

[54] **VIBRATORY FINISHING MACHINE WITH SCREENING AND LOADING MECHANISM**

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[58] Field of Search 51/163, 164

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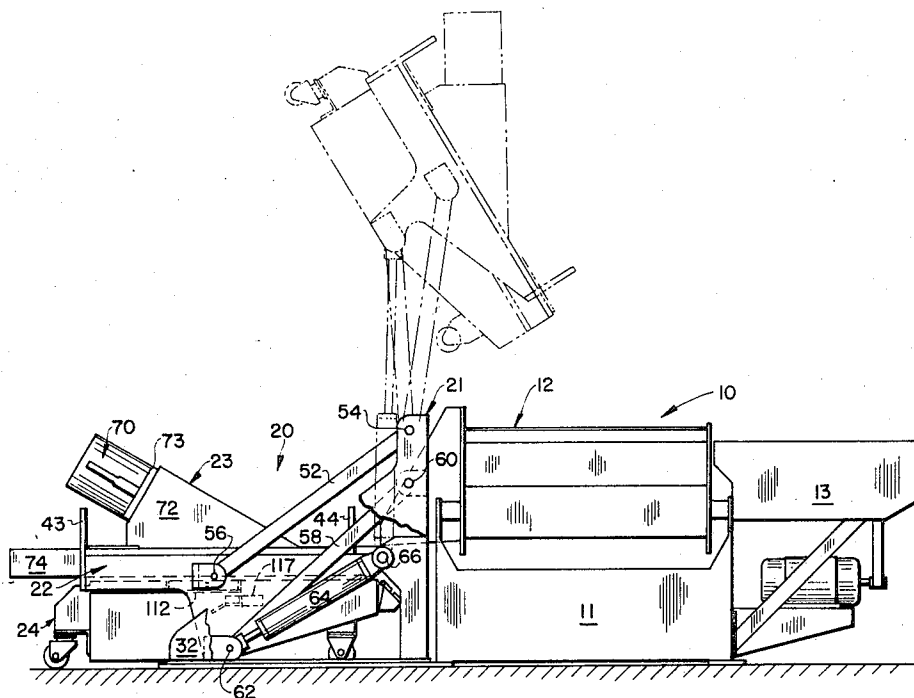
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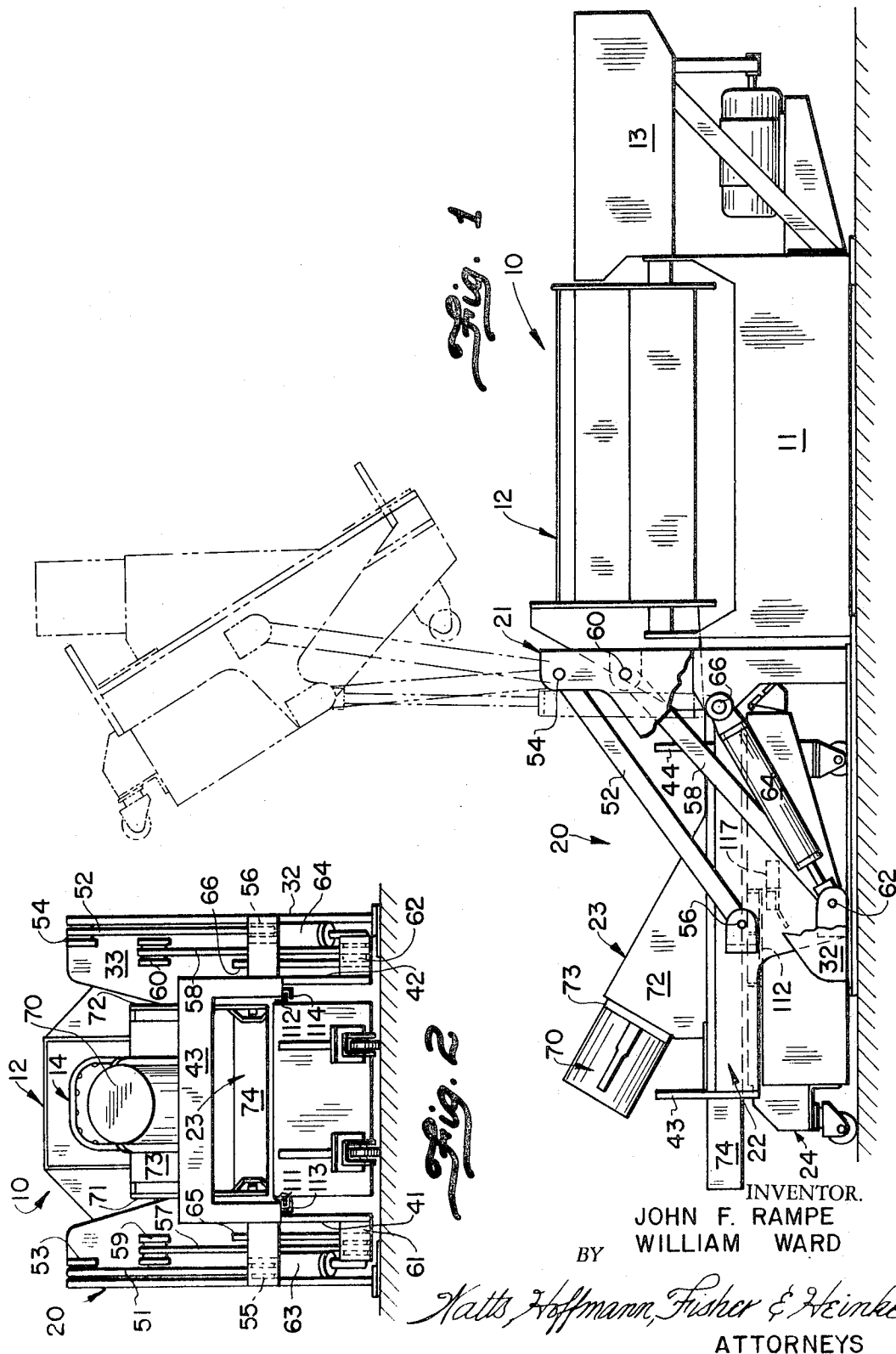
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ABSTRACT

A vibratory finishing machine with a screening and loading mechanism which includes a vibratory screen assembly. The screen assembly is movable between a screening position and a tub loading position. A movable hopper dolly is selectively positioned beneath the screen and when so positioned is movable with the assembly from the screening position to the loading position where the contents of a dolly pan are discharged into the finishing machine.

