United States Patent [19]

Deve

[11] **3,897,910**

[45] **Aug. 5, 1975**

[54] **SHAKEOUT AND CRUSHING APPARATUS**

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[73] Assignee: **Combustion Engineering, Inc.**, Windsor, Conn.

[22] Filed: **Apr. 5, 1974**

[21] Appl. No.: **458,371**

[52] **U.S. Cl.** **241/77**; 241/156; 241/DIG. 10

[51] **Int. Cl.** **B02c 17/02**

[58] **Field of Search** ..... 241/69, 76, 77, 78, 79, 241/84, 84.1, 84.3, DIG. 10, 152 R, 156

[56] **References Cited**

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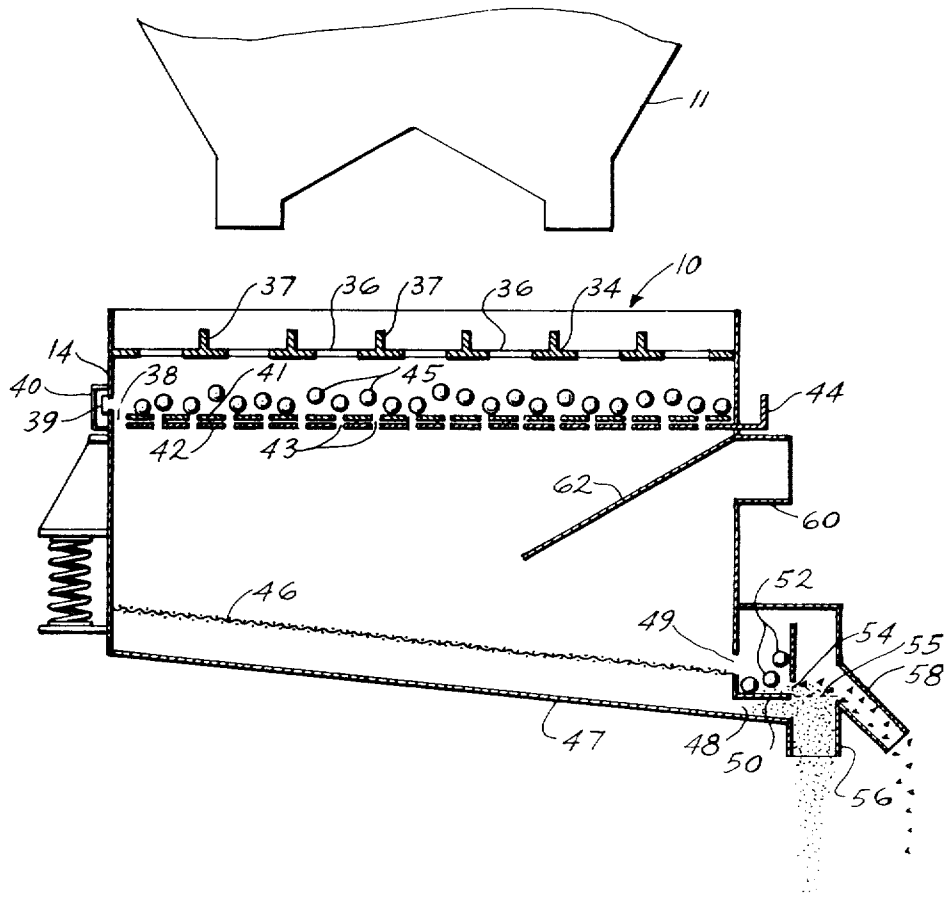
551,772	12/1895	King	241/DIG. 10
2,452,362	10/1948	Erisman	241/DIG. 10
3,762,656	10/1973	Deve	241/77

Primary Examiner—Granville Y. Custer, Jr.
Attorney, Agent, or Firm—Robert L. Olson

[57] **ABSTRACT**

A shakeout and crushing apparatus for reducing bonded sand molds to a condition for reuse in a molding process. The apparatus consists of an orbitally vibrated chamber having a first upper shakeout deck, a second intermediate disintegration deck including a plurality of crushing balls, and a third deck which consists of a screen. Material not passing through the screen passes through a secondary disintegration deck where any remaining friable material is crushed.

