United States Patent

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[54] APPARATUS AND METHOD FOR CLEANING HOLLOW CASTINGS

6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **51/7,** 51/317
[51] **Int. Cl.** **B24b 19/00**
[50] **Field of Search** 51/7, 2, 317

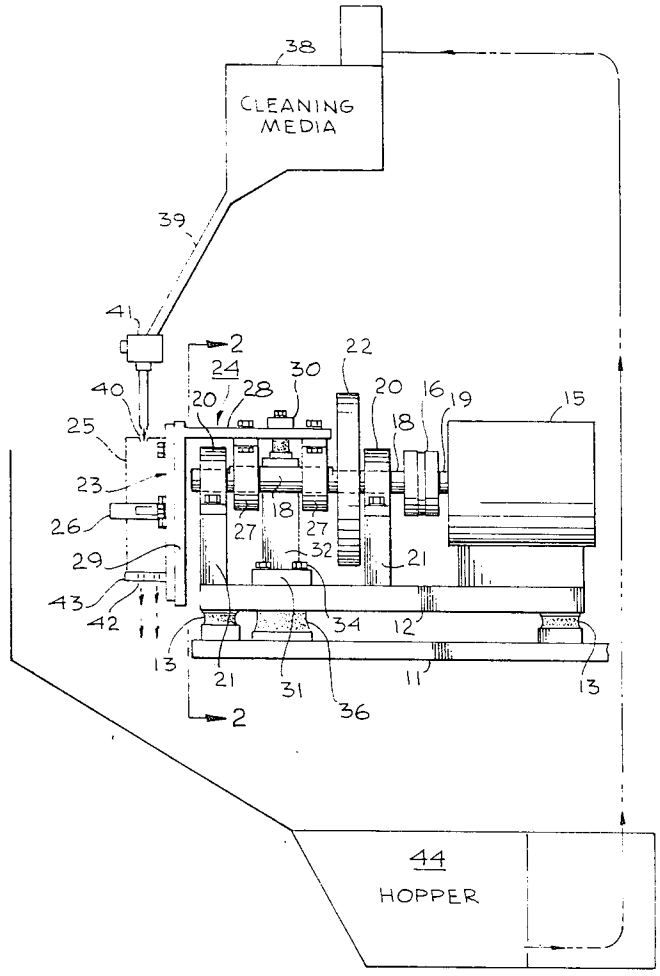
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ABSTRACT: A rapid method is provided for cleaning out adhering sand particles from a sand-cored metal casting, by passing a continuous stream of hard cleaning granules into and out of the cavity in said casting while simultaneously strongly vibrating the casting and the contained granules therein, said vibration being strong enough to cause the granules to bounce against the walls within the cavity. A vibratory machine having an eccentric or offset shaft operated by a horizontal shaft motor is provided, the vibration thereby generated being of a gyratory nature in a plane generally perpendicular to the stream of granules passing into and out of the cavity of the casting.



