cutting off of all compressed air flow to the vibratory unit, if desired, so that only the clamping means 13, will be operated when the valve handle 53 is in either Fig. 5 or Fig. 6 position, so that the clamping means may be used as a gripping device.

In the description of the device of the invention above, no mention has been made of certain mechanical details such as, washers, gaskets, etc., all of which may be necessary to make an efficient operating tool, however, such details are all well known to those skilled in the art of tool manufacture, and a description thereof is not necessary for an understanding of the principles of the invention.

While the device of the invention has been described as applied to a pneumatically operated tool, the principles thereof are not limited to such type of power supply, as a device principle of the invention could be satisfied by use of electrical power, wherein a vibrator unit could be motor driven, and associated clamping means may utilize a solenoid, while an electrical switch could be arranged for the operational operation of the clamping means and vibrator unit, as set forth heretofore in the description of a device of the invention.

What is claimed is:

1. A vibrator assembly comprising in combination a vibrator unit including a pneumatic motor and an offset rotary element driven by the motor, a clamping means affixed to the vibrator unit and including a pneumatically operable piston means having a clamping jaw at an end thereof, inlet means and associated passageways for conduction of pneumatic medium to the vibrator unit and the clamping means for operation thereof, and a control valve adapted for regulation of flow of pneumatic medium to the clamping means and the vibrator unit, wherein the control valve has three operative positions, an "off-position" in which pneumatic medium is prevented from flowing to either the clamping means or the vibrator unit, a "clamp-on position" in which pneumatic medium is allowed to flow to the clamping means, and a "clamp-vibrator on position" in which pneumatic medium is allowed to flow to the clamping means and the vibrator unit.

2. A vibrator assembly according to claim 1, wherein the clamping jaw on the piston means is arranged for movement toward or away from a fixed jaw section formed upon the clamping means.

3. A vibrator assembly according to claim 1, wherein a spring means is compressively arranged to oppose move-
ment of the piston means when the latter is being moved by pneumatic medium.

4. A vibrator assembly according to claim 1, wherein a detent means is adapted to hold the control valve in any one of its three operative positions.

5. In a suspended core box pneumatic vibrator assembly of the character described for use with a core box supported apart from the assembly, and including a pneumatically operable vibrator unit: a casting member to which the vibrator unit is fixed; a lift cable attached at the top of the casting; and clamping means comprising a jaw element integral with the underside of the casting and a pneumatically operable piston housed in the casting and having at the end thereof a clamping jaw complementing the integral jaw element, the piston being arranged for movement so as to draw the clamping jaw toward the integral jaw to effect a clamping action of both jaws against opposite portions of the core box; pneumatic pressure supply control means affixed to the casting and common to the vibrator unit and the piston, the control means adapted in one position to supply pneumatic pressure to drive the piston in said movement, and in another position to release the pneumatic pressure from the piston; and spring means for automatically returning the piston from said movement upon release of the pneumatic pressure; and the lift cable serving to suspend the casting in relation to the core box for engagement or disengagement of the clamping means from the latter.

6. A suspendable core box pneumatic vibrator assembly comprising in combination a pneumatic vibrator unit, a core box clamping means arranged at the underside of the assembly, the clamping means including a clamp jaw fixed to the vibrator unit and including a pneumatically operable piston having a clamping jaw at an end thereof engageable with the fixed jaw, passage means for conduct of operating pneumatic fluid to the vibrator unit and to the piston, a control valve adapted for regulating flow of the pneumatic fluid to the piston and to the vibrator unit, a supporting casting common to the vibrator unit, to the passage means, and to the control valve, a handle forming part of the casting whereby the assembly may be manually moved about for gripping association of the clamping means with a core box located apart from the assembly, and a hook carried by the casting whereby the assembly may be suspended from a hoist and the core box lifted by the assembly from its mold subsequent to loosening of the latter in response to the operation of the vibrator unit.

7. A suspendable core box vibrator assembly comprising in combination a cylinder section, pneumatic clamping means including a piston reciprocable in said cylinder section and a pair of opposed jaws at the underside of the cylinder section, one of which jaws is fixed and the other of which is pneumatically movable relative to the cylinder section for effecting a clamped hold upon a core box, a pneumatic vibrator attached to the cylinder section and fixed jaw for loosening a core box that has been clamped between the jaws from its mold by vibrating the clamped core box, a common pneumatic supply control arrangement for effecting pneumatic operation of the vibrator and the clamping means, and means at the upper side of the cylinder section for suspending the cylinder section from a hoist whereby the assembly may be moved for association of the clamping means with a core box and whereby upon loosening of the associated core box from its mold the core box may be hoisted free of the mold.

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