6 Claims, 3 Drawing Figures



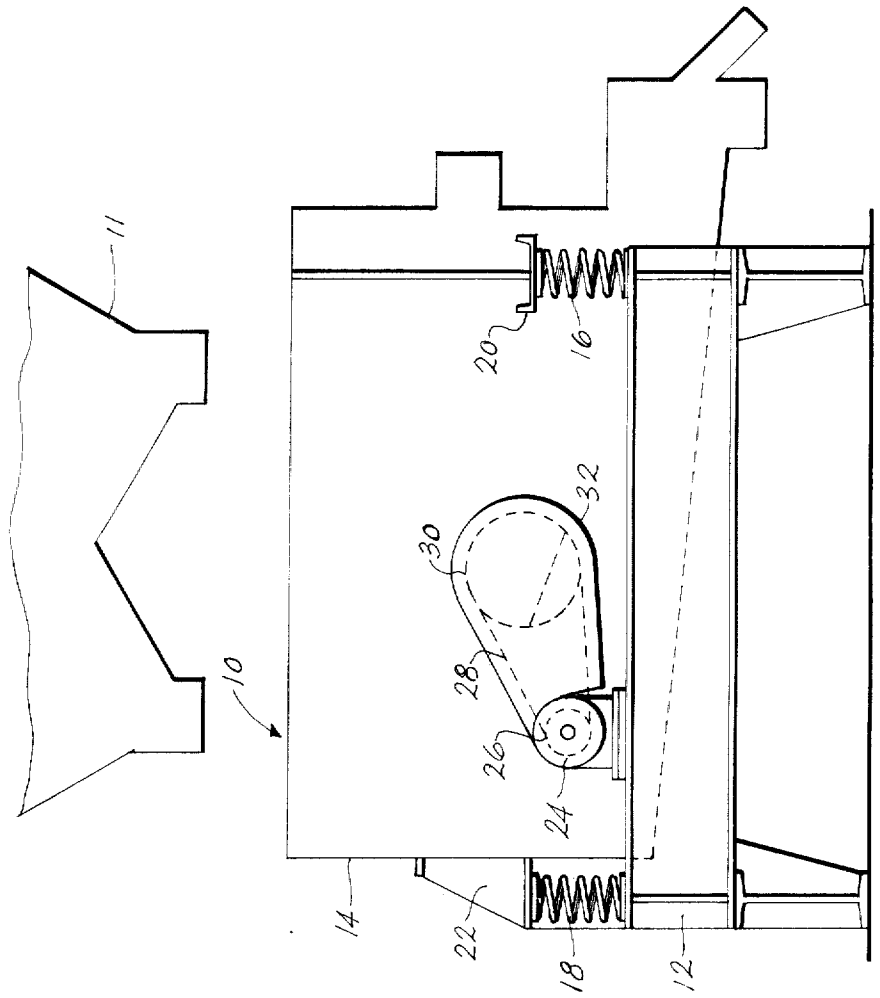

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FIG-1

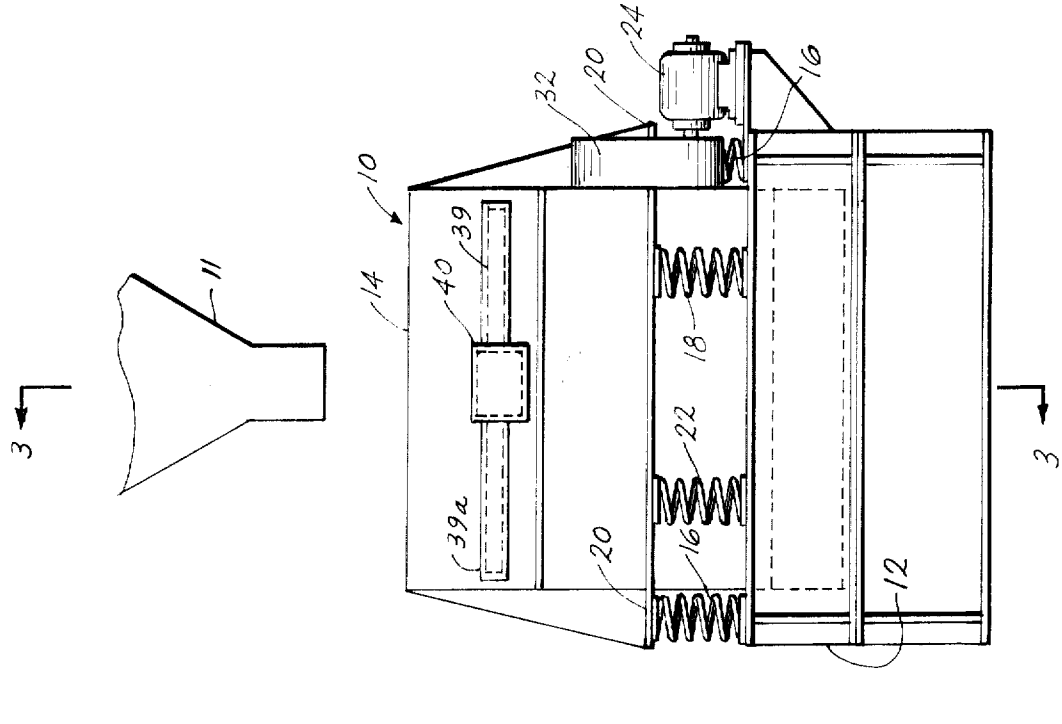

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FIG-2

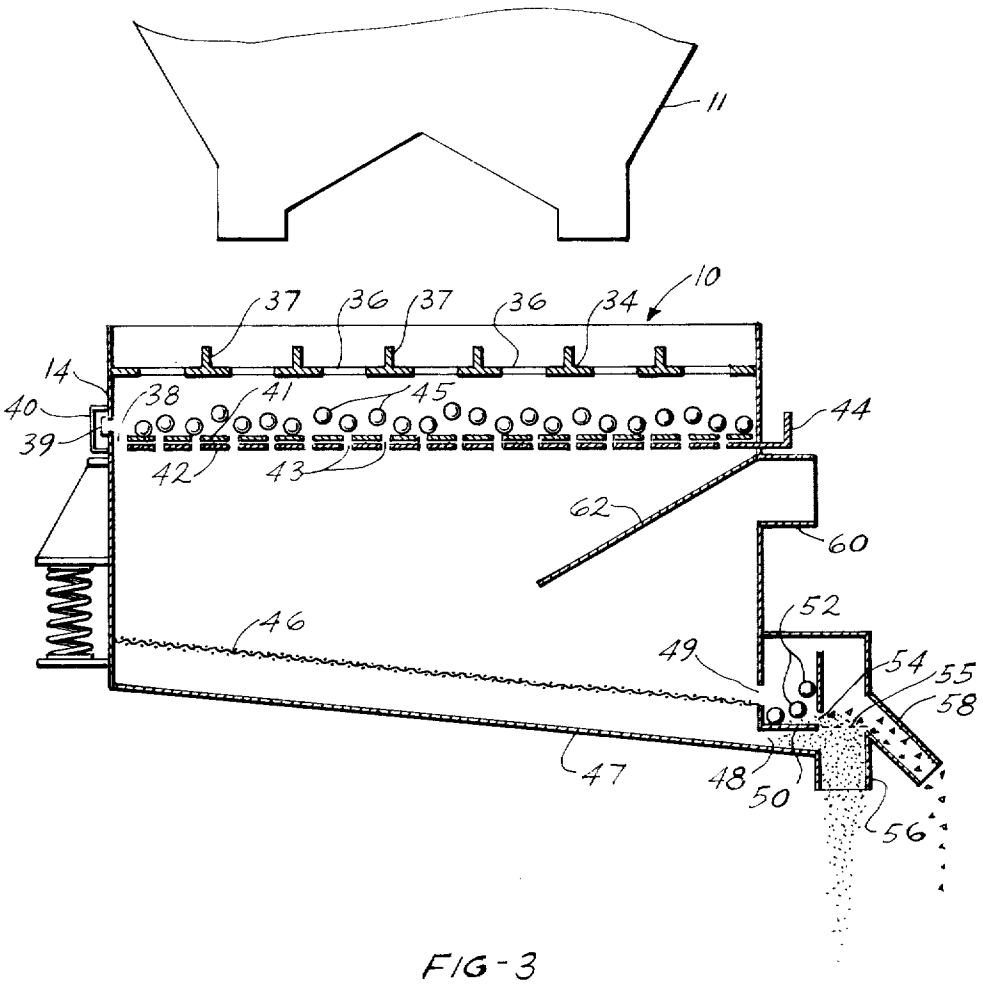

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FIG-3

SHAKEOUT AND CRUSHING APPARATUS

BACKGROUND OF THE INVENTION

The advent of automation in foundries in recent times, and the concern over depletion of natural resources, has caused many foundries to install equipment for recycling the sand used in molds. The mold including the casting therein is initially passed through a vibratory shakeout unit which breaks the metal casting loose, and reduces the sand mold into large lumps.