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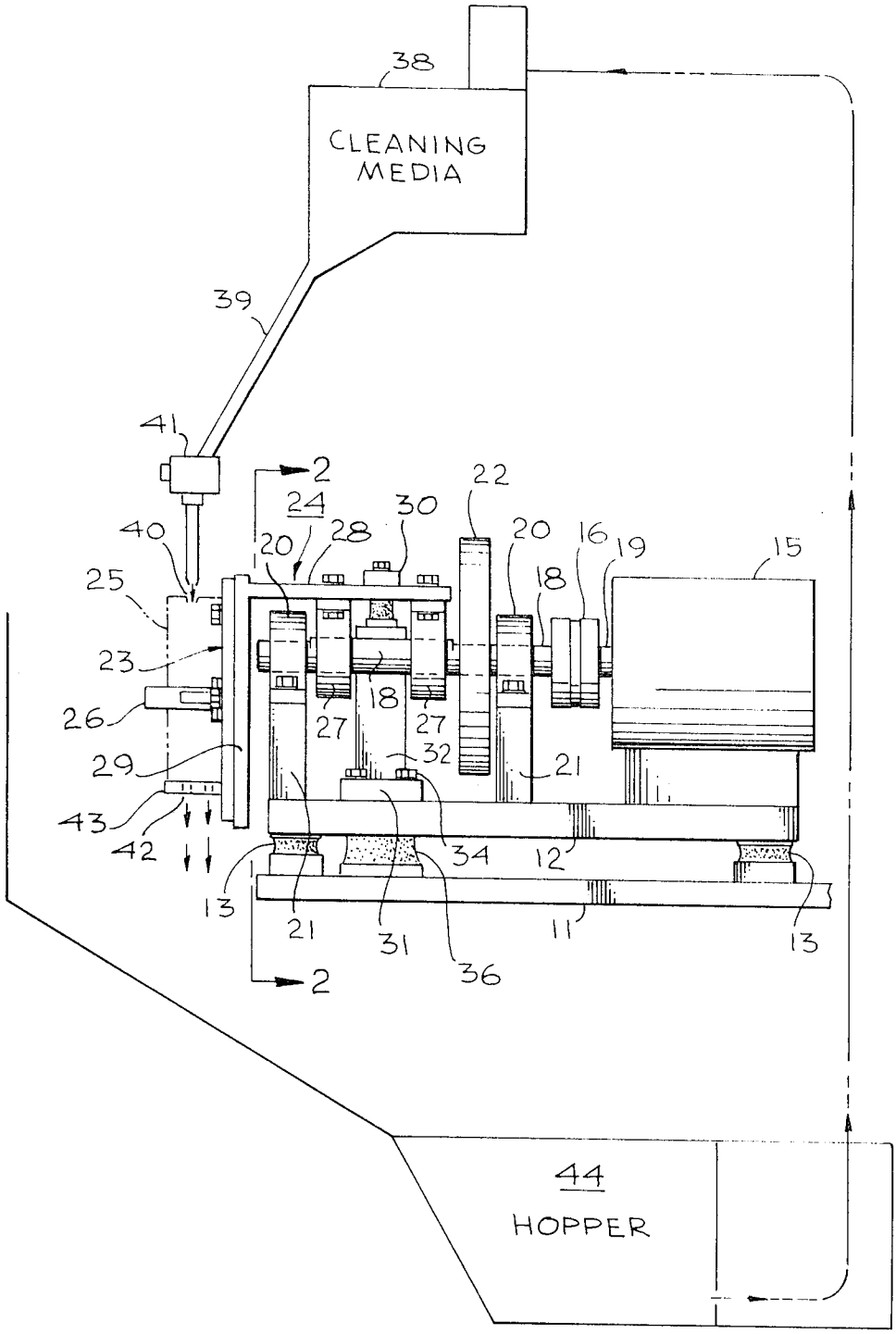


Fig. 1

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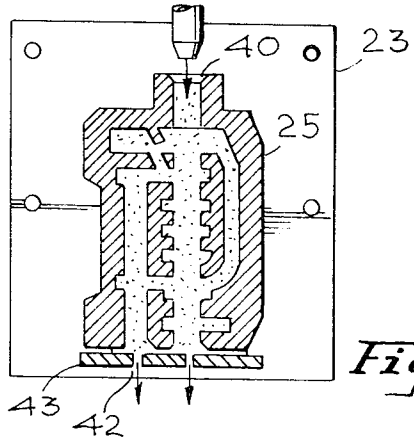


