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GRADING AND SORTING GRADING APPARATUS

Filed May 16, 1929

2 Sheets-Sheet 1

Fig. 1

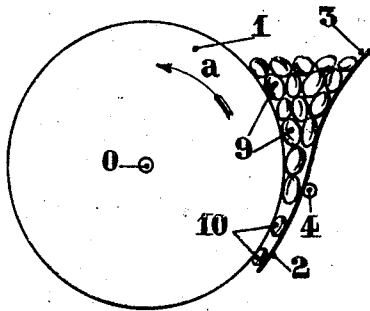


Fig. 2

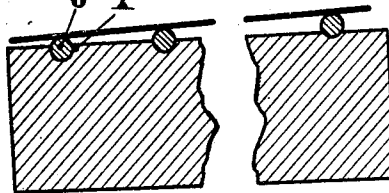


Fig. 3

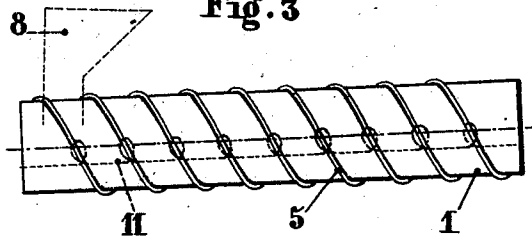


Fig. 4

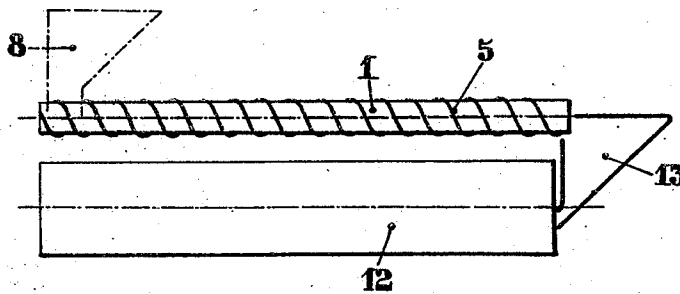
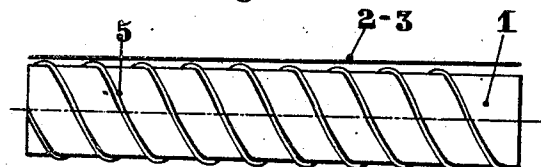


Fig. 5

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Fig. 6

Fig. 1^a

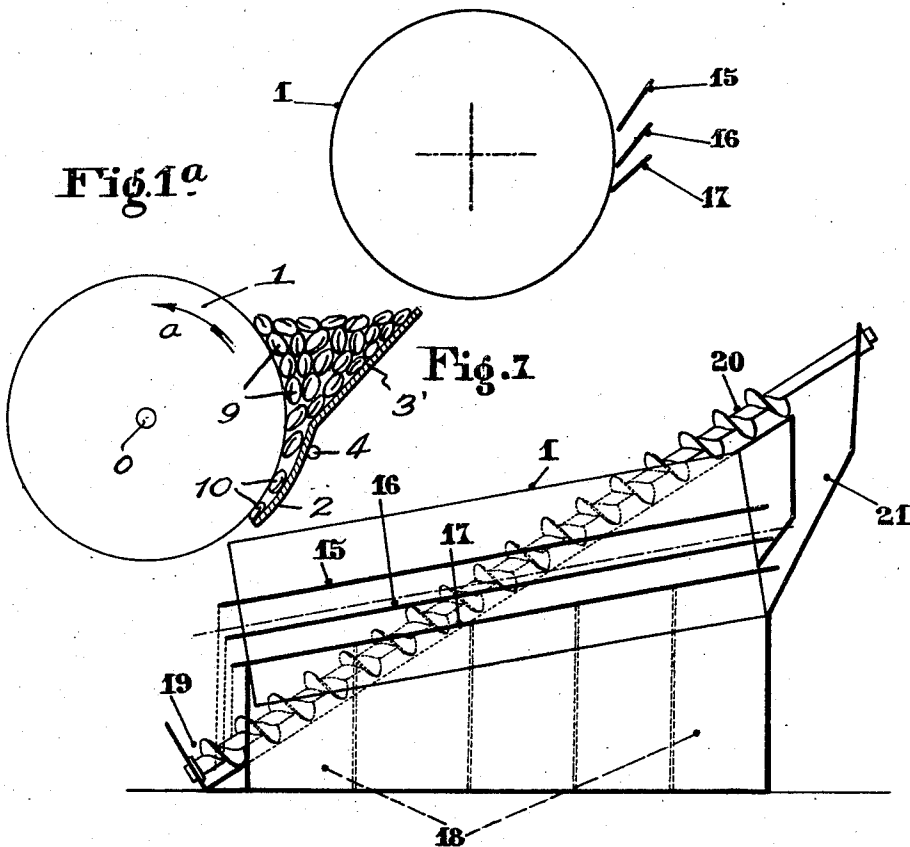
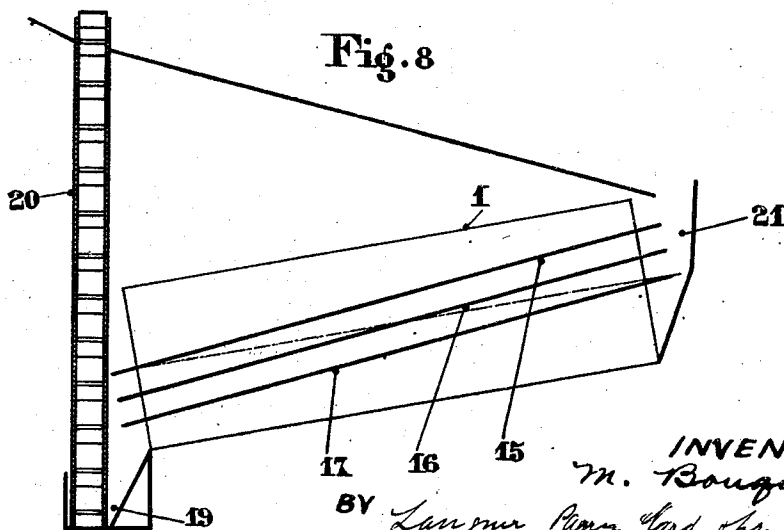