A linkage system connects the carriage and an upstanding frame of the finishing machine and is uniquely constructed so that when the carriage is raised the dolly pan is maintained in a substantially horizontal attitude until it has been elevated to the vicinity of the loading position whereupon the hopper dolly is tipped to discharge its contents into the finishing machine.

65 Claims, 6 Drawing Figures




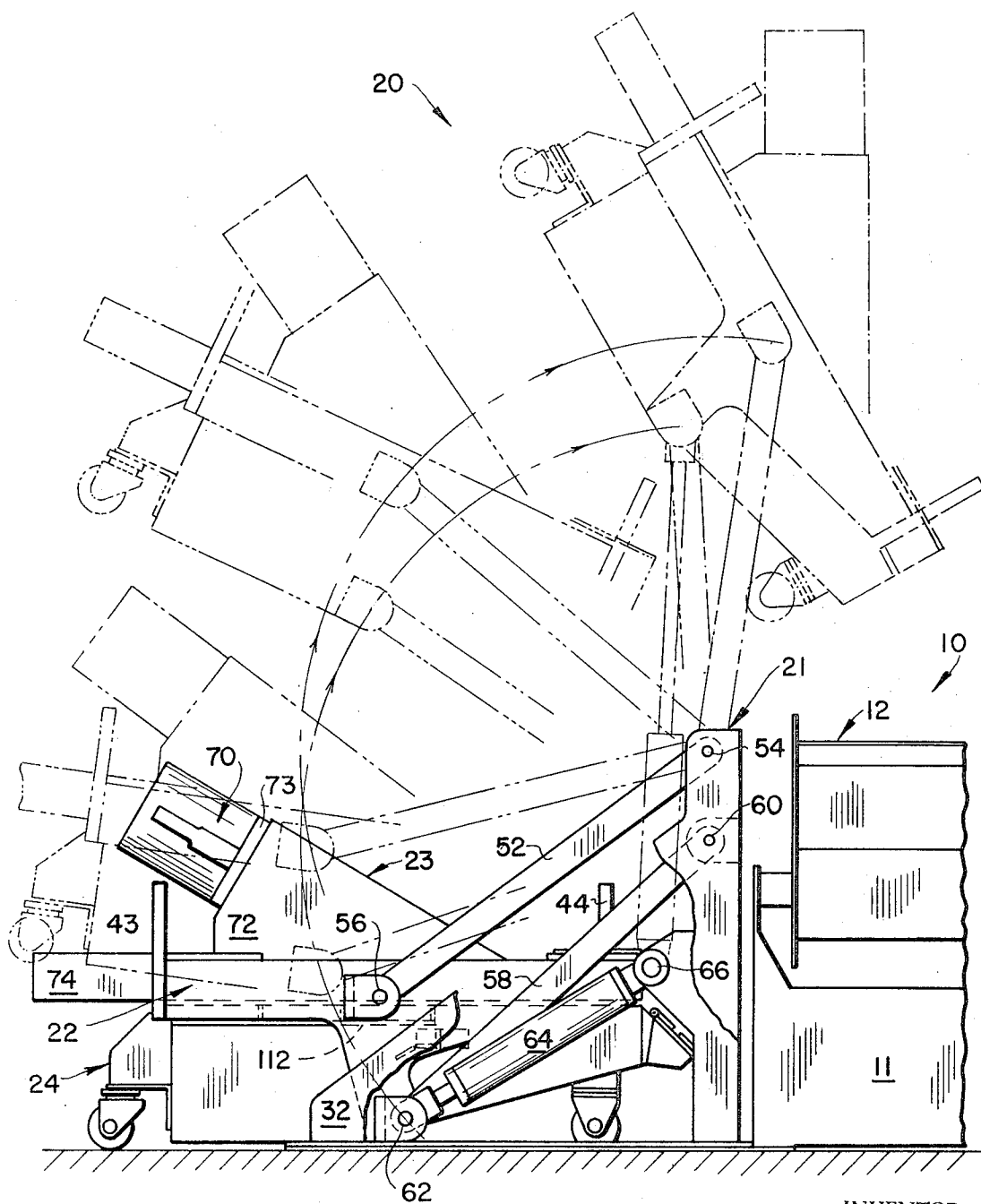
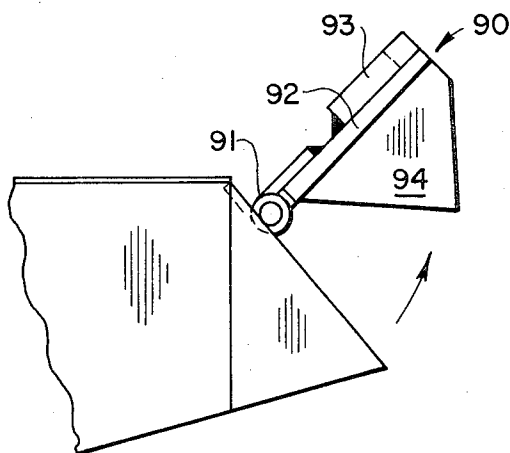
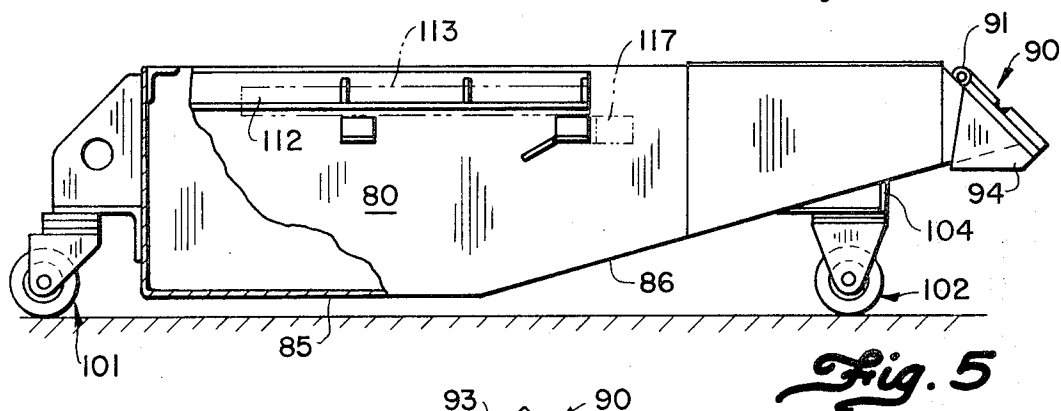
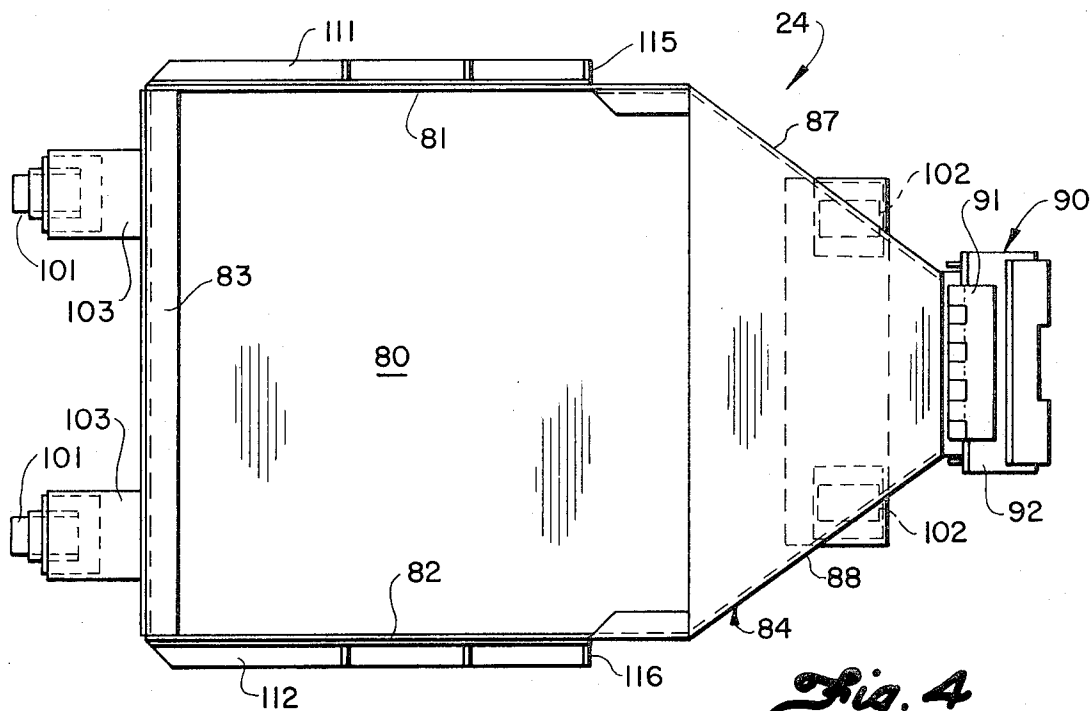