Fig. 4

Fig. 3

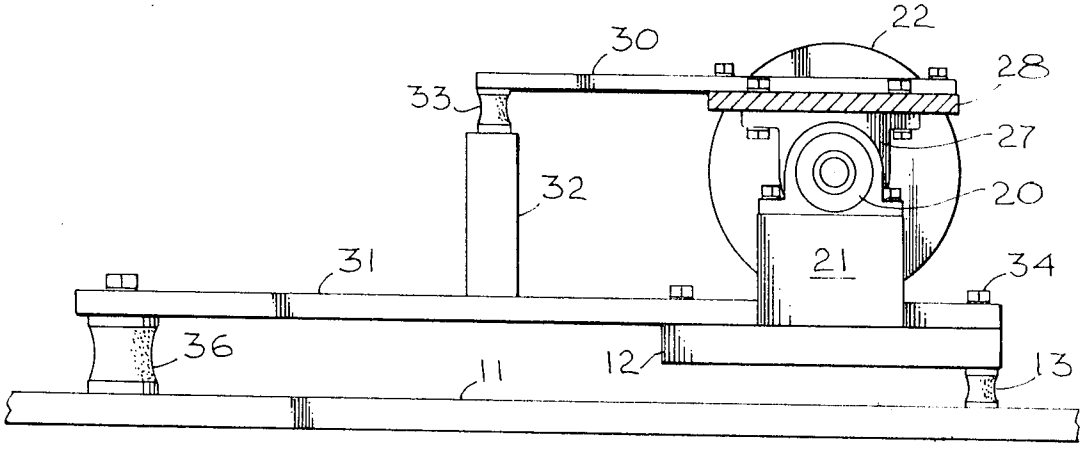


Fig. 2

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APPARATUS AND METHOD FOR CLEANING HOLLOW CASTINGS

BACKGROUND OF THE INVENTION

Metal castings are commonly made in which the cavities are produced by the use of shaped sand cores, which after the metal has hardened around them, must be removed. The sand for the cores is bonded with a bonding agent which disintegrates and loses its binding power when subjected to the heat of the molten metal. The loose sand and pieces of the core are removed by shaking the casting or manually prodding the weakened core, but the removal of the particles of sand which adhere to the internal surfaces of the casting or are locked in blind and otherwise inaccessible passages presents a more difficult problem, especially where the cavity surfaces are to be machined, or are to be used in sliding contact with other metal parts, where residual sand cannot be tolerated. In many such castings the external openings are restricted so that hand tools such as brushes, scrapers and the like cannot be used effectively. The commonly used method of tumbling the castings in a drum with steel shot results in cleaning and smoothing the external surfaces of the castings, but does little toward removing the same particles adhering to the walls of the cavity.

SUMMARY OF THE INVENTION

The principal object of this invention is to provide a quick and thorough method of cleaning the cavity walls of hollow metal castings. Another object is to provide a vibratory machine which is especially arranged to strongly vibrate individual hollow castings, each casting being rigidly attached to the vibrator machine adjacent

BRIEF DESCRIPTION OF THE DRAWING the source of the vibrations generated by the machine, and to provide means for passing a continuous stream of hard granules such as steel shot into and out of the cavity, the granules being set into motion by the vibratory forces. The particular machine described has been found to rapidly and thoroughly clean out any sand particles originally adhering to the walls of the cavity. Brief Description of the Drawing

A preferred form of a vibrator is shown in the accompanying drawings in which

FIG. 1 is a side elevational view of the vibrator including the driving motor, the eccentric shaft and its mounting, and showing the hollow casting mounted in position on a vibratory adapter plate to be cleaned;

FIG. 2 is an elevational view partly in section, taken from the line 2–2 of FIG. 1;

FIG. 3 is a top plan view, with parts broken away and shown in section of the mechanism of FIG. 1; and

FIG. 4 is a cross-sectional view of the mounted hollow casting, taken on the line 4–4 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, a base 12 for a vibratory machine and its driving motor is attached to a rigid main mounting base 11, by rubber mounting supports 13 which dampen the vibration of the base 12 with respect to the main mounting base 11. The motor 15 is rigidly attached to the base 12; the shaft 19 of the motor is operatively connected to a vibrator shaft 18 by the coupling 16. The shaft 18 is mounted at its ends for rotation in the pillow block ball bearings 20 which are mounted upon support blocks 21 attached to base 12, a portion of the shaft 18 between said bearings 20 being eccentric. A flywheel 22 is mounted between the bearings 20 near one end of the vibrator shaft 18. The inverted L-shaped casting fixture adapter 24 is operatively attached on its horizontal portion 28 by pillow block ball bearings 27 to the eccentric portion of shaft 18. A casting fixture 23 is removably attached to the depending apron portion 29 of the adapter fixture 24, and is provided with clamping means 26 which securely holds a casting 25. The casting fixture 23 is replaceable and may be particularly designed to hold castings of different sizes and configurations. One end of a resonating bar 30 is attached to the horizontal portion 28 of the fixture adapter 24, the other bar end being attached to the stabilizing bar 31 by the connector 32 through the rubber resonating isolator 33. The inner end of the stabilizer bar 31 is connected to the base 12 by bolts 34, and the outer end by the rubber support 36 on the rigid base 11.