Fig. 8



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GRADING AND SORTING-GRADING APPARATUS

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The present invention has for its object a number of improvements in grading apparatus adapted to select, according to their sizes, different granular substances, and particularly grains and seeds, these improvements being applicable to such apparatus in which the grains pass through a channel or gutter, open at the bottom, formed by a rotary cylinder and a movable shutter, the distance of which from the walls of the cylinder can be regulated; this distance, owing to the position of the shutter, increasing progressively so that the smallest grains can pass through the aperture at a point closely adjacent their point of entry, the larger seeds falling, according to their size, at progressively distanced points, whilst the largest seeds which are greater than the largest aperture in the channel, are discharged at the end of the grading apparatus.

The invention also has for its object a combined grading and sorting apparatus adapted to sort and grade sowing seeds and characterized by the combination of a sorting cylinder having compartments of known type, and a grading device constructed according to the present invention, the latter being adapted to be attached to the sorting device or the outer surface of same is adapted to be utilized as a grading cylinder, irrespective of the direction followed by the seeds during grading.

Apparatus have already been devised comprising flat shutters, the lower edge of which was located either in the horizontal plane of the cylinder axis or below this plane; in like manner grading apparatus are known which comprise cylinders provided with grooves or helicoidal projections which facilitate the longitudinal movement of the seeds.

In all these apparatus, however, the longitudinal movement of the seeds to be graded was always effected in the direction of the slope of the cylinder, the materials to be treated being admitted into the channel at its highest point, the refuse being discharged at the lowest point of the said channel.

The improvements which form the object of the present invention are as follows:—

1. The movable shutter, the position of

which can be adjusted, is concave-convex; with respect to the cylinder the lower part of the shutter is concave, the upper part being convex. The curvature of the concavity of the shutter must always be less accentuated than that of the cylinder, correspondingly to the nature of the materials to be graded. The upper convex part of the shutter may be replaced by a flat part. Thus on the one hand the channel is formed by the wall of the cylinder and on the other hand by the shutter, the latter being closer to the cylinder at its lower end than at its upper end, in a proportion which can be regulated.

2. The cylinder carries a projecting helicoidal winding, which may for example consist of a metallic cable located in grooves provided on the cylinder, these grooves, however, being sunk in the cylinder in such a manner that they are deeper at the lowest end of the latter than at the top, so that the cable located in the said groove projects less at the lowest end of the cylinder than at its upper end.

3. The seeds or materials to be graded are introduced into the channel at the lower end of same, so that they pass longitudinally upwards, the refuse being discharged at the top end of this channel.

