March 1, 1966 E. T. KOCH, JR., ETAL 3,237,768

SCREEN STRUCTURE FOR COMMINUTING APPARATUS

Filed March 20, 1963 4 Sheets-Sheet 1

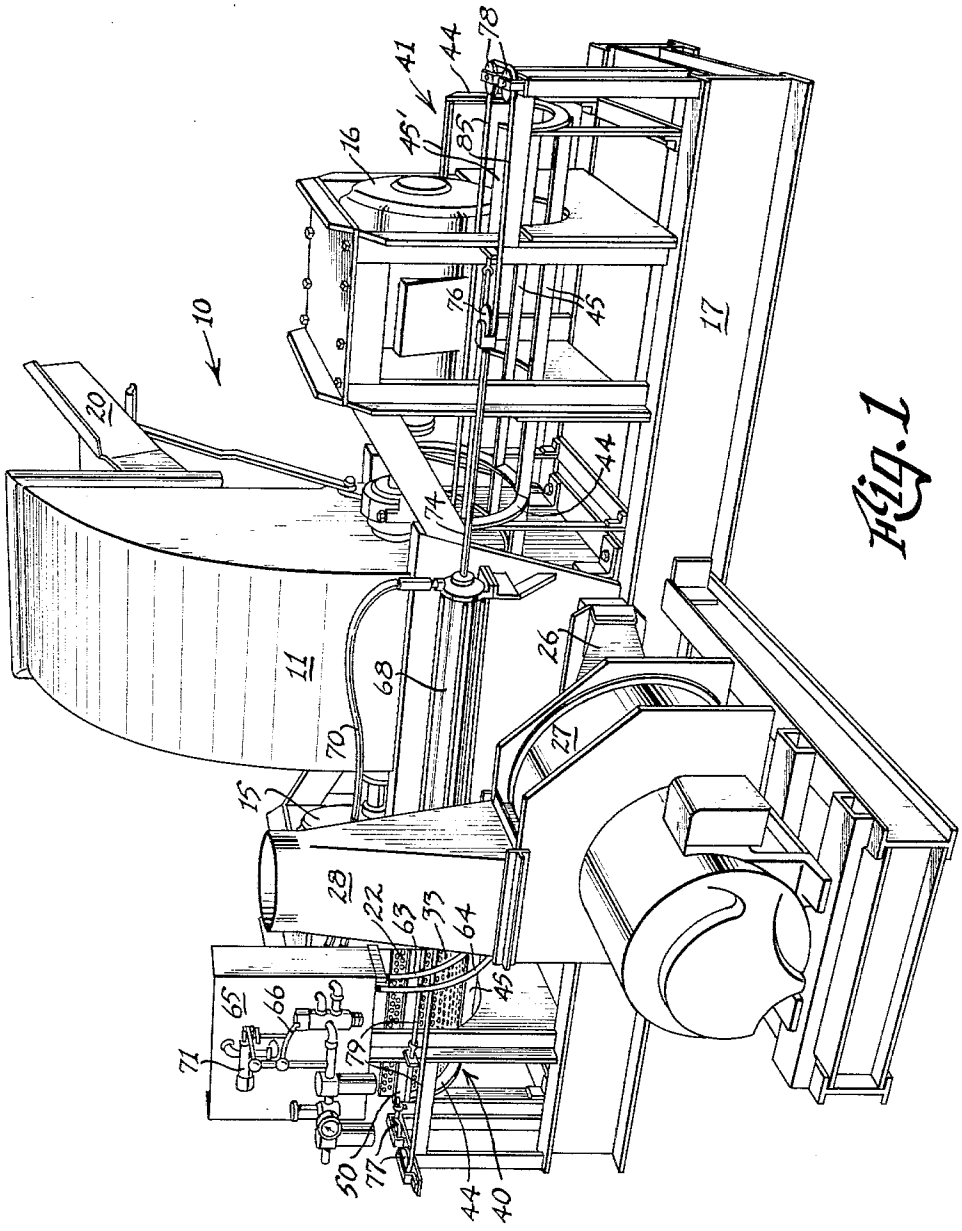


Fig. 1

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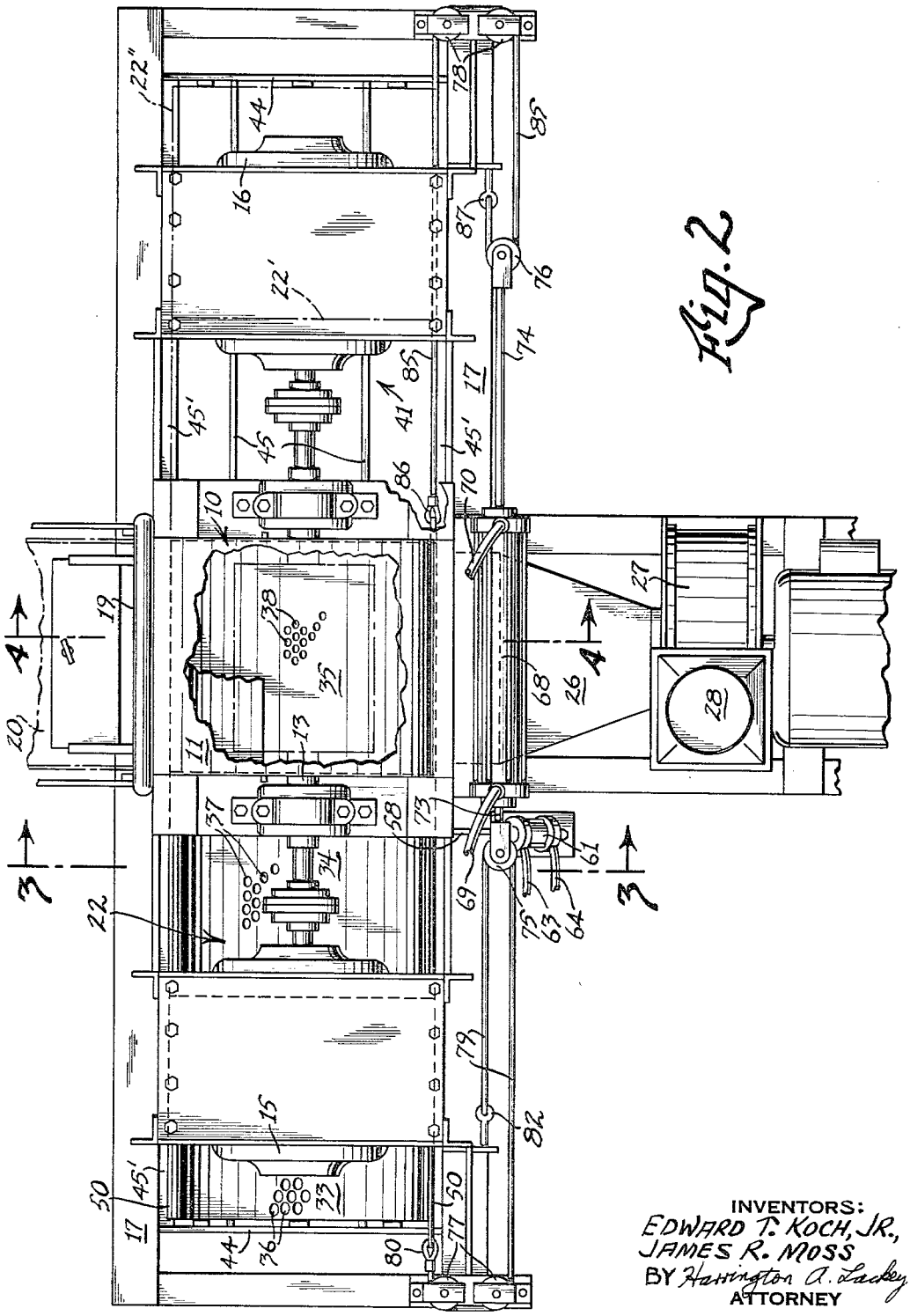