Fig. 3

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VIBRATORY FINISHING MACHINE WITH SCREENING AND LOADING MECHANISM

CROSS-REFERENCE TO RELATED PATENT

Vibratory Finishing Machine, U.S. Pat. No. 3,449,869 issued June 17, 1969 to John F. Rampe.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to abrasive finishing machines and more specifically to a vibratory finishing machine equipped with a mechanism for handling the supply and removal of abrasive media for finishing operations.

2. Prior Art

Known vibratory finishing machines are adapted to smooth and finish the surfaces of a variety of materials by such operations as deburring, burnishing, descaling, and cleaning. Typically such machines vary in capacity from 1 cubic foot to 30 cubic feet and even larger. The required cycle time for such finishing operations varies generally depending upon the size of the material, the accessibility of the material to be removed, the type of vibratory action applied, and the type of abrasive media used.

During operation of a finishing machine, workpieces to be finished and a selected abrasive media are brought to the finishing machine and loaded into an open top tub of the machine. After a finishing operation has been completed, the finished workpieces and media are discharged from the tub. In the past they have been transported to a separating station where the media and workpieces are segregated.

These loading and unloading operations have involved one or more time consuming manual steps. Where it is desirable to perform the finishing operation with a series of different abrasive media, the unloading, separating, changing, and reloading of media with prior techniques is quite time consuming and costly, especially since one or more steps are performed by hand.

The usual ratio of media to workpieces by volume is three parts media to one part workpieces. A 30 foot capacity machine will therefore ordinarily employ over 20 cubic feet of abrasive media when operating at full capacity. Accordingly, it is apparent that, especially because of the manual labor involved, the loading and unloading of abrasive media poses a significant material handling problem.

Various proposals have been made to provide vibratory screening apparatus adapted to segregate finished workpieces from abrasive media. While such proposed screening apparatus may provide for the separation of parts and media, they do not ordinarily otherwise assist in the unloading of media from, transporting media to and from, and loading media into a finishing machine.

SUMMARY OF THE INVENTION

The present invention overcomes the foregoing disadvantages of the prior art and provides a finishing machine with a screening and loading apparatus adapted to facilitate the handling of abrasive media.

The finishing machine disclosed here includes a vibratory screen for separating media from workpieces. The screen is positioned on a screen carriage at a

height sufficient to permit a movable hopper dolly to be positioned beneath it and low enough for the contents of a workpiece finishing tub of the machine to be discharged directly onto it.

Another feature of the present invention is that the screen carriage is movable between a screening and a tub loading position. In the screening position, the screen bed is disposed adjacent the discharge end of the finishing machine tub with the hopper positioned therebeneath. In the tub loading position, the screen and the hopper are raised above the tub of the finishing machine and tilted to empty the contents of the hopper into the tub.

Separation of parts and abrasive media is accomplished by vibrating the screen whereby the abrasive media passes through the screen and into the hopper while the finished workpieces pass across top of screen. The hopper dolly with abrasive media in it may then be wheeled away and stored without removing the media from the hopper. Alternately, the hopper remains in the screen carriage and the contents are reloaded into the tub for another workpiece finishing cycle.