The combination of a grading apparatus such as that described above, with a sorting cylinder according to the present invention, presents the following advantages:

In the case where the grading cylinder is either independent of the sorting cylinder or is formed by the outer surface of the latter:—

4. As the grading is effected prior to the sorting, in contradistinction to that which takes place in known apparatus, the grading eliminates in advance all small and medium sized seeds and in consequence the sorting apparatus only receives seeds intended for sowing, and substantially identical in size. As a result the work of the sorter is greatly reduced, as on the one hand a considerable portion of the seeds treated have been eliminated by the grader and on the other hand, the seeds left over for the sorter have already been freed of all small foreign seeds, and also

of the small and medium seeds only suitable for consumption.

In the case where the grading apparatus is formed solely by the outer surface of the sorting cylinder:—

5 The grading cylinder, instead of being independent is formed by the cylindrical outer surface of the sorting apparatus, so that the costs of construction are considerably reduced;

6. Owing to the large diameter of the sorting cylinder (60, 70, 85 c. m. according to capacity) it is possible to arrange along the outer surface of the said cylinder a plurality of movable shutters, which enable the grading output to be increased proportionately to the number of superposed shutters, without the space occupied by the apparatus being thereby increased.

25 In the accompanying drawings:—

Fig. 1 shows diagrammatically a cross section of a grading device, constructed in accordance with the invention.

Fig. 1^a shows a view similar to that of Fig. 1, with the single difference that the upper part of the movable shutter is plane instead of convex.

Fig. 2 shows diagrammatically a section through the axis of rotation of a part of a grading cylinder, provided with a helicoidal winding constructed according to the invention.

Fig. 3 is a diagrammatical elevation of the manner in which the seeds to be graded move in the apparatus;

Fig. 4 is also a diagrammatical plan view of the same device;

Fig. 5 illustrates the manner in which a grading apparatus, constructed according to the invention, may be attached to a sorting cylinder.

Fig. 6 is a diagrammatical cross section of a sorting and grading apparatus, having three movable shutters, constructed in accordance with the invention.

Figs. 7 and 8 are diagrammatical views in side elevation of sorting and grading apparatus constructed according to the invention, but in which the grading is effected in the direction of the slope of the shutters.

As will be seen from the drawings, and particularly in Fig. 1, a grading device constructed according to the invention is formed by a cylinder 1 (which may be set in rotation by any suitable means) and by a movable shutter comprising a concave part 2, located adjacent the cylinder wall and a convex part 3 or flat part 3' forming, with the cylinder, a kind of hopper into which fall the seeds to be graded.

The shutter may swing for example around a shaft 4 (which may be located following any suitable generatrix of the shutter) in such a manner that the opening of the curvilinear angle formed at right angles by the

wall of the cylinder 1 and the concave part 2 of the shutter, may be varied as desired; on the other hand, the pivotal supporting axis 4 of the shutter may be displaced transversely so as to enable it to be approached to or moved away from the axis *o* of the cylinder, this being necessary to permit of leaving at all times a larger aperture at the top end of the channel and to enable the width of this aperture to be varied over the whole length of the cylinder, according to the nature and dimensions of the seeds treated. The shutter may be fixed in any position which may be imparted to it.

On its outer surface (Figs. 2 and 3) the cylinder carries a helicoidal winding 5 which projects beyond the said surface, the winding, consisting for example of metal cables 6, being housed in helicoidal grooves 7 provided in the cylinder. The helicoidal winding may be of any pitch, the choice of the latter depending upon the rotary speed of the cylinder, the nature of the work involved and the slope and diameter of the grading cylinder. As shown in Figure 5, the receiving hopper 13 is adapted to receive material from the helical winding 5 and to transfer the same to the sorting apparatus 12.

In an apparatus of this kind, and as shown in Fig. 4, it is essential that the aperture of the channel should be larger at the top end of the cylinder than at its lower end where admission is effected. In certain cases, and when materials have to be treated comprising very small seeds, it may be necessary to approach the shutter, at the point of admission, very close to the cylinder. In order to prevent the projection of the winding interfering at this point with the adjustment of the shutter, notches have been provided adapted to receive the projecting cables or wires, in such a manner that they are deeper at the lower part than at the higher part, this depth decreasing uniformly from one end of the cylinder to the other.

This arrangement is shown diagrammatically in Fig. 2, which illustrates a part of the cylinder in section through its axis of rotation, from which will be seen that the grooves provided in the cylinder are deeper at the lower end than at the top end, the projection of the windings thus increasing progressively in upward direction.

In an apparatus constructed in accordance with the invention, the seeds to be treated reach the channel through a hopper 8, fed by a distributor of any type, the opening of which discharges into the channel at its lower end; the cylinder is set in rotation in the direction of the arrow *a* (Fig. 1) and the helicoidal winding is such that it constantly tends to cause the seeds to ascend towards the top of the cylinder. Owing to this winding, the seeds falling from the hopper into the channel are carried longitudinally up-

wards and take up their position in the channel as shown in Fig. 1.

The line of intersection of the two curved surfaces (concave and convex) of the shutter, the distance of which from the cylinder has been suitably adjusted, effects, in the mass of seeds, a primary selection, the largest seeds 9 being kept above this line, only the smallest 10 being allowed to pass between the cylinder and the concave part of the shutter.

Owing to the particular shape of this part of the shutter, the small seeds which alone are admitted, cannot move radially and are held individually in contact with the cylinder wall; the longitudinal sliding action of the helicoidal wires exercises its full effect on same and these seeds are rapidly conveyed towards the point where the slot in the channel is sufficiently wide to permit their escape, or to the outlet, if their size permits of their being conveyed thus far.

The realization of the ascent of the seeds also presents the following advantage: on a level with the concave part, the mass of seeds is carried longitudinally but, owing to the shape of the shutter and the slope of the device, inversely to the direction of movement a part of the mass overflows the wire and falls back to the point which they have just left following a path substantially analogous to that shown by the curve 11 in Fig. 3. Owing to this fact a very energetic and highly effective stirring of the mass of seeds to be graded takes place which has the effect of considerably increasing the capacity of the apparatus.

In addition to the foregoing advantages, the adaptation to grading apparatus of the improvements according to the present invention permits of simplifying the apparatus in which a sorting device follows a grading device and operates in conjunction with same. In fact when the grading is effected in the direction of the slope of the cylinder, and which is the same in the sorting cylinders it is necessary either to make a very high apparatus, or to provide elevators to take up the seeds as they leave the grading apparatus and convey them to the hopper of the sorting apparatus. On the contrary when a grading apparatus constructed according to the present invention is attached to a sorting apparatus the entity formed by these two apparatus may be that shown diagrammatically in Fig. 5 in which the grader may consist of any number of cylinders 1 being located immediately above the sorting apparatus 12 having the same slope and direction as the latter the materials passing into the grading apparatus through the hopper or hoppers 8 and the refuse falling from the orifice of the helical member into the hopper 13 which lowers it into the cylinder 12 for the sorting.

In this manner a very simple apparatus

may be constructed of low height and comprising no conveyor mechanism.

The invention may also be adapted to a sorting and grading apparatus analogous to that shown diagrammatically in Figs. 6, 7 and 8, in which the sorting cylinder proper acts with its outer wall as grader.

The combination of this device with the improvements in grading apparatus forming the object of this invention permits the construction of a sorting and grading apparatus in which the materials to be treated are first admitted to the lower outer end of the sorting cylinder, in the channel formed by the said cylinder and the juxtaposed shutter or shutters; the sorting operation effected on the outside of the cylinder conveys the largest seeds (whilst ascending the slope of the cylinder) as far as the top end of the latter, where the seeds fall of themselves through apertures provided for this purpose, into the sorting cylinder, where they are sorted.

This combination may also be realized in the case where the grading of the seeds is effected not in ascending but following the slope of the cylinder and the shutters, in which connection these slopes may be different as shown in Fig. 8.

In both cases such an apparatus consists of a sorting cylinder having pockets of known type such as sockets provided on the inner surface of the cylinder, the outer surface of which is suitably machined either by turning or by fitting a second casing or again by a coating of suitable material so as to serve as a grading cylinder.

Adjacent the outer surface of this cylinder one or more movable shutters are arranged (15, 16 and 17 in Fig. 6) which serve for effecting the primary grading of the seeds to be selected and sorted.

Foreign seeds, the small and medium seeds which have passed through the grading device are collected according to size in boxes 18 to which they may be conveyed by inclined planes located under the grader.

The large seeds forming the refuse of the grader, are collected in a hopper 19 from which they are again taken by an elevator device (Archimedian screw 20 for example) which conveys them into a second hopper 21 whence they pass to the interior of the sorting cylinder to be freed therein from the foreign seeds which may be mixed with them.

This apparatus operates in the following manner:—

On leaving the distributor the seeds are poured either on to the lower part (if the grading is effected by ascending the slope) or on to the upper part (if the grading is effected by following the actual slope of the cylinder) of the first shutter. The distance between this shutter and the cylinder as also its slope are so adjusted that the said shutter discharges as refuse at the outlet about

one sixth of the total quantity of seeds fed in by the distributor at the inlet, in other words this adjustment is such that $\frac{5}{6}$ ths of the seeds treated by the first shutter fall on to the second.

The shutter 16 is in turn adjusted in such a manner that it discharges as refuse at the outlet about one fifth of the quantity of the seeds which fall on to it after passing between the shutter 15 and the cylinder 1; finally the shutter 17 is so adjusted that its refuse is equal to one quarter of the quantity of seeds which fall on to it after passing between the shutter 16 and the cylinder 1. The result is that if the adjustment of the shutters is suitably effected the total of the refuse of the three shutters is equal to one half the quantity of seeds treated; the other half of the seeds, definitely classified according to size by the grading apparatus having been eliminated the sorting apparatus thus only receives the half of the seeds treated in the whole of the apparatus.

The sorting apparatus receiving this refuse, which then consists solely of sowing seeds acts like an ordinary sorting apparatus as it eliminates all foreign seeds which may be present therein.

In the case where the slope of the sorting cylinder is insufficient to enable the grading device described above to operate under proper conditions the slope imparted to the movable shutters may be more accentuated than that of the cylinder; this arrangement is shown diagrammatically in Fig. 8. In this case it will be seen that the lower edge of the movable shutters will not be rectilinear but helicoidal.

It will be readily understood that an apparatus constructed in the manner described will combine the advantages presented by an independent grading and an independent sorting apparatus. The cost price however of such an apparatus will be considerably less than the price of two independent apparatus, moreover as owing to the large diameter of the sorting cylinder it is possible to mount a plurality of movable shutters against the outer surface of the said cylinder a greater output is obtained for the grader and a more perfect selection of the sowing seeds.

Finally as the sorting apparatus only has to deal with half the seeds introduced into the apparatus, its output is doubled the more easily owing to the fact that the sorting is effected with seeds already freed from foreign seeds and small and medium seeds which have been eliminated by the grader.

I claim:—

1. In grading apparatus of the type described, a rotary cylinder and an adjustable shutter located adjacent and at an angle to the wall of said cylinder to form an open channel the lower part of said shutter being concave with respect to the cylinder wall.

2. In grading apparatus of the type described a rotary cylinder and an adjustable shutter located adjacent and at an angle to the wall of said cylinder to form an open channel the lower part of said shutter being concave with respect to the cylinder wall and the upper part being convex with respect thereto.

3. In grading apparatus of the type described a rotary cylinder said cylinder being provided with a helicoidal groove a flexible member adapted to be received in said groove and an adjustable shutter located adjacent and at an angle to the wall of said cylinder to form an open channel the lower part of said shutter being concave with respect of the cylinder wall.

4. In grading apparatus of the type described a rotary cylinder said cylinder being provided with a helicoidal groove a flexible member adapted to be received in said groove and an adjustable shutter located adjacent and at an angle to the wall of said cylinder to form an open channel the lower part of said shutter being concave with respect to the cylinder wall and the groove in said cylinder varying in depth according to the distance of said shutter from said cylinder substantially as described.

5. In grading apparatus of the type described a rotary cylinder said cylinder being provided with a helicoidal groove hopper means for feeding the substances to be graded located at the beginning of said groove, a flexible member adapted to be received in said groove and an adjustable shutter located adjacent and at an angle to the wall of said cylinder to form an open channel the lower part of said shutter being concave with respect to the cylinder wall.

6. In grading apparatus of the type described a rotary cylinder said cylinder being provided with a helicoidal groove hopper means for feeding the substances to be graded located at the beginning of said groove a flexible member adapted to be received in said groove and an adjustable shutter located adjacent and at an angle to the wall of said cylinder to form an open channel, the lower part of said shutter being concave with respect to the cylinder wall and the groove in said cylinder varying in depth according to the distance of said shutter from said cylinder substantially as described.

7. In grading and sorting apparatus of the type described an inclined sorting cylinder a plurality of adjustable shutters located adjacent the outer surface of said cylinder and at an angle to the wall of said cylinder to form open channels and a feed device for transferring seeds graded on the exterior of said cylinder to be sorted in the interior of said cylinder substantially as described.

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