Fig. 2

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SCREEN STRUCTURE FOR COMMINUTING APPARATUS

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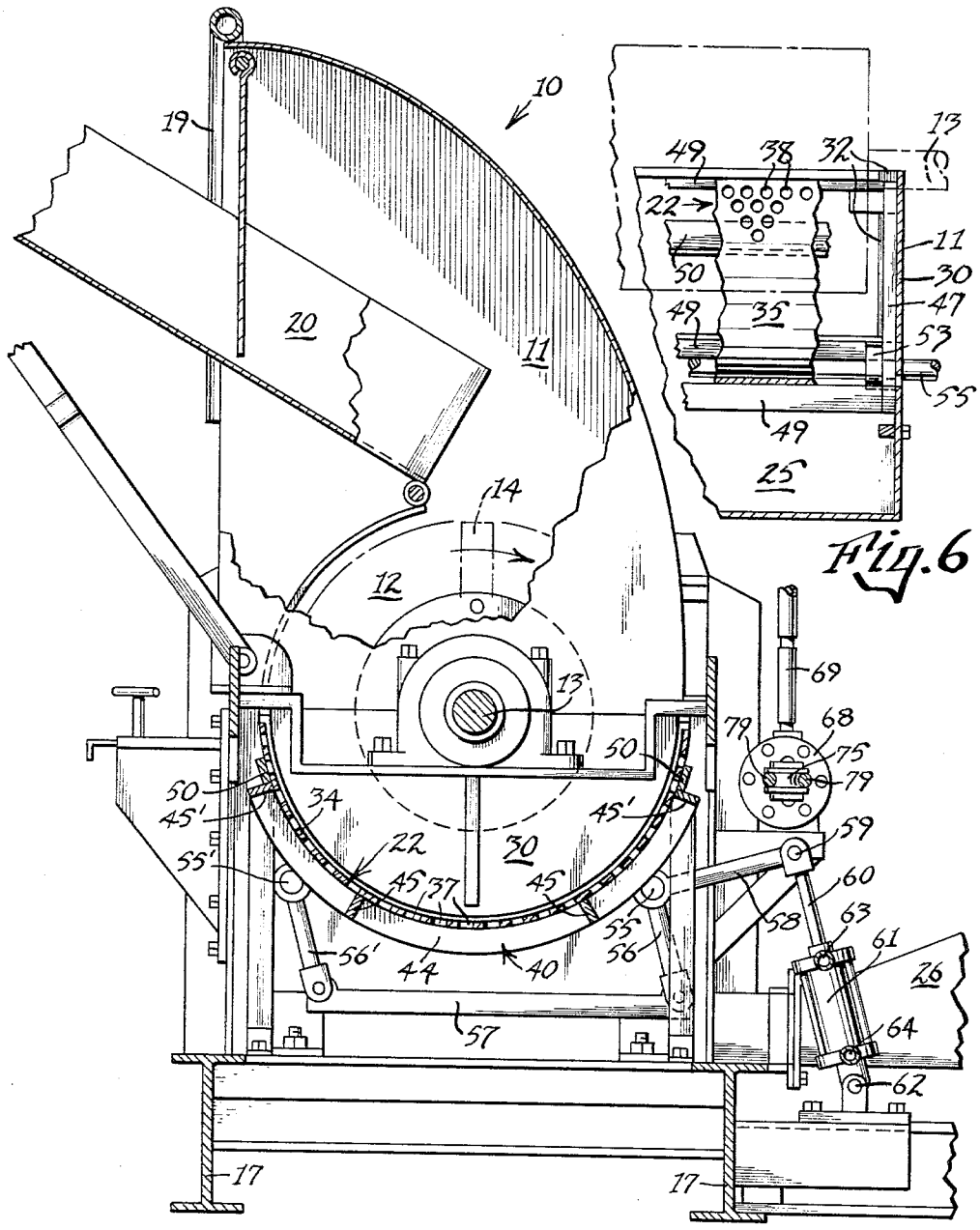


Fig. 6

Fig. 3

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SCREEN STRUCTURE FOR COMMINUTING APPARATUS

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Fig. 5

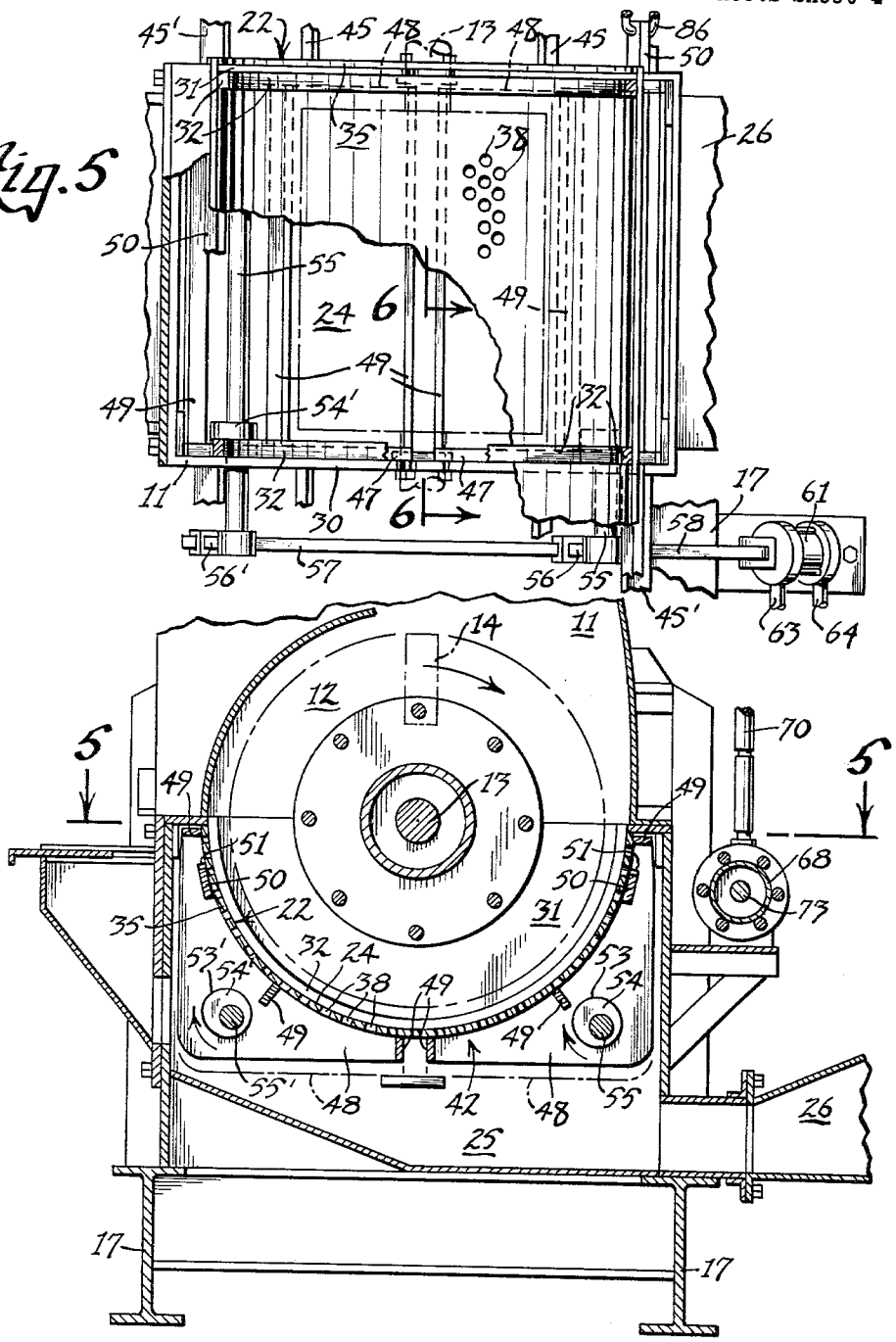


Fig. 4

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3,237,768

SCREEN STRUCTURE FOR COMMINUTING APPARATUS

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2 Claims. (Cl. 209—253)

This invention relates to screen structure, and more particularly to an apparatus for changing screens for classifying comminuted material.

Heretofore in the art of classifying comminuted material, and particularly in the classifying of comminuted material discharged from a hammer mill, single screen panels of various sizes have been interchangeably employed in the discharge opening of the hammer mill. Thus, where different sizes of comminuted materials are desired, the hammer mill must be shutdown while the individual screen panels are interchanged. In grain milling, a single hammer mill is employed for grinding different kinds of grain, such as barley, corn, oats, so that many different sizes of ground grain are desired. In order to accommodate the various sizes, an individual screen panel for each size is maintained in stock so that the various panels may be interchanged as desired. However, the manual interchanging of these individual panels requires a certain amount of labor time, plus the shutdown time of the machine. Such time-consuming practices result in considerable inefficiency in the processing of the grain and the operation of the hammer mill.