In accordance with another aspect of the present invention, the movable hopper is of novel configuration. The hopper is provided with a funnel-shaped end portion closed by a pivotally mounted door which serves to retain abrasive media within the hopper until the hopper is moved to the loading position. In the loading position, the hopper door opens and the funnel-shaped end portion directs the abrasive media into the finishing machine tub.

Flange tracks along the sides of the hopper dolly overlap hopper support elements on the carriage so that as the carriage is elevated the hopper is elevated with it.

A novel linkage system provides a further feature of the invention. The linkage has two pairs of non-parallel linkage arms provided for supporting the movable carriage from an upstanding frame. The linkage system defines a particularly advantageous path of movement for the carriage relative to the frame between the screening and loading positions. When the carriage is raised from the screening position, the carriage is slightly tilted to facilitate retention of the movable hopper in the carriage. The carriage then is elevated as the hopper is maintained in a substantially horizontal but slightly tilted attitude. As the carriage approaches the loading position, the linkage arms are substantially vertically disposed, during which movement the hopper is relatively abruptly tilted to discharge its contents into the tub of the finishing machine.

With one method of operation, the loading of a charge of abrasive media into the finishing machine is accomplished by wheeling a hopper dolly containing the media into position beneath the screen such that the hopper dolly is engaged by the carriage. The carriage is then raised to discharge the contents of the hopper into the tub of the finishing machine. The tub of the finishing machine is then vibrated with the abrasive media and workpieces in it to finish the workpieces.

After the finishing operation is completed, the mixture of abrasive media and finished workpieces is discharged onto the vibrating screen to segregate the workpieces from the abrasive media. The abrasive media passes through the screen and into the movable hopper dolly.

The hopper dolly containing the abrasive media is then either wheeled away to store or dispose of the abrasive media, or raised to the loading position to reload the media into the tub.

In order to change abrasive media in the machine, the contents of the machine are unloaded onto the screen and separated by vibratory screening action. The finished workpieces are removed from the screen and the hopper dolly of used abrasive media is then replaced with a hopper dolly of other abrasive media. The carriage is then raised to discharge the other media into the finishing machine.

Accordingly, it is the principal object of the present invention to provide a vibratory finishing machine having an improved apparatus for the handling of abrasive media.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a finishing machine including the screening-loading mechanism of the present invention, the carriage of the screening-loading mechanism being shown by solid lines in the screening position and in phantom in the loading position;

FIG. 2 is an end view of the screening-loading mechanism shown in the screening position;

FIG. 3 is a schematic motion diagram illustrating the movement of the carriage between the screening and loading positions;

FIG. 4 is a plan view of the hopper dolly which may be removably received by the carriage;

FIG. 5 is an elevational view of the hopper dolly of FIG. 4 with portions thereof broken away to illustrate detail; and

FIG. 6 is an enlarged elevational view of a portion of the hopper dolly illustrating the operation of the discharge door of the hopper dolly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a vibratory finishing machine is shown generally at 10. The finishing machine 10 includes an upstanding base support structure 11. A receptacle or tub 12 is movably supported above the base 11. A vibratory drive, indicated generally by the numeral 13, is connected to the tub 12 for cyclically vibrating the tub at rates of from approximately 900 to 1,800 cycles per minute. A vibratory finishing machine of this type is described and claimed in detail in the referenced Rampe patent.

In operation, workpieces such as castings, which are to be deburred, burnished, descaled or cleaned are deposited in open top tub 12 with a supply of suitable abrasive media. The tub is then vibrated to perform the required finishing operation. When the finishing operation is completed, the finished workpieces and the abrasive media are discharged from the tub 12 through a door 14, as shown in FIG. 2.

A screening-loading apparatus 20 is provided in order to facilitate the separation of the abrasive media from the finished workpieces, and to facilitate the loading or reloading of the abrasive media into the tub 12. The screening-loading apparatus is positioned adjacent the tub discharge, at the left end of the machine 10 as

viewed in FIG. 1. The screening-loading apparatus 20 includes a rigid upstanding frame indicated generally by the numeral 21. The screening-loading apparatus 20 also includes a carriage 22. The carriage 22 is movable between a screening position shown in solid lines in FIG. 1 and a loading position in phantom in FIG. 1.

A vibratory screen mechanism 23 is supported by the carriage 22. A movable hopper dolly 24 is removably received by the carriage 22 beneath the screen mechanism 23. As will be explained in greater detail, the mixture of abrasive media and finished workpieces discharged from the finishing machine 10 through the door 14 are separated by the screen mechanism 23. The abrasive media passes through the screen and drops into the hopper dolly 24 while the larger workpieces do not.

After the finished materials pass over the screen, the carriage may then be moved from the screening position to the loading position to empty the abrasive media from the hopper 24 back into the open tub 12. If, in the alternative, it is desirable to change the abrasive media being used in the finishing machine 10, the hopper 24 may be wheeled away and serve as a storage bin for the abrasive media, and a second hopper dolly may be wheeled into position carrying the desired abrasive media. With the second hopper dolly in position in the carriage 22, the carriage may then be moved to the loading position and the abrasive media from the second hopper dolly discharged into the tub 12.

The upstanding frame 21 includes a substantially U-shaped structure including a pair of spaced side members 31, 32. The side members 31, 32 are interconnected by a transversely extending reinforcing member 33.

The carriage 22 includes a pair of spaced side members 41, 42 interconnected by a pair of transversely extending, inverted U-shaped members 43, 44.

A first pair of linkage arms 51, 52 connect at one end with the upstanding frame 21 through axially aligned pivotal connections 53, 54. The opposite ends of the linkage arms 51, 52 connect to the movable carriage structure 22 through axially aligned pivotal connections 55, 56. A second pair of linkage arms 57, 58 connect at one end to the upstanding frame 21 through axially aligned pivotal connections 59, 60, which are below and inwardly of the pivots 53, 54. The opposite ends of the linkage arms 57, 58 connect with the movable carriage structure 22 through axially aligned pivotal connections 61, 62.