The flywheel 22 serves to equalize the speed and absorb the vibratory shock of vibrator shaft 18 at the mounting bearings 20.

The resonating bar 30 and the stabilizing bar 31 serve to moderate the vibratory action, as well as to prevent the rotation of the adapter 24.

The speed of the motor may be varied but 3600 r.p.m. has been found to give satisfactory vibratory action for cleaning castings up to about 50 pounds in weight. The offset of the axis of the eccentric shaft is not large, being generally a few thousandths of an inch for efficient vibratory action. The vibration is generally gyratory in nature in a plane perpendicular to the axis of the shaft.

A reservoir 38 for the cleaning media, preferably steel shot, is disposed at an elevation above the vibratory mechanism, with a conduit 39 leading from the bottom of said reservoir 38 to a top opening 40 in the casting 25 leading to the cavity therein which is to be cleaned. An adjustable valving means 41 is provided in the conduit 39 so that the gravity flow of cleaning media, for example steel shot, may be regulated. One or more holes 42 in the lower portion of the mounted casting 25 are utilized for discharge of the shot, and an orifice plate 43 welded to adapter 23 adjacent said discharge holes so that the outflow of steel shot and sand grains removed from the cored opening in the casting may be regulated in its discharge into a collecting hopper 44. The sand is there separated from the steel shot, and the shot returned to the reservoir 38 above the vibratory machine for reuse. While steel shot is the usual cleaning medium for removing sand from castings, and is the preferred material for use in this invention, other hard media such as fused alumina particles or shaped metallic granules may be employed.

The method of cleaning the cored opening in a casting mounted on the casting fixture 23 will be understood from the above description of a preferred vibratory and shot feeding mechanism. By gravity-feeding steel shot into a selected core opening in the casting while the casting is being rapidly vibrated, and simultaneously controlling the discharge of the steel shot from other cored openings in the casting, the internal cavities of the casting are kept more or less full of rapidly bouncing steel shot, which action removes all adhering sand particles from the internal walls. The stream of shot is circulated through the cavity in the casting at all times during the cleaning operation. The time of cleaning is quite short, castings with large cavities being thoroughly cleaned in from one-half to 2 minutes, although the exact time depends upon the conditions of the particular casting, including the cavity space, the weight of the casting, etc.

While a preferred vibratory machine has been shown for carrying out the vibratory cleaning operation, other vibratory means which oscillate the castings in such a way that the steel shot bounces around in the cavity against the walls, as a stream of said shot flows through the cavity, may also be employed.

We claim:

1. A vibratory machine for cleaning the interior of a cored metal casting comprising:

a horizontal base plate;

a horizontally disposed vibrator shaft mounted at its end portions in main bearings supported in said base plate, a portion of the shaft between said bearings being eccentric;

a flywheel attached on said vibrator shaft for rotation therewith;

a motor means operatively connected to said vibrator shaft;

an adapter plate mounted by bearing means on the eccentric portion of said vibrator shaft;

means attached to said adapter plate to prevent its rotation;

and means for attaching a hollow casting to be cleaned to said adapter plate.

2. The vibratory machine defined in claim 1, in which the means to prevent the rotation of the adapter plate comprises an elongated resonator bar attached at one end to said adapter plate and its other end to said base plate.

3. The vibratory machine defined in claim 1, in which the means to prevent the rotation of the adapter plate consists of an elongated resonator bar attached at one end to said adapter plate and connected at its other end to a stabilizing bar extending laterally from said base plate, said bars being fastened together by a rubber resonating isolator.

4. The vibratory machine defined in claim 1, in which said adapter plate is provided with a depending apron disposed in a plate perpendicular to the axis of rotation of said vibrator shaft, said apron having means for securely holding a hollow casting thereon.

5. In combination, the vibratory machine defined in claim 1, and means for passing a stream of hard granules into and out of a hollow metal casting mounted on said adapter plate during the operation of said machine.

6. In the combination defined in claim 1, the said means for passing a stream of granules into and out of a hollow metal casting comprising an elevated reservoir for holding the cleaning granules, a valved conduct from said reservoir to an opening in said hollow casting, and an exit orifice for the gravity discharge into a hopper of the granules and dislodged grains of sand from inside said casting.