It is therefore an object of this invention to overcome the above disadvantages by providing a novel screen structure for automatically interchanging screen panels in a minimum of time and without shutting down the material processing equipment, such as a hammer mill.

One object of this invention is to provide a unitary screen structure incorporating the desired number of screen panels in series and means for shifting the unitary structure to register the desired panel with the classifying station or discharge opening of the comminuting apparatus.

Another object of this invention is to provide an elongated unitary screen structure incorporating a series of screen panels of uniform dimensions but having progressively different size openings and means for reciprocating the structure beneath the discharge opening of a hammer mill for registering any single panel with the opening.

Another object of this invention is to provide a movable screen structure having a series of screen panels of different size openings, and novel control means for reciprocating the screen structure.

A further object of this invention is to provide a novel apparatus for changing screen panels of different sizes in a hammer mill, and novel means for locking each panel in registry with the discharge opening of the hammer mill.

Another object of this invention is to provide an automatic screen changer for a hammer mill which may be rapidly and efficiently operated to change and lock screen panels in their operative positions in a minimum of time and without shutting down the hammer mill.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings, wherein:

FIG. 1 is a perspective view of a hammer mill incorporating the invention;

FIG. 2 is a fragmentary top plan view of the hammer mill and the invention disclosed in FIG. 1, with parts broken away;

FIG. 3 is a section taken along the line 3—3 of FIG. 2, with parts broken away;

FIG. 4 is a section taken along the line 4—4 of FIG. 2;

FIG. 5 is a section taken along the line 5—5 of FIG. 4, with a portion of the screen structure broken away;

FIG. 6 is a section taken along the line 6—6 of FIG. 5, disclosing a fragment of the screen structure.

Referring now more particularly to the drawings, a typical hammer mill 10 is disclosed having a housing 11 including a rotary chamber 12 receiving a rotary shaft 13 carrying a plurality of hammers 14. The shaft 13 is driven by a pair of motors 15 and 16 supported on a stationary frame 17. The upper portion of the housing 11 is provided with an inlet 19 receiving a chute 20 to carry coarse material, such as whole grain to be discharged into the rotary chamber 12. The coarse material or grain is ground to a size determined by the openings in the screen structure 22 which closes the discharge opening 24 in the rotary chamber 12, and then deposited in a receiving chamber 25. The grain is then drawn through the conduit 26 by suction means, such as the fan 27, and discharged through the outlet pipe or nozzle 28 to a receptacle or conduit, not shown.

The screen structure 22 is an elongated unitary structure having a uniform arcuate cross-section adapted to conform to the same arcuate configuration of the bottom edges of the end walls 30 and 31 of the housing 11, having arcuate band seats 32, which define the discharge opening 24 and seat against the screen structure 22 in locked position. The screen structure 22 is substantially longer than the discharge opening 24 and is divided into a plurality of screen panels 33, 34 and 35 of equal dimensions such that each panel may register with the discharge opening 24 for classifying the comminuted grain ground in the rotary chamber 12 by the hammers 14. Each screen panel 33, 34 and 35 contains a plurality of screen openings or mesh 36, 37 or 38, respectively, of uniform size, but the mesh in each screen panel is of different size from the mesh in any other screen panel. For example, FIG. 2 discloses the screen panel 33 having large uniform size openings 36; screen panel 34 has intermediate uniform size openings 37; and screen panel 35 has small uniform size openings 38. The screen panels 33, 34 and 35 may be constructed from a single sheet of arcuate material, such as metal, by forming the respective size holes 36, 37 and 38 in the single sheet of material to form the unitary screen structure 22. The unitary screen structure 22 may also be formed by constructing each panel 33, 34 and 35 individually and then securing the panels in successive and adjacent end to end abutting relationship, by welding or by any other convenient securing means.

A first cradle 40 and a second cradle 41 are fixedly mounted on the frame 17 on opposite sides of the hammer mill housing 11. A third or intermediate cradle 42 is mounted beneath the discharge opening 24. Each cradle 40 and 41 comprises a plurality of longitudinally spaced transverse arcuate members 44 connected by a plurality of longitudinal members or beams 45 and 45'. The intermediate cradle 42 includes a pair of end plates 47 and 48 having arcuate upper surfaces, concave upward, and connected by longitudinal members or beams 49. The cradles 40, 41 and 42 are longitudinally aligned so that the arcuate surfaces of the transverse members 44 and the end plates 47 and 48 will conform to and slidably support the arcuate screen structure 22. Fixed to the opposite outer surfaces of the screen structure 22 are a pair of longitudinal runners 50 adapted to slide along the beams 45' of the cradles 40 and 41 (FIG. 3) and through the slots 51 in the end plates 47 and 48 of the cradle 42 (FIG. 4).

The end plates 47 and 48 are also provided with openings 53 and 53' for rotatably receiving eccentric cams 54 and 54' affixed to rotary shafts 55 and 55' rotatably sup-

ported in stationary journals, not shown. The shafts **55** and **55'** are connected to the upper ends of the crank arms **56** and **56'**, the lower ends of which are pivotally linked by the arm **57**. A lever **58** is also connected to the shaft **55** and is pivotally connected by a pin **59** to a piston rod **60** adapted to be reciprocated in the hydraulic cylinder **61** pivotally mounted at **62** on the frame **17**. The hydraulic cylinder **61** is double-acting and supplied with fluid through the lines **63** and **64**, which are alternately supplied with hydraulic fluid from the control panel **65** through the valve **66**. Thus, it is seen that by manipulating the valve **66**, hydraulic fluid is introduced into the cylinder **61** to withdraw the piston rod **60** to rotate the shafts **55** and **55'** in the direction of the arrow disclosed in FIG. 4 to elevate the intermediate cradle **42** and the screen structure **22** to firmly seat the screen structure **22** against the arcuate end walls **30** and **31**. This operation completely closes the discharge opening **24**, except for the screen openings **36**, **37** or **38** and locks the appropriate screen panel **33**, **34** or **35** in position for classifying the material comminuted by the hammer mill.

The mechanism for reciprocably moving the screen structure **22** to its various longitudinal positions beneath the housing **11** is best disclosed in FIGS. 1 and 2. This mechanism comprises a hydraulic cylinder **68** mounted adjacent the housing **11** and having its longitudinal axis substantially parallel to the longitudinal axis of the screen structure **22**. The cylinder **68** is double-acting and communicates through the fluid lines **69** and **70** with the valve **71** on the control panel **65**. By manipulating the handle **71**, hydraulic fluid may be fed into the cylinder **68** on either side of the piston, not shown, supporting piston rods **73** and **74** extending longitudinally from the opposite ends of the cylinder **68**. The free ends of the piston rods **73** and **74** support freely rotatable pulleys or sheaves **75** and **76**, respectively. A pair of pulleys **77** are supported to rotate about vertical axes on the left end of the frame **17**, and a second pair of pulleys **78** are similarly mounted to rotate about vertical axes on the right end of the frame **17**. A first cable **79** is fixed at one end by any convenient means, such as the loop **80** extending through an opening in the left end of one of the runners **50**. The cable then passes around the pulleys **77**, the piston rod pulley **75**, and is fixedly connected at its opposite end by means such as an eye bolt **82** to a portion of the frame **17**.

In a like manner, a second cable **85** is fixed at one end by a loop **86** extending through an opening in the opposite end of the same runner **81**. The cable **85** likewise passes around the pulleys **78** and the piston head pulley **76**, and is connected at its opposite end by means of an eye bolt **87** to a fixed part of the frame **17**.

Thus, it will be seen that the hydraulic cylinder **68** may be actuated by the valve **71** to move the piston rods **73** and **74** as a unit either to the right or to the left, thereby moving the screen structure **22** in the opposite direction, namely to the left or to the right, respectively. It will also be observed that the piston head pulleys **75** and **76** and the eye bolts **82** and **87** give the hydraulic cylinder **68** and piston rods **73** and **74** a mechanical advantage of two to one so that the screen structure **22** may be moved longitudinally twice as far as is necessary to move either piston rod. The hydraulic valve **71** may be manipulated until the desired panel **33**, **34** or **35** registers with the discharge opening **24**, either by sight alignment, or by any other convenient type of indexing means.