In accordance with one aspect of the present invention, the axes of the frame pivotal connections 53, 54 and 59, 60 are spaced apart by a distance which is less than the spacing between the axes of the carriage pivotal connections 55, 56 and 61, 62. The linkage arms 51, 52 and 57, 58 are of substantially identical lengths. Such an arrangement provides a particularly advantageous movement to the carriage 22 as it moves from the screening position to the tub loading position.

As is best illustrated in FIG. 3, as the linkage arms 51, 52 and 57, 58 are moved from the screening to the tub loading position, they rotate clockwise as seen in FIGS. 1 and 2, about their respective pivotal connections with the upstanding frame 21. The carriage structure 22 is tilted slightly toward the upstanding frame and toward the finishing machine. This tilting action serves to prevent the dislodging of the movable hopper dolly from the carriage structure 22. As the carriage structure

moves upwardly from the screening position and as the linkage arms rotate clockwise through the horizontal position, the carriage and hopper dolly are maintained in a substantially horizontal attitude. As the carriage approaches the loading position, the hopper dolly is tilted relatively abruptly toward the finishing machine such that the contents of the hopper are discharged into the tub 12.

A pair of hydraulic cylinders 63, 64 connect at one end with the upstanding frame 21 through axially aligned pivotal connections 65, 66. The opposite ends of the hydraulic cylinders 63, 64 connect with the movable carriage structure 22 through the pivotal connections 61, 62. In their retracted position, the cylinders 63, 64 position the carriage in the screening position. In their extended position, the cylinders 63, 64 position the carriage in the tub loading position.

The vibratory screen mechanism 23 includes a suitable air-powdered or mechanical vibrator 70 supported from the carriage structure 22. A pair of vibrator support arms 71, 72 extend upwardly from the carriage side structures 41, 42 and mount a transversely extending mounting plate 73. The vibrator 70 is secured to the mounting plate 73. Suitable linkage, not shown, connects the vibrator 70 to a screen 74 which is resiliently supported from the carriage 22. By this arrangement, the vibrator 70 serves to reciprocally vibrate the screen 74. The screen mechanism 23 is adapted to receive screens of a variety of orifice sizes to effectively segregate finished materials from abrasive media of various sizes and shapes.

Referring to FIGS. 4-6, the construction and arrangement of the novel hopper car is shown in greater detail. A centrally disposed, generally rectangularly shaped pan 80 is provided. The pan 80 has a pair of substantially vertically disposed side panels 81, 82, a substantially vertically disposed end panel 83, and a tapered funnel and guide portion 84. As is best seen in FIG. 5, the floor of the hopper dolly 24 extends substantially horizontally in the region 85 adjacent the end portion 83 and slants upwardly in the region 86 within the vicinity of the funnel and guide portion 84. The side panels 81, 82 include inwardly inclined portions 87, 88 in the region of the funnel and guide portion 84.

A door 90 is pivotally mounted on the hopper dolly 24 by means of a hinge structure 91. The door 90 closes the funnel and guide portion 84 at times other than when media is being discharged. As is best seen in FIG. 6, the door 90 comprises a heavy metal plate 92 welded to the hinge structure 91. An additional heavy metal plate 93 is welded to the door plate 92 to provide an additional weight which will assist in maintaining the door 90 in a closed position. A pair of side flaps, one of which is shown at 94 are also welded to the plate 90 to provide added weight to the door and assure its proper closure.

The hopper pan 80 is supported by means of two pairs of rollers 101, 102. The rollers 101 are supported by a front pair of mounting brackets 103. These brackets 103 are welded to the upstanding end panel 83. The rollers 102 are supported from a rear bracket 104. The rear bracket 104 is welded to the underside of the pan floor portion 86. In the preferred embodiment, the rollers 101 comprise swivel casters and the rollers 102 comprise casters which have restricted rotation about a common axis.

In order that the hopper dolly 24 may be removably received by the carriage 22 for movement between the screening and loading positions, a pair of outwardly turned flange tracks 111, 112 are welded along the exterior surfaces of the side plates 81, 82. A cooperating pair of inwardly turned flange tracks 113, 114 are provided on the carriage structure 22, as best seen in FIG. 2. The inwardly turned flange tracks 113, 114 are adapted to underly the outwardly turned flange tracks 111, 112 to permit the carriage 22 to lift the hopper pan. A pair of stops 115, 116 are formed integrally with the flange tracks 111, 112. A cooperating pair of stops one of which is shown at 117 in FIG. 1, are formed on the carriage 22 to position the hopper pan longitudinally within the carriage.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A finishing machine comprising the combination of:

- a. a supporting structure;
- b. a receptacle movably carried by said supporting structure and adapted to receive abrasive media and parts to be finished;
- c. drive means interposed between and connected to said supporting structure and said receptacle to impart a finishing action to the parts within said receptacle;
- d. a carriage movable between a screening position and a loading position above the receptacle;
- e. a vibratory screener mechanisms carried by said carriage for movement therewith;
- f. a hopper disposed beneath said vibratory screener and operably connected to said carriage for movement therewith along a path;
- g. said vibratory screener mechanism being operable when in said screening position to receive finished parts and abrasive media discharged from said receptacle and to segregate the finished parts and the abrasive media whereby the media passes through said screener and into said hopper;
- h. said hopper being adapted to discharge its contents into said receptacle when in said loading position; and,
- i. said carriage being operable during movement from said screening position to said loading position to move said screener mechanism to a position permitting movement of the hopper along said path without interference by said screener mechanism to the loading of the contents of said hopper means into said receptacle.

2. The finishing machine of claim 1 additionally including power drive means adapted to move said carriage between said screening and said loading positions.

3. The finishing machine of claim 2 additionally including an upstanding frame, and linkage means connecting said carriage and said frame and defining a path of movement for said carriage relative to said frame.

4. The finishing machine of claim 3 wherein said linkage means comprises first and second pairs of rigid

linkage arms each connecting at one end with said upstanding frame and at the other end with said movable carriage.

5. The finishing machine of claim 4 wherein the respective points of connection of each pair of linkage arms with said upstanding frame and said movable carriage are substantially axially aligned such that the linkage arms of each pair move in unison.

