Jan. 19, 1926. 1,570,081

J. J. ROSS

GRAIN HULLER

Filed March 15, 1923 3 Sheets-Sheet 1

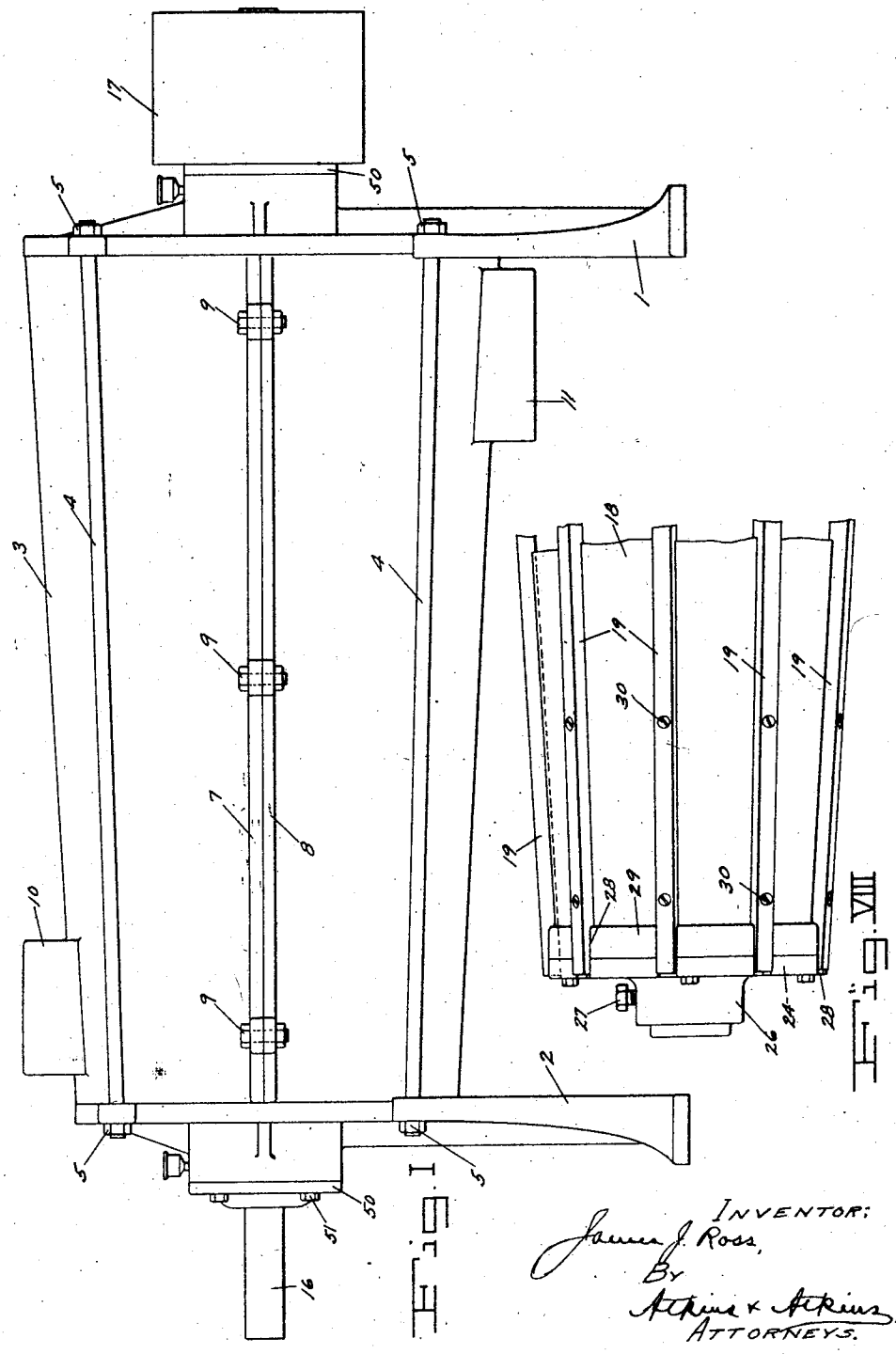


FIG. 1.

FIG. II.

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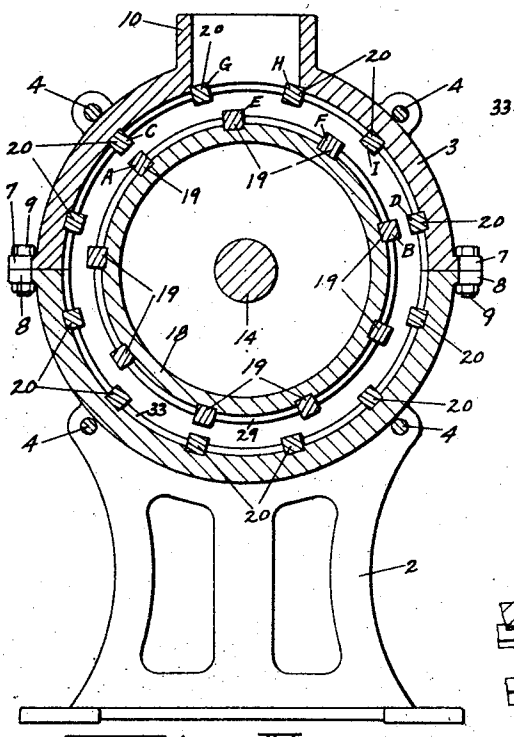


Fig. IV

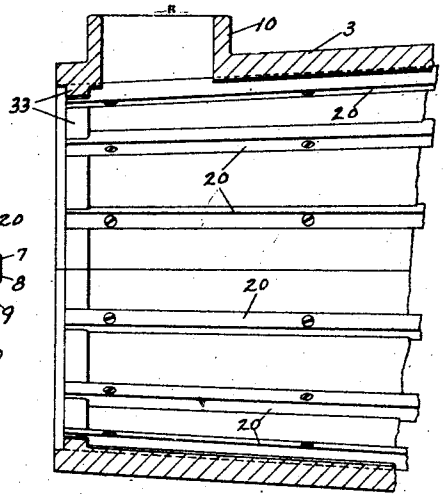


Fig. VI

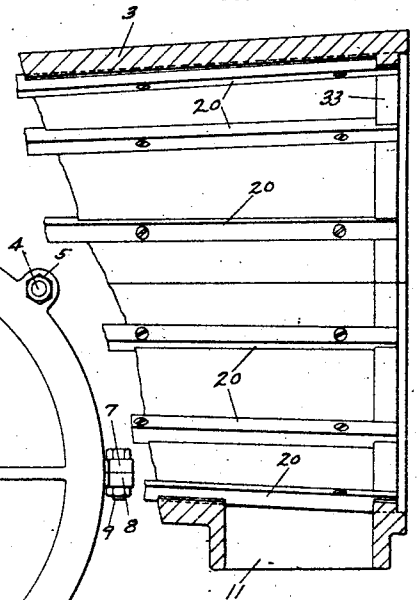


Fig. VII

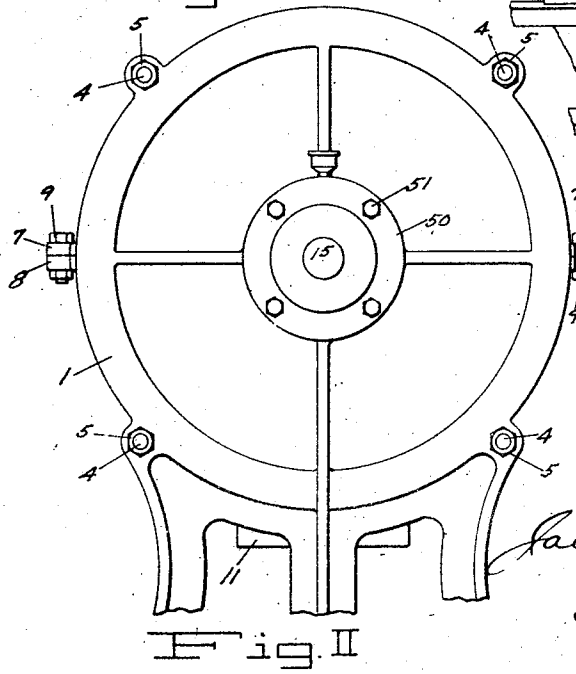


Fig. II

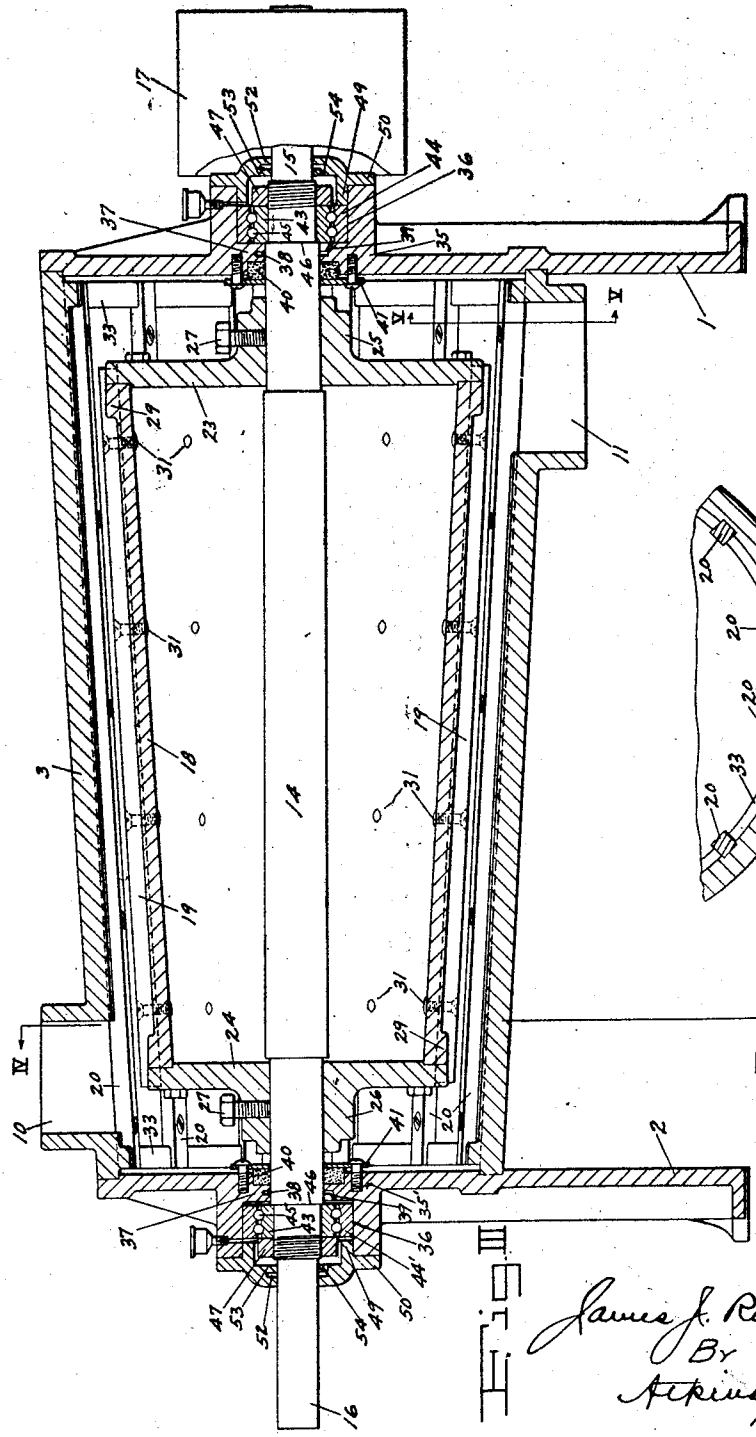
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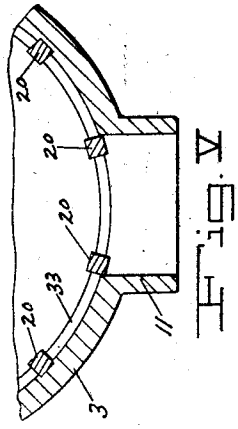


FIG. 4

FIG. 3

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Patented Jan. 19, 1926. 1,570,081

UNITED STATES PATENT OFFICE.

JAMES J. ROSS, OF PORTLAND, OREGON, ASSIGNOR TO THE J. J. ROSS MILL FURNISHING COMPANY, OF PORTLAND, OREGON, A CORPORATION OF OREGON.

GRAIN HULLER.

Application filed March 15, 1923. Serial No. 625,340.

To all whom it may concern:

Be it known that I, JAMES J. ROSS, a citizen of the United States of America, and resident of Portland, in the county of Multnomah, in the State of Oregon, have invented certain new and useful Improvements in Grain Hullers, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to machines for rendering groats from grain through the operation of hulling.

Among the objects of my invention the following may be enumerated, to wit: to accomplish the hulling of grain in the green state by means which effect a substantially perfect initial separation of the hulls from the groats; to secure an even distribution of the grain after it is fed to the machine; and to provide such definite relationship between the coactive elements of the machine and the rate of speed of their relative movement, as will capacitate, solely through variation of the rate of speed, to operate successfully upon different kinds or grades of grain.

In respect to the results accomplished through variation of the speed factor, it may be specified, for example and illustration, that my machine for the successful hulling of oats requires a high rotative speed of the rotary element, which, for different kinds of oats, may range from 1600 to 2200 revolutions per minute, or say a normal speed of say 1800 revolutions. At that rate a constant efficiency of substantially one hundred per cent may be developed without injury to the groats product.

By contrast, if the machine be used for hulling barley, a speed of the range above specified has the effect of partially pulverizing the grain to the degree of destroying the value of the groats as such; but by reducing the rate of speed to 1000 revolutions per minute a substantially perfect hulling of barley without injury to the groats may be accomplished.

Besides the objects above enumerated, my invention comprehends certain structural features that are of importance in the manufacture of a commercially successful machine.

What constitutes my invention will be hereinafter specified in detail and succinctly set forth in the appended claims.

In the accompanying drawings,

Figure I is a side elevation of my invention in present preferred form of embodiment.

Figure II is a partial end elevation of the same looking towards the outlet end of the machine, without the drive pulley.

Figure III is a vertical longitudinal diametrical section, partly in elevation, of the subject matter of Figure I.

Figure IV is a transverse section of the machine taken as on the line IV—IV of Figure III, looking from right to left.

Figure V is a vertical section taken as on the line V—V of Figure III.

Figure VI is a vertical medial longitudinal section of the inlet end of the shell detached and partly broken away.

Figure VII is a vertical section of the outlet end of the shell of the machine detached, corresponding to the view of the other end shown in Figure VI.

Figure VIII is a side elevation of the smaller end of the drum detached, the same being a counterpart, in details of construction, with the other end of the drum.

Referring to the numerals on the drawings, 1 indicates one end frame-piece of the machine, and 2 the other end frame-piece. They are spaced apart by a horizontally disposed conical shell 3, and are united thereto and to each other into a suitable and stable frame as by a series of rods 4, which are preferably provided with opposite threaded ends that take into nuts 5, which screw against the outer faces of the members 1 and 2, respectively.

The shell is preferably made, for convenience of assemblement, in two parts that are upon opposite sides of the shell provided, respectively, with abutting longitudinal flanges 7 and 8, which are at intervals joined together as by bolts 9. 10 indicates a grain inlet, opening into the top of the shell, and communicating with the interior thereof near its smaller end. At the oposite end of the shell, is provided an outlet 11 located in the bottom of the shell.

Within suitable bearings provided in the end frame-pieces 1 and 2, respectively, is

mounted a horizontal rotative shaft 14, whose opposite, preferably reduced, ends 15 and 16 extend beyond the frame for the accommodation of a drive pulley 17, which may be operatively affixed to either end of the shaft, at will.

Mounted upon and fixed to the shaft 14 by which it is rotated, is a drum 18 whose conical exterior corresponds relatively in external shape and dimensions to the conical interior of the shell 3 which encases it, and with which it is made coaxial by the disposition of the shaft to the shell.

The opposing surfaces of the drum 18 and of the shell 3 are provided each with a series of longitudinally disposed bars or beaters 19 and 20, respectively, the bars being preferably substantially square in cross-section and equidistantly disposed laterally, in their respective series. The distance of separation of the bars 19 from the bars 20, which is hereinafter denominated the "gap" between the bars, and their relative lateral disposition in their respective series hereinafter denominated the "spacing" of the bars, in effect, constitute, both respectively and collectively, important and essential features of my invention. The gap aforesaid is a constant factor, which being determined by the maximum diameter in cross-section of a kernel of grain which the machine is designed to hull may be taken to be equal to one quarter of an inch in all machines. The aforesaid spacing in series of the bars of the two series is also, to the extent specified in the remainder of this paragraph, a constant factor. The space between the bars in series, measured in actual inches, may vary according to the number of bars in each series, but the ratio of the number of bars in one series to the number of bars in the other series is a constant ratio of three to four. For example, if, as the drawings show, the bars 19 be nine in number then the bars 20 will be twelve in number, which is the ratio specified.

According to that ratio, the series of bars 19 is divisible into three equal groups. The said groups are pure concepts of the mind, and may be measured from any single bar 19 as a starting point. So measured, each group of a series of nine requires for its completion three other bars besides the first. Consequently each group comprehends four bars of which the first and fourth may be regarded as group terminals and the second and third are intermediates, of which a plurality is always provided according to the ratio specified.

The aggroupment of the bars 20 corresponds to that described with reference to the bars 19, except that the former includes in each group one more intermediate bar to the group than the latter. Consequently between any two opposing groups of the bars 19 and of the bars 20, only the terminals of the two groups may come at any single moment of contemplation into simultaneous radial alignment. As to the intermediates of both of said groups there is always a staggered relationship as shown in Figure IV, for example. If A and B, as shown in that figure, represent the terminals of any hypothetical group of bars 19, then C and D will be the terminals of the correspondent group of bars 20. Two bars E and F are intermediates to the terminals A and B, and three bars G, H, and I are intermediates to the terminals C and D. It should be observed that in every analytical division such as that just described, the terminal bars of any group are common to the respective groups next adjacent thereto, and that in the constantly changing picture presented to the mind by the rotation of the drum 18, each bar may be successively taken for a terminal in any attempt made to vizualize them into groups for the purpose of analysis. The practical value of such analysis is found in the presentation it affords of the fact that only between the terminals of counterposed groups of bars 19 and 20 is there, at any moment of rotation, possibility of radial alignment, and that at such moment of alignment there is a necessary disalignment between intermediate bars. The effect thereby produced is a continuous rolling motion of the grain kernels confined in the space between the drum and the shell, modified only by the impacting action of the bars 19 and 20 in the driving of the kernels back and forth between the opposing walls of the drum and of the shell.

The foregoing explanation is deemed to be necessary in order to communicate a clear and correct understanding of the fact that the successful operation of my machine is demonstrated in practice to depend upon the relationship between the spacing of bars 19 and 20 in their respective series and in respect to the gap between them. In other words, that relationship is the fact relied upon to support certain claims of a patent in the present case, because it is found in actual practice to produce uniformly efficient results, and because any substantial variation of that relationship is likewise found to impair the efficiency of the machine. The theory of operation advanced to account for the fact specified, while it is believed to be the true one, is, of course, subordinated to the fact relied upon as above set forth.

Furthermore, the gap and the spacing between the bars 19 and 20 respectively, being constant factors, it is possible only by variation of the third factor, namely that of speed, to adapt my machine to the hulling of different varieties of grain or to the hulling of different grades of grain.

The drum 18 preferably comprises a hollow truncately conical structure that is secured to end-plates 23 and 24, whose respective hubs 25 and 26 are fastened to the shaft 14 as by abutment screws 27. The outside wall of the drum is longitudinally channelled for embedding into the wall the bars 19 which, in order to qualify them for their work, are necessarily made of hard metal, preferably tool steel, and whose ends are confined within close fitting clefts 28 provided for them in annular terminal rims 29 and in the periphery of the plates 23 and 24, respectively. Between the rims 29, each bar is penetrated at suitable intervals by apertures through each of which is inserted a screw 30 which is threaded into a corresponding screw hole in the drum through which the screw extends, its end being secured as by a riveted head 31 on the inside of the drum.

Substantially in like manner the bars 20, corresponding in form and material to the bars 19, are secured on the inside of the shell 3, which is provided near its opposite ends, respectively, with an annular rim 33. The small end of the drum 18 preferably extends within the shell 3 across the greater portion of the space that lies directly below the grain inlet 10, and with the addition of its hub 26 extends entirely across the same, thereby constituting a grain distributer whose office is to scatter and distribute, in a substantially uniform shower, the grain to be hulled as it is fed into the machine through the said inlet.

In order to preserve the permanency of the gap or space of separation between the opposing faces of the bars 19 and the bars 20, it is necessary to provide at one end against longitudinal movement of the shaft 14 to which the drum 18 is affixed. To that end, I prefer to employ the form of anti-friction journal-bearing illustrated in Figure III as attached to the end frame-pieces 1 and 2, whereof description follows. The same consists substantially of a box 35 into which extends from its cylindrical inner wall 36 an annular coaxial web 37 of a thickness to accommodate an annular lubricant groove 38 and a drainage duct 39 leading therefrom into the box upon the outside of the web 37. On the inside of the web an elastic packing ring 40 is secured as by a plate 41 screwed to the inner face of the box 35.

Within the wall 36 I prefer to provide a two part cage comprising annuli 43 and 44 which are separated by anti-friction rollers or balls 45, which run in suitable race-ways formed in the opposing faces of the said annuli. The annulus 43 is fixed, as by a driven fit, to the shaft 14 against a shoulder 46 formed by reduction of its end, the security afforded by the fit of the annulus upon the shaft being augmented by a lock nut 47 threaded to the shaft and having an outside diameter substantially equal to or a little less than the outside diameter of the annulus 43. The annulus 44 is secured as by a press fit in the box 35, and is also held therein by an annular sleeve 49 projecting at right angles from a plate 50 secured as by screws 51 to the outer end of the box 35. The plate 50 carries a collar 52 which snugly fits around the shaft 14, and which is provided with a lubricant groove 53 and a drainage duct 54 corresponding substantially in form and function for one end of the box 35 to the elements 38 and 39 provided for the other end of the box.

In the end frame-piece 2, a journal-bearing is provided that is substantially the same as that described in the last two preceding paragraphs with this variation, that within the box designated for distinction as 35′ space is provided for movement of the ball-bearing cage, in order to accommodate the bearing to that longitudinal expansion and contraction of the shaft 14 which is a necessary incident to variations of temperature which are developed in the practical operation of the machine. To that end, the annulus within the box 35′ designated by 44′ to distinguish it from the annulus 44 in the box 35, is accommodated within the wall of the box 35′ with a "creeping" fit, so as to enable it, without impairment of its proper function as part of an anti-friction bearing, to move endwise of its box in the space provided as aforesaid for such movement.

The operation of my machine may be briefly described as follows. After the shaft 14 is set in motion, grain to be hulled, having been first cleansed of trash, if the condition of the grain demands it, is fed by any usual means into the inlet 10. In passing through the inlet into the interior of the shell, the grain first comes into contact with the end of the drum and its hub 26 which are in the foregoing specification designated a grain distributer, whose rotation effects a substantially uniform distribution of the grain into the confined space provided between the shell 3 and the drum. The rotation in either direction of the drum within the shell effects through coaction of the bars 19 and 20 the hulling operation desired, which proceeds until the commingled chaff and hulled product is finally discharged, by the combined action of gravity and the rotation of the drum, along the downward incline of the bottom of the interior of the shell until it finds exit through the outlet 11. After its discharge therefrom the chaff and groats of the commingled mass are subjected to a process of separation, which may be accomplished by any usual or other suitable means preferred.

It is to be observed that the provision of of a proper gap between the opposing bars

19 and 20, eliminates any shearwise coaction between the bars with consequent crushing or severing of the groats, and is one of the distinguishing features between my invention and what is known in the prior art.

What I claim is:

1. In a grain huller, the combination of a horizontally disposed internally conical shell provided with a grain inlet and an outlet, and a rotatable drum having an external conical form corresponding to the internal form of the shell, with a series of separated, projecting, longitudinally disposed bars fixed in the inside wall of the shell, and a series of bars fixed in like manner in the outside wall of the drum, the opposing bars of the said two series being separated by a constant gap substantially equal to the average maximum dimension of a kernel of the grain which the machine is designed to hull.

2. A machine substantially as described in claim 1 in which the number of bars of the series on the drum bears to the number of bars of the series on the shell the ratio of three to four.

3. In a machine of the kind described, the combination with an oblong conical member having a wall provided at intervals with longitudinal channels for the reception of bars, of annular terminal rims provided at opposite ends of said member with close fitting clefts aligned, respectively, with said channels, and adapted to afford firm support for the ends of respective bars embedded in the said channels.

4. A machine substantially as described in claim 1 in which the drum is carried upon a shaft mounted in its end frame-pieces provided and constituting terminal supports for the shell, and in which journal-bearings for the opposite ends of said shaft are provided in the said end frame-pieces, respectively, one of said journal-bearings fixing the shaft against endwise movement and the other journal-bearing being adapted to admit of such movement of the shaft.

5. A machine substantially as described in claim 1 in which the drum is carried upon a shaft mounted in its end frame-pieces provided and constituting terminal supports for the shell, and in which journal-bearings for the opposite ends of said shaft are provided in the said end frame-pieces, respectively, one of said journal-bearings fixing the shaft against endwise movement and the other journal-bearing being adapted to admit of such movement of the shaft, said journal-bearings comprising each a pair of complementary annuli operatively assembled with intermediate antifriction rollers, one annulus of each pair being fixed to the shaft and the other in operative engagement with the frame-piece which carries it.

6. In a machine for hulling grain, the combination of a casing or shell having an interior chamber, which increases gradually in diameter from one end to the other and is inclined downward from its smaller to its larger end and provided with inlet and outlet openings that communicate with said chamber adjacent the smaller and larger ends, respectively, a series of bars extending longitudinally of the annular wall and projecting radially into said chamber, and a drum of the same external form as said chamber rotatably mounted in the chamber and provided with a plurality of annularly spaced longitudinally extending ribs which are uniformly spaced from the inwardly extending casing bars, when in alignment therewith, throughout their length a distance equal to the average maximum dimension of a kernel of the grain which the machine is designed to hull.

7. In a grain huller, the combination of a substantially horizontally disposed, internally conical, shell, provided with a grain inlet and an outlet, a series of laterally spaced bars extending longitudinally of the shell and projecting inward from the annular wall thereof, and a rotatable drum within the shell having a series of peripheral bars extending longitudinally thereof in continual parallel relation to the inwardly projecting bars of the shell, the bars on the drum being of a different length from those on the shell, and the parts being so related that the adjacent faces of aligned members of the two sets of bars will be separated throughout the length of one of said sets of bars by a constant gap substantially equal to the average maximum dimension of a kernel of the grain which the machine is designed to hull.

In testimony whereof, I have hereunto set my hand.

JAMES J. ROSS.