In operating the invention, screen structure **22** is initially unlocked, that is, lowered to the position disclosed in FIG. 3, by manipulating the valve **66** so that the hydraulic cylinder **61** will urge the piston rod **60** upward to rotate the shafts **55** and **55'** in a counter-clockwise direction. With the screen structure **22** unlocked, the valve **71** may then be manipulated to move the screen structure **22** in either longitudinal direction until the appropriate screen panel, for example **35**, is in vertical alignment or registry with the discharge opening **24** in the bottom of the housing **11**, as disclosed in FIG. 2. Since the disclosed screen panel **35** incorporates the smallest screen openings **38** in the screen structure, then very fine ground material will be obtained.

With the screen structure **35** in proper registry, the valve **66** is then manipulated to withdraw the piston rod **60** into the cylinder **61**, thereby counter-rotating the shafts **55** and **55'** in a clockwise direction, as disclosed in FIG. 4, in order to cause the eccentric cams **54** and **54'** to move in their respective holes **53** and **53'** and thereby elevate the cradle **42** to force the screen structure **22** upward against the arcuate edges of the end walls **30** and **31**. Thus, the discharge opening **24** is sealed, except for the screen openings **38**. The motors **15**, **16** and the suction fan **27** are then started to drive the hammer mill and grind the whole grain or other solid materials introduced into the housing **11** through the chute **20**. The comminuted material is then discharged through the screen openings **38** into the receptacle **25** and through the suction fan **27** to the outlet **28**.

Even while the hammer mill is in operation, the screen structure **22** may be unlocked by actuating the valve **66**, as previously described, and the screen structure may be longitudinally moved to a position registering the screen panel **34** with the discharge opening **24**, as illustrated by the phantom-line position **22'** in FIG. 2, or to register the screen panel **33** with the discharge opening **24** in the position indicated by phantom-line **22''** in FIG. 2. After the screen structure has been moved to its desired position, the valve **66** is again moved in the opposite direction to lock the screen structure **22** in position, as previously described.

Thus, it will be apparent that the screen structure **22** and its controls provide a mechanism for quickly and efficiently changing screens, but also for quickly changing the screens without shutting down the hammer mill. It is, of course, within the scope of this invention to provide any number of screen panels in the unitary screen structure **22**, which are needed and which can be effectively controlled.

It will be apparent to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. An apparatus for classifying comminuted material, comprising:

(a) a housing for receiving said material having first and second opposed end walls,

(b) said end walls having bottom edges comprising longitudinally aligned arcuate seats defining a discharge opening therebetween,

(c) a first elongated cradle having an arcuate cross section stationarily mounted adjacent the outside of said first end wall, and longitudinally aligned, but spaced slightly below said arcuate seats,

(d) a second elongated cradle stationarily mounted adjacent the outside of said second end wall, said second cradle being longitudinally aligned with and having the same arcuate cross section as said first cradle,

(e) an intermediate cradle having the same arcuate cross section as said first and second cradles, and mounted longitudinally between said first and second cradles and beneath said discharge opening,

(f) a unitary screen structure longer than said intermediate cradle, and having the same arcuate cross section as said arcuate seats and said intermediate cradle,

(g) said screen structure comprising a plurality of longitudinally aligned screen panels, each panel being individually adapted to register with said discharge opening,

(h) means for vertically moving said intermediate cradle from a lower open position where said screen structure is supported for longitudinal movement

upon at least two adjacent cradles, to an upper closed position where said screen structure is elevated above said first and second cradles and snugly fitted against said arcuate seats to close said discharge opening, except for the openings in said screen structure, and

(i) means for longitudinally moving said screen structure over said cradles in open position to register any one of said panels with said discharge opening.

2. The invention according to claim 1 further comprising elongated runners mounted on the bottom of said screen structure, means on said intermediate panel for slidably receiving said runners, and means on said first and second cradles for supporting said runners for longitudinal movement thereof.

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