6. The finishing machine of claim 5 wherein said linkage arms are all of substantially equal length and said points of connection of said pairs of linkage arms with said carriage are spaced apart a greater distance than said points of connection with said upstanding frame, whereby said pairs of linkage arms are disposed in non-parallel relationship.

7. The finishing machine of claim 6 wherein:

said points of connection with said upstanding frame are spaced above said points of connection with said movable carriage when said movable carriage is in said screening position; and,

said points of connection with said upstanding frame are spaced below said points of connection with said movable carriage when said movable carriage is in said loading position.

8. The finishing machine of claim 7 wherein said path of movement from said screening position to said loading position includes an intermediate movement wherein said linkage arms are substantially horizontally disposed during which intermediate movement said carriage is maintained in a substantially horizontal attitude, and a subsequent movement wherein said linkage arms are substantially vertically disposed during which subsequent movement said carriage is tilted toward said receptacle.

9. The finishing machine of claim 7 wherein said means adapted to move said carriage comprises a pair of hydraulic cylinders each connected at one end to said upstanding frame and at the other end to said movable carriage.

10. The vibratory finishing machine of claim 7 wherein said means to move said carriage comprises a pair of hydraulic cylinders connecting at one end with said upstanding frame, at axially aligned points spaced below said points of connection of said linkage arms with said upstanding frame, and connecting at the other end with said movable carriage axially with the points of connection of one of said pairs of linkage arms.

11. The finishing machine of claim 1 wherein said vibratory screener mechanism includes a screen movably mounted on said carriage and a vibratory drive means mounted on said carriage and connected to said screen to vibrate said screen relative to said carriage.

12. The finishing machine of claim 1 wherein said hopper comprises a movable hopper dolly removably received by said carriage for movement therewith.

13. The finishing machine of claim 12 wherein said hopper dolly is mounted on rollers and includes a substantially rectangular pan portion having a funnel and guide portion communicating therewith.

14. The finishing machine of claim 13 wherein said funnel and guide portion is adapted to direct the contents of said hopper dolly into said receptacle when said hopper dolly is moved to said loading position.

15. The finishing machine of claim 14 wherein said funnel and guide portion has a pivotally mounted door mounted thereon to selectively close said funnel and guide portion to retain abrasive media in said hopper

dolly until said hopper dolly is moved to said loading position.

16. A finishing machine comprising the combination of:

a. a movably mounted receptacle adapted to receive media and parts to be finished;

b. drive means connected to the receptacle for moving the receptacle to impart a finishing action to parts within the receptacle;

c. an upstanding frame;

d. a movable carriage connected to the frame and adapted to be moved between a first position near said receptacle and a second position above said receptacle;

e. a hopper connected to the carriage for movement therewith between said first and second positions;

f. linkage means connecting with said carriage and said upstanding frame to define a path of movement for said carriage relative to said frame and for maintaining said carriage in a substantially horizontal attitude until it approaches the vicinity of said second position whereupon the carriage is tilted toward said receptacle to discharge the contents of said hopper into said receptacle.

17. The finishing machine of claim 16 wherein said linkage means comprises first and second pairs of rigid linkage arms each connecting at one end with said upstanding frame and at the other end with said movable carriage.

18. The finishing machine of claim 17 wherein said linkage arms are of substantially equal length and connect with said carriage at points which are spaced apart a greater distance than their points of connection with said upstanding frame, whereby said pairs of linkage arms are disposed in non-parallel relationship.

19. The finishing machine of claim 18 wherein:

said points of connection with said upstanding frame are spaced above said points of connection with said movable carriage when said movable carriage is in said first position; and

said points of connection with said upstanding frame are disposed below said points of connection with said movable carriage when said carriage is in said second position.

20. The finishing machine of claim 19 wherein said path of movement from said first position to said second position includes an intermediate movement wherein said linkage arms are substantially horizontally disposed during which intermediate movement said carriage is maintained in a substantially horizontal attitude, and a subsequent movement wherein said linkage arms are substantially vertically disposed during which subsequent movement said carriage is tilted toward said receptacle.

21. The finishing machine of claim 20 additionally including a vibratory screener mechanism mounted on said carriage for movement therewith, said vibratory screener being operable to segregate finished parts and abrasive media when in said first position.

22. The finishing machine of claim 21 wherein said hopper comprises a movable hopper dolly removably received by said carriage beneath said screener mechanism for movement with said carriage, said movable hopper dolly being adapted to receive abrasive media passed through said screener mechanism when in said first position and being adapted to discharge the con-

tents of said hopper dolly into said receptacle when in said second position.

23. The vibratory finishing machine of claim 22 wherein said path of movement defined by said linkage arms imparts a relatively small tilt to said carriage to facilitate retention of said movable hopper dolly within said carriage for movement between said first and second positions.

24. A finishing machine comprising the combination of:

- a. a movably mounted receptacle adapted to receive abrasive media and parts to be finished;
- b. drive means connected to the receptacle for moving the receptacle to impart a finishing action to parts within the receptacle;
- c. a movable hopper dolly movable between a receiving position and a discharging position;
- d. dolly support means positioned near said receptacle for supporting said dolly during movement between said receiving and discharging positions;
- e. said movable hopper dolly being engaged by and removably received within said support means when said dolly is in said receiving position;
- f. said support means being operable during its initial movement from said receiving position to said loading position to establish a connection with said dolly to effect movement of said dolly between said receiving and loading positions; and,
- g. said dolly being adapted to discharge its contents into said receptacle when in said discharging position.

25. The finishing machine of claim 24 wherein said receptacle has a discharge means constructed to discharge abrasive media from said receptacle into said dolly when said dolly is in said receiving position.

26. The finishing machine of claim 24 wherein:

- a. said dolly includes a plurality of rollers supporting said dolly for movement; and
- b. cooperative engagement means are provided on said dolly and said support means to permit said hopper dolly to be removably received by said support means for movement therewith.

27. The finishing machine of claim 24 wherein said dolly additionally includes:

- a. a substantially rectangular pan;
- b. a funnel and guide portion communicating with said pan; and
- c. a pivotally mounted door closing said funnel and guide portion to retain abrasive media within said pan until said dolly is moved to said discharging position whereupon said door opens to discharge the media into said receptacle.

28. The vibratory finishing machine of claim 27 wherein said funnel-shaped end portion includes a shield overlying at least a portion of said funnel and guide portion to direct the contents of said dolly toward said door when said dolly is moved to said discharging position.

29. In combination, a finishing machine having a movably mounted receptacle and a drive system for moving the receptacle to impart a finishing action to abrasive media and workpieces positioned within the receptacle, and screening-loading apparatus for facilitating the charging of abrasive media into the finishing machine receptacle, comprising:

- a. a movable carriage for positioning selectively and one at a time near the finishing machine receptacle in a screening position and a loading position;
- b. a screener mechanism carried by said carriage and movable therewith; and
- c. a movable hopper means removably received by said carriage for movement with said carriage;
- d. said hopper means being positioned beneath said screener mechanism when in said screening position;
- e. said hopper means being tilted toward said receptacle when in said loading position;
- f. whereby abrasive media may be passed through said screener into said hopper means when said carriage is in said screening position, and the contents of said hopper means may be discharged into the finishing machine when said carriage is in said loading position.

30. The apparatus of claim 29 additionally including an upstanding frame, and linkage means connecting said carriage and said frame and defining a path of movement for said carriage relative to said frame.

31. The apparatus of claim 30 additionally including means adapted to move said carriage between said screening and said loading positions.

32. The apparatus of claim 31 wherein said linkage means comprises first and second pairs of rigid linkage arms connecting at one end with said upstanding frame and at the other end with said movable carriage.

33. The apparatus of claim 32 wherein said first and second pairs of linkage arms are of equal length and connect with said carriage at points which are spaced apart a greater distance than their points of connection with said upstanding frame, whereby said pairs of linkage arms are disposed in non-parallel relationship.

34. The apparatus of claim 33 wherein said means adapted to move said carriage comprises a pair of hydraulic cylinders each connected at one end to said upstanding frame and at the other end to said movable carriage.

35. The apparatus of claim 34 wherein:

- said hydraulic cylinders connect at one end with said upstanding frame at a point below said points of connection of said pairs of linkage arms with said upstanding frame; and
- said hydraulic cylinders connect at the other end with said movable carriage substantially coaxially with said points of connection of one of said pairs of linkage arms with said carriage.

36. In combination, a finishing machine having a movably mounted receptacle and a drive system for moving the receptacle to impart a finishing action to abrasive media and workpieces positioned within the receptacle, and a screening-loading apparatus for facilitating the charging of abrasive media into the finishing machine receptacle, comprising:

- a. an upstanding frame;
- b. a carriage movable between a screening position and a loading position;
- c. linkage means connecting with said carriage and said frame and defining a path of movement for said carriage relative to said frame;
- d. screening means carried by said carriage;
- e. a movable hopper dolly removably received by said carriage beneath said screening means when in the screening position, the hopper dolly being adapted for movement with said carriage; and,

- f. means adapted to move said carriage between said screening and loading positions;
- g. whereby materials of a selected size may be passed through said screening means into said hopper dolly when said carriage is in said screening position and said hopper dolly may then be moved by said carriage to said loading position to discharge the contents of said hopper dolly into the finishing machine, said screening means being moved by said carriage as said hopper dolly is moved to said loading position to a screening means position clear of dolly movement.

37. The apparatus of claim 36 wherein said path of movement provides a relatively small tilting of said carriage toward said upstanding frame to retain said hopper dolly within said carriage.

38. The apparatus of claim 37 wherein said path of movement additionally provides a substantially abrupt tilting motion of said carriage as said carriage approaches said loading position.

39. The apparatus of claim 38 wherein said linkage means comprises first and second pairs of rigid linkage arms each connecting at one end with said upstanding frame and at the other end with said movable carriage.

40. The apparatus of claim 39 wherein said first and second pairs of linkage arms are of equal length and connect with said carriage at points which are spaced apart a greater distance than their points of connection with said upstanding frame, whereby said pairs of linkage arms are disposed in non-parallel relationship.

41. The apparatus of claim 40 wherein said means adapted to move said carriage comprises a pair of hydraulic cylinders each connected at one end to said upstanding frame and at the other end to said movable carriage.

42. In combination, a finishing machine having a movably mounted receptacle and a drive system for moving the receptacle to impart a finishing action to abrasive media and workpieces positioned within the receptacle, and screener-loader for facilitating the charging of abrasive media into the finishing machine receptacle, comprising:

- a. a movable carriage positioned near the receptacle and movable between a screening position beside the finishing machine and a loading position above the finishing machine;
- b. a movable screener mechanism mounted on said carriage and movable therewith;
- c. said screener mechanism being positioned when in said screening position to receive a mixture of abrasive media and finished materials as they are discharged from the finishing machine;
- d. a movable hopper dolly removably received by said carriage beneath said screener mechanism for movement with said carriage; and
- e. means adapted to move said carriage between said screening and said loading positions;
- f. whereby the mixture of abrasive media and finished materials discharged from the finishing machine may be separated by said screener mechanism with said abrasive media dropping into said hopper dolly when said carriage is in said screening position, and the contents of said hopper dolly may be emptied into the finishing machine when said carriage is moved to said loading position.

43. The apparatus of claim 42 wherein said screener mechanism is adapted to receive screens of a variety of orifice sizes.

44. The apparatus of claim 42 wherein:

- a. said carriage includes a pair of inwardly turned flange portions positioned on opposite sides of said hopper dolly; and
- b. said hopper dolly includes a pair of outwardly turned flanged portion adapted to be engaged by said flanged portions on said carriage;
- c. whereby said hopper dolly is removably received by said carriage for movement therewith.

45. The apparatus of claim 44 wherein a first pair of stops are formed on said hopper dolly and a second pair of cooperative stops are formed on said carriage to limit the inward movement of said hopper dolly into said carriage.

46. The apparatus of claim 42 wherein said hopper dolly additionally includes:

- a. a substantially rectangular pan;
- b. a funnel and guide portion communicating with said pan portion; and
- c. a pivotally mounted door closing said funnel and guide portion to retain abrasive media within said hopper dolly until said hopper dolly is moved to said loading position.

47. The apparatus of claim 46 wherein said hopper dolly is supported on a plurality of wheels and said door is weighted such that the force of gravity serves to maintain said door in said closed position until said hopper dolly is moved to said loading position.

48. The apparatus of claim 47 wherein said funnel and guide portion further includes a shield overlying at least a portion of said funnel and guide portion to direct the contents of said hopper dolly toward said door when said hopper dolly is moved to said loading position.

49. A finishing machine comprising:

- a. a movable supported receptacle having a charging opening for receiving workpieces and finishing media, and having a discharge opening for discharging workpieces and finishing media from said receptacle;
- b. drive means coupled to the receptacle to impart a finishing action to the contents of the receptacle;
- c. a loader mechanism positioned near said receptacle and movable between first and second positions;
- d. a hopper connected to said loader mechanism for movement therewith between said first and second positions;
- e. said hopper being positioned near said discharge opening when in said first position to receive material discharged through said discharge opening;
- f. said hopper being adapted to discharge its contents through said charging opening into said receptacle when moved with said loader mechanism to said second position;
- g. overlying coating formation means formed on said hopper and on said loader mechanism which establish a releasable connection between said hopper and said loader mechanism that releases automatically when said hopper is moved to said first position and connects automatically when said loader mechanism begins moving from said first position toward said second position.

50. The finishing machine of 49 wherein said loader mechanism is operable to effect an initial tilting of said hopper as said hopper is moved from said first position toward said second position to assure that the connection between said hopper and said loading mechanism is maintained when said hopper is out of said first position.

51. A finishing machine comprising:

- a. a movably supported receptacle having a charging opening for charging workpieces and finishing media into said receptacle, and having a discharge opening for discharging workpieces and finishing media from said receptacle;
- b. drive means coupled to said receptacle to impart a finishing action to the contents of the receptacle;
- c. separator-reloader means movable between a separating position near said discharge opening and a loading position above said receptacle, said separator-reloader including:
 - i. a carriage structure;
 - ii. linkage means mounting said carriage structure for movement between said separating and loading positions and defining a path of movement for said carriage between said separating and loading positions;
 - iii. a separator mechanism carried by said carriage and movable therewith, said separator mechanism being arranged to receive media and workpieces discharged through said discharge opening when in said separating position;
 - iv. a hopper carried by said carriage beneath said separator mechanism and being arranged to discharge its contents into said receptacle when in said loading position.

52. The finishing machine of claim 51 wherein said hopper is removably coupled to said carriage and comprises a movable hopper dolly.

53. The finishing machine of claim 51 wherein said path of carriage movement is initially substantially vertical as said carriage is raised from said separating position, whereafter said path becomes curved to tilt said carriage toward said receptacle to effect discharge of the contents of said hopper means into said receptacle.

54. The finishing machine of claim 53 wherein said linkage means comprises a non-parallel linkage system having link members of equal length supporting said carriage for movement.

55. A vibratory finishing system comprising:

- a. an upstanding supporting structure;
- b. a receptacle movably supported on said structure for receiving workpieces and finishing media;
- c. first vibratory drive means interposed between said receptacle and said structure to impart a finishing action to the contents of said receptacle;
- d. a hopper mounted on said structure for movement between a first position to one side of said receptacle and a second position above said receptacle;
- e. linkage means movably mounting said hopper on said structure and defining a path of movement for said hopper between said first and second positions;
- f. separator means movably supported by said linkage for movement between said first and second positions with said means;

g. second vibratory drive means interposed between said linkage means and said separator means;

h. said separator means being above said hopper when in said first position to receive media and workpieces discharged from said receptacle and to pass the media therethrough and into said hopper means;

i. said hopper means being arranged when moved to said second position to discharge its contents into said receptacle.

56. The finishing system of claim 55 wherein said hopper means is removably carried by said linkage means.

57. The finishing system of claim 55 wherein said linkage means includes a carriage structure which is positioned in a substantially horizontal attitude when in said first position, and which is tilted from the horizontal toward said receptacle when in said second position.

58. The finishing machine of claim 57 wherein said linkage means comprises a non-parallel linkage system interconnecting said carriage structure and said supporting structure, and power drive means is interposed between said carriage structure and said supporting structure to move said carriage structure along the path of movement defined by said linkage system.

59. The finishing machine of claim 55 wherein said separator means comprises an apertured member one end of which is disposed, when in said first position, near a discharge opening formed in said receptacle.

60. The finishing machine of claim 59 wherein said second vibratory drive means is positioned above said apertured member at a position removed from said one end.

61. A finishing machine comprising:

- a. a movably supported receptacle having a charging opening for receiving workpieces and finishing media and discharge opening for discharging workpieces and finishing media from said receptacle;
- b. drive means coupled to said receptacle to impart a finishing action to the contents of the receptacle;
- c. a hopper positionable in a first position near said discharge opening to receive material discharged through said discharge opening;
- d. a reloader mechanism connected to said hopper means to move said hopper from said first position to a second position above said receptacle to discharge the contents of said hopper into said receptacle;
- e. said reloader mechanism including:
 - i. linkage means defining a path of movement for said hopper between said first and second position; and,
 - ii. drive means operably coupled to said linkage means to effect movement of said hopper between said first and second positions;
- f. a separator mechanism carried by said reloader mechanism and being positioned thereby above said hopper when said hopper is in said first position to receive workpieces and finishing media discharged from said receptacle and to segregate the workpieces from the finishing media; and,
- g. said reloader mechanism being operable to move said separator mechanism to an elevated out-of-the-way position during movement of said hopper from said first position to said second position.

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62. The finishing machine of claim 1 additionally including connection means establishing a releasable connection between said hopper and said carriage, said connection means being automatically released when said carriage is in said screening position, and being operable in response to the initial movement of said carriage from said screening position toward said loading position to connect said hopper and said carriage.

63. The finishing machine of claim 62 wherein said connection means includes overlying coacting formations on said hopper and on said carriage.

64. The finishing machine of claim 16 additionally

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including connection means establishing a releasable connection between said hopper and said carriage, said connection means being automatically released when said carriage is in said first position, and being operable in response to the initial movement of said carriage from said first position toward said second position to connect said hopper and said carriage.

65. The finishing machine of claim 64 wherein said connection means includes overlying coacting formations on said hopper and on said carriage.

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