This material is then passed through apparatus where the castings and most of the tramp metal are removed, for example by magnetic means. The remaining material, consisting basically of lumps of sand and some small pieces of tramp metal, is crushed and classified. One type of apparatus presently used for crushing and classifying foundry sand is shown in my U.S. Pat. No. 3,762,656 which issued on Oct. 2, 1973. This patent shows a shakeout and crushing apparatus for foundry sand reclamation which has an orbitally vibrated chamber having an upper shakeout deck, an intermediate disintegration deck having a plurality of crushing balls thereon, and a lower screen deck. Material not passing through the screen was conveyed up to the second deck level by means of an elevator for further crushing action.

SUMMARY OF THE INVENTION

The shakeout and crushing apparatus of the invention comprises an orbitally vibrated chamber having an upper shakeout deck, an intermediate crushing deck including a plurality of crushing balls, and a lower deck made of screening material. Material not passing through the screen drops to a lower crushing deck using crushing balls to further reduce any remaining oversize particles. The two crushing decks have associated therewith openings for permitting tramp metal to be continuously and automatically removed from the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the shakeout and crushing apparatus of the invention;

FIG. **2** is a view taken on lines **2—2** of FIG. **1**; and

FIG. **3** is a cross-sectional side view of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Looking now to FIGS. **1** and **2**, numeral **10** depicts the shakeout and crushing apparatus in its entirety. Broken parts of sand molds and tramp metal are fed to the unit from hopper **11**. The apparatus consists of a base **12** on which a sloping-bottom housing **14** is supported by means of two pair of springs **16** and **18**, one spring being located in each corner. Brackets **20** and **22** which are integral with housing **14** form the spring seats. A motor **24** is supported on base **12**, and drives an eccentric weight pulley **30** by means of drive belt **28** and pulley **26**. This orbital drive arrangement causes the housing **14** and all of the apparatus contained therein to vibrate at hundreds of cycles per minute, typically 900 RPM. A protective housing **32** encloses the vibratory drive arrangement.

Referring now to FIG. **3**, the details of the apparatus contained in housing **14** is shown. In the upper portion is a horizontal shakeout deck **34** containing large openings **36** therein (2 to 3 inches in diameter). Intermediate the rows of openings **36** are vertical scalping bars **37**.

Beneath the shakeout deck **34** is a disintegration or crushing deck **38**. Crushing balls **45** coact with the deck **38** to further reduce the size of lumps of friable material passing through the openings in deck **34**. Deck **38** is made up of a slotted upper plate **41**, and a closely spaced slotted lower plate **42**. Both of these sections have slots **43** therein, which slots are of the same size, being approximately one-half inch wide. By moving the lower plate **42** to the left or right for example by means of lever **44**, the ultimate width of the slots through deck **38** can be made smaller. This may be desirable, depending on the bonding resin used in forming the sand molds. The crushing balls **45** are made of iron, and have a coating of polyurethane thereon to reduce the noise level. If a polyurethane coating is used on all of the crushing balls within the unit, the noise level can be reduced from approximately 120 decibels to approximately 90 decibels.

The crushing balls **45**, and also any pieces of tramp metal on deck **38**, are in constant motion due to the orbital vibrations. In order to allow most of the larger pieces of tramp metal to be automatically removed, one side of the housing **14** is provided with a slot **39** (FIGS. **2** and **3**) positioned slightly above deck **38** covered with a door **39***a*. From time to time the door **39***a* is removed and as the pieces of tramp metal are randomly bounced around, they will eventually encounter slot **39**, and be removed from the unit. The height of the slot **39** is made small enough so that the crushing balls **45** cannot pass therethrough. For example, if the balls are 2½ inches in diameter, the slot may be two inches wide. In order to permit a more thorough removal of tramp metal from above deck **38**, a removable door **40** (see FIG. **3**) is provided through which an operator can rake out the tramp metal.

The small lumps of friable material passing through the openings in deck **38** fall onto screen **46**, which is positioned at a slight angle to the horizontal. The vibrating screen **46**, which typically can be of twenty mesh, breaks up most of the remaining small lumps of friable material, allowing the properly sized grains of sand to pass through onto the housing bottom **47**, which is also at an angle to the horizontal. The vibratory action causes the sand particles to gravitate to opening **48**, for discharge from the unit. The larger particles which do not pass through the screen also gravitate to the right and fall onto a secondary crushing deck **50** through opening **49**. Crushing balls **52**, which are also iron with a polyurethane coating thereon, coact with the imperforate deck **50** to crush any friable particles. The material then passes through opening **54** with the sand particles falling through screen **55** to join the other sifted sand passing through discharge spout **56**. Small metallic particles and incrushable sand lumps not reduced in size by crushing balls **52**, flow out of the unit through opening **58**.

The dust created during the operation is removed from housing **14** through duct **60**, which is connected to suitable dust collection equipment and a vacuum source. The angled plate **62** prevents sand particles from being drawn into duct **60**, and also directs the sand and other material falling from deck **38** to have some residence time on screen **46**.

From the above, it can be seen that a compact, efficient sand reclamation unit is provided in accordance

with the invention. Tramp metal is automatically removed from the two crushing areas through openings **39** and **58**, thereby substantially reducing the frequency of manual cleanout. Each successive stage of the crushing and classifying operation is located beneath the preceding one, so that gravity causes the material to move therethrough. This completely eliminates the need for any costly elevators for the unit.

What is claimed is:

1. A shakeout and crushing apparatus for reclamation of friable material comprising a base, a housing mounted on said base, means for imparting orbital vibration to said housing, said housing containing a first upper porous deck, a second porous deck, and a third porous deck the openings in each deck being progressively smaller than the preceding one, the second deck being located beneath the first deck being located beneath the first deck, the third deck being located beneath the second deck, so that material passing through the openings in the first deck fall onto the second deck, and material passing through the second deck fall onto the third deck, a fourth deck positioned beneath and off to one side of the third deck in such a manner that material not passing through the third deck falls onto it, a plurality of crushing balls located above and supported by both the second and fourth decks to aid in the disintegration of the lumps of foundry sand, and discharge means for permitting removal of properly sized sand particles from both the third and fourth decks.

2. The apparatus set forth in claim **1**, including opening means in the housing above the second deck through which pieces of tramp metal can be automatically thrown by the bouncing action caused by the orbital vibration of the housing, the opening means being small enough so that the crushing balls cannot escape therethrough.

3. The apparatus set forth in claim **2**, including opening means in the housing above the fourth deck through which pieces of tramp metal can be automatically discharged from the housing, the opening means being small enough so that the crushing balls cannot escape therethrough.

4. The apparatus set forth in claim **3**, wherein the crushing balls are made of metal with a coating of polyurethane thereon, to reduce the noise level.

5. The apparatus set forth in claim **4**, wherein the second deck is made up of closely adjacent upper and lower porous plates, the openings in the plates being substantially aligned, and the size of the ultimate openings through the second deck can be varied by moving one of the plates horizontally with respect to the other, thereby partially misaligning the openings in the two plates.

6. A shakeout and crushing apparatus for reclamation of friable materials comprising a base, a housing mounted on said base, means for imparting orbital vibration to said housing, said housing containing a first upper porous deck, a second porous deck, and a third porous deck, the openings in each deck being progressively smaller than the preceding one, the second deck being located beneath the first deck, the third deck being located beneath the second deck, so that material passing through the openings in the first deck fall onto the second deck, and material passing through the second deck fall onto the third deck, a fourth deck positioned beneath and off to one side of the third deck in such a manner that material not passing through the third deck falls onto it, a plurality of crushing balls located above and supported by the fourth deck to aid in the disintegration of the lumps of foundry sand, and discharge means for permitting removal of properly sized sand particles from both the third and fourth decks.

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PO-1050
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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,897,910 Dated August 5, 1975

Inventor(s) Vagn Deve

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 15, add a comma (,) after "deck" (first occurrence)

Column 3, lines 17 & 18, delete "being located beneath the first deck"

Signed and Sealed this

eleventh Day of *May 1976*

[SEAL]

Attest:

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Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks