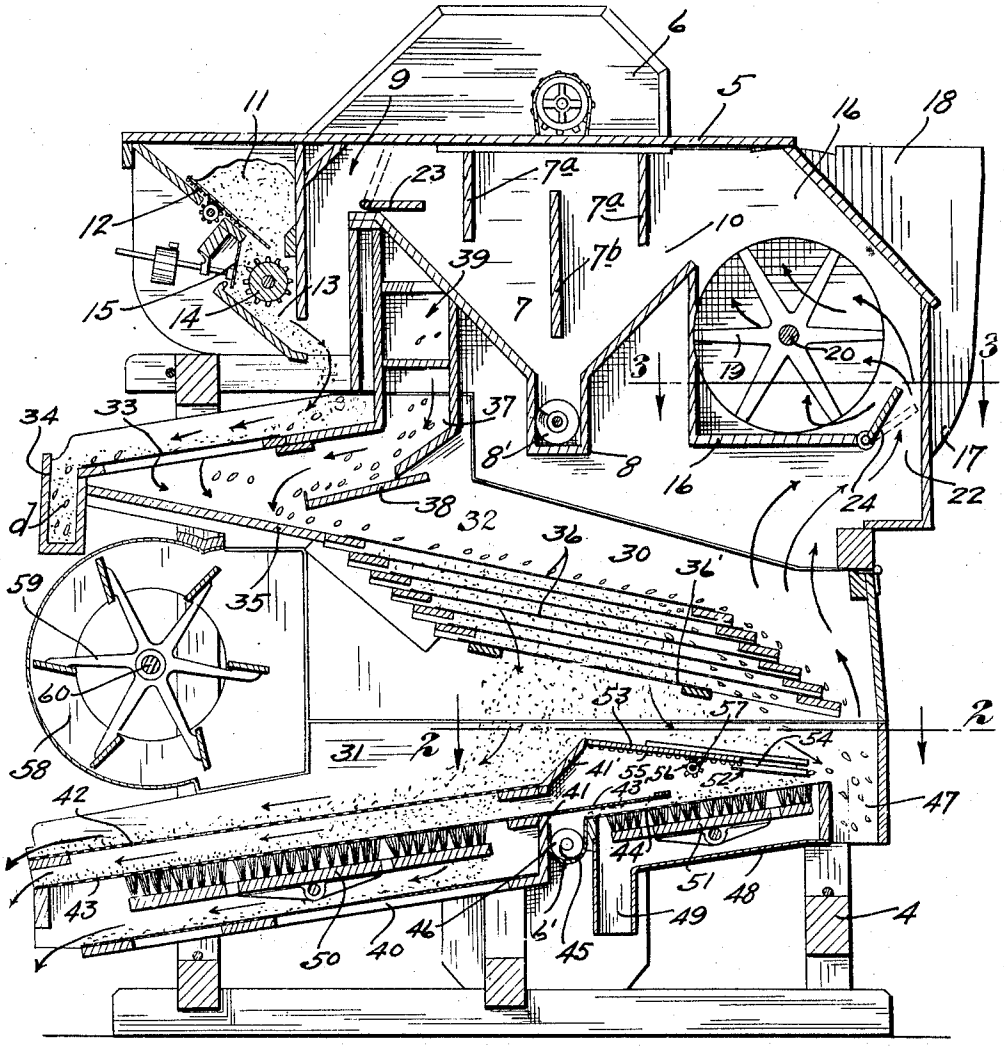
April 10, 1928. 1,665,756

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GRAIN SEPARATOR

Filed June 12, 1924 2 Sheets-Sheet 1

Fig. 1



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GRAIN SEPARATOR

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Fig. 2

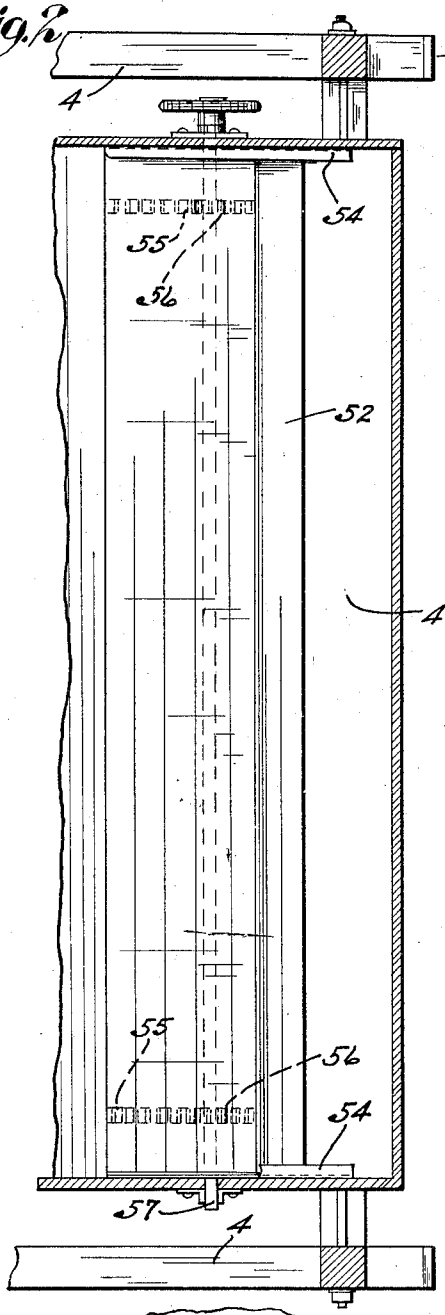


Fig. 3

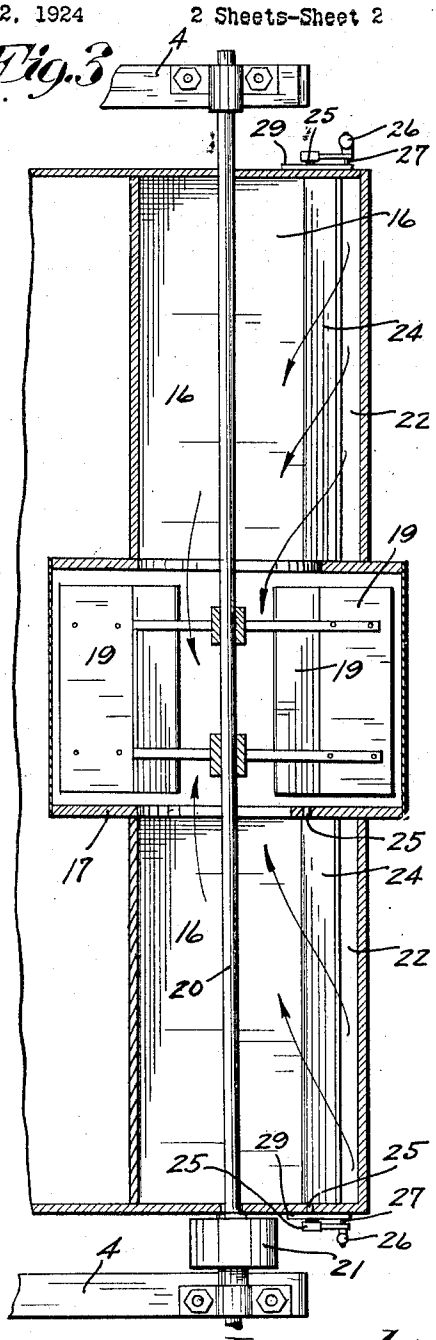
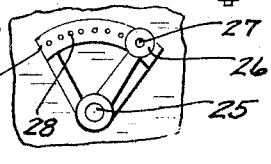


Fig. 4



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UNITED STATES PATENT OFFICE.

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GRAIN SEPARATOR.

Application filed June 12, 1924. Serial No. 719,522.

My invention provides certain highly important improvements in grain separators of the type wherein vibratory sieves and fans or blowers are employed, and generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

More particularly, the invention relates to grain separators of high capacity, such as are required in grain elevators, flour mills, and similar places where the separation of wheat from oats and other commingled foreign materials, such as chaff, small seeds and dust.

A machine embodying the various novel features of my invention is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a vertical section taken centrally from front to rear of the improved machine;

Fig. 2 is a fragmentary horizontal section on an enlarged scale taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary horizontal section on an enlarged scale taken on the line 3—3 of Fig. 1; and

Fig. 4 is a detail in right side elevation showing means for adjusting and holding one of the suction-regulating valves of the machine.

All of the parts of the machine are supported directly or indirectly on a strong braced skeleton framework 4, which, at its upper portion, rigidly supports a hood structure 5 and at one side supports an elevator leg 6, in which latter the usual endless elevator belt is arranged to work and to be driven in the well known or any suitable manner, not necessary for the purposes of this case to consider.

Within the fixed hood 5 are certain devices of well known construction and which may be briefly noted as follows: Located centrally in said hood is a settling chamber 7 terminating at its bottom in a trough 8 shown as equipped with a feed screw 8′ that delivers the light screenings or dust out of the machine through one side of the hood, and within the upper portion of the settling chamber 7 are staggered baffle plates 7^a and 7^b. The settling chamber 7 has an inlet passage 9 and an outlet passage 10.

The wheat, oats and other commingled materials will be fed in the customary way into a receiving hopper 11 equipped with a master gate 12 that controls the flow of material to a feed passage 13 shown as equipped with the customary feed roller 14 and automatic feed gate 15. The air inlet passage 9 to the settling chamber 7 extends down to the lower portion of the feed passage 13, so that the dust may be readily drawn from the commingled mass.

In the rear portion of the hood 5 is a transversely extended air chamber 16 in which is interposed a fan casing 17 that is open at both sides and is provided with a discharge spout 18, which, in practice, will be connected to a dust house or other suitable point of discharge that will carry the dust out of the room in which the separator is installed. Working in the fan casing 17 is a fan head 19 secured to a long transverse shaft 20 journaled in suitable bearings on the frame 4 and provided with a pulley 21 (see Fig. 3), adapting the fan to be driven through a power-driven belt, not shown.

By the fan casing 17, the air chamber 16 is divided into two parts and these two parts are provided with large lower air intake passages 22. It will now be noted that there are two sources of air supply to the fan 19, to wit, through the air intake passage 9 and through the divided air intake passage 22. The flow of air through the air intake passage 9 is controlled by a feed suction regulator shown in the form of a pivoted valve 23; and the flow of air through the air passages 22 is controlled by a tail suction regulator made up of two pivotally adjustable valves 24. The usual or any suitable means may be employed for holding the valves 23 and 24 in their differently set adjustments. In the present instance, the two valves 24 are shown as independently connected to rock shafts 25 having levers 26 equipped with pins 27 engageable with holes 28 and large arches 29 rigidly secured to the sides of the hood, so that the two valves 24 are capable of independent adjustments. For adjusting the valve 23, a construction similar to that just described may be employed.

Mounted below the hood 5 is an upper vibratory shoe 30 and mounted below said shoe 30 is a lower vibratory shoe 31. These two shoes carry sieves and various other devices presently to be noted, and they may be supported and vibrated by the usual or any suit-

able means, but, for the purposes of this case, it may be assumed that they vibrate transversely of the machine and that, as is common practice, they are connected for simultaneous movements in reverse directions, so that they are counterbalanced, one against the other.

The upper shoe 30 carries the following elements, to wit: the commingled material falling from the feed passage 13 is received by an inclined imperforate deck 32 that delivers to a coarse scalping sieve 33, which, in turn, delivers to a transversely inclined discharge spout 34. The material passing through the screen 33 falls onto an inclined imperforate deck 35 that delivers to the top member of a gang of sieves 36, the lower member 36′ of which is considerably shorter than the other members of the gang, and at its lower end terminates considerably forward of the rear end of the next lowermost sieve of the gang. Just rearward of the deck 32, the shoe 30 is provided with a repeat spout 37 that delivers to a repeat spreader 38, which latter delivers onto the imperforate deck 35. The said parts 32 to 38, inclusive, are relatively fixed in respect to each other and in respect to the shoe 30, so that they all partake of the common vibratory movements of the latter.

The hood 5 is provided with a transversely oblique repeat spout 39 that receives the material from the elevator leg 6 and delivers the same to the repeat spout 37 of the upper shoe.

The lower shoe 31 carries the following elements, to wit: The numeral 40 indicates an inclined imperforate lower deck having an upright rear end board 41 with an oblique upper portion 41′. Above said deck 40 are upper and lower inclined grading screens 42 and 43. The inclined board 41′ delivers to the upper rear end of the upper screen 42 and the screen 43 is provided with an imperforate inclined rear end extension 43′. The upper extremities of the screens 42 and 43 lie in a vertical plane that intersects about centrally the gang of sieves 36. The deck 40 and sieves 42 and 43 discharge at the front end of the shoe 31.

At its rear portion, the shoe 31 carries a forwardly inclined repeat screen 44, the front portion of which extends with ample clearance under the imperforate deck extension 43′ of the screen 43. Said screen 44, at its lower end, delivers into a transverse repeat spout 45, which, at one end, delivers into the lower portion of the elevator leg 6, through an opening 6′ in the latter. A spiral conveyor 46 is preferably arranged to work in the repeat spout 45 to facilitate the discharge of the grain. At its extreme rear end, beyond the repeat screen 44, the shoe 31 has an oat-discharge spout 47 through which all of the oats that are delivered off from the lower ends of the gang of sieves 36 will be discharged. Secured to the shoe 31, below the repeat screen 44, is a forwardly inclined imperforate deck 48 that terminates in a seed-discharge spout 49. The numerals 50 and 51 indicate automatic intermediately pivoted brushes arranged to work below the sieves or screens 43 and 44.

Located above the repeat screen 44 is a rearwardly inclined repeat board of novel construction and arrangement. As shown and as preferably designed, this repeat board involves a relatively short repeat board 52 and a relatively long adjustable repeat board 53, the board 52 being rigidly secured at its ends to the sides of the shoe 31 and the plate 53 being slidably adjustable in suitable guideways 54 on the sides of said shoe. For adjusting the repeat board 53, it is shown as provided with rack teeth 55 that are engaged by a spur pinion 56 carried by a shaft 57 journaled in the sides of the shoe 31 and arranged to be rotated and secured by any suitable means. It is important to note that when the repeat board 43 is adjusted forward as far as it will go, it engages with the oblique board 41′, thereby preventing any grain or material from falling onto the imperforate deck extension 43′ of the sieve 43 and causing all of the grain dropping onto said board 53 or onto the board 52 to be delivered onto the upper end of the repeat screen 44. The importance of this arrangement and the functions resulting therefrom will be further considered a little later on.

Rigidly supported by the machine frame 4, between the front end portions of the two vibratory shoes 30 and 31 is a blast fan arranged to deliver a blast of air rearward under and upward through the gang of sieves 36. This blast fan may take various forms, but for the purposes of this case, it is only necessary to note the fan case 58 and a fan head 59 rotatable within said case and carried by a shaft 60 journaled in suitable bearings on the front side portions of the frame 4. The fan case 58 is open at its rear side for the discharge of a blast of air in a rearward direction between the gang of sieves 36 and the underlying sieve 42, board 41′, and repeat board 53—54.

Operation.

The commingled stock in the feed hopper 11 may be assumed to be made up of wheat, oats, rye, small seeds, chaff and dust, all of which, of course, will be fed downward by the feed roller 14 and passed through the air that is drawn by the fan 19 upward through the air passage 9. The air draft will be so regulated that only the light dust will be drawn off from the stock at this point and the other materials will drop onto the scalping sieve 33 and all of these mate-

rials will pass through said scalping sieve, except the chaff, which latter will be discharged into the spout 18. Said materials, passing through the sieve 33, will be delivered to the gang of sieves 36—36′. Nearly all of the good wheat and most of the small seeds will pass through the several sieves of the gang before they are advanced rearward beyond the upper edge of the deflecting board 41′ and, hence, will be delivered onto the upper screen 42, but the oats, rye, and some of the wheat will pass farther rearward on the sieves of the gang. The largest of the wheat will be discharged off from the lower end of the grading sieve 42, but the smaller wheat and the small seeds will pass through the sieve 42 and onto the lower grading sieve 43, which latter should be of slightly smaller mesh than the upper sieve 42. The wheat caught on the sieve 43 will be discharged off from the lower end thereof where it may be commingled with the larger wheat or may be kept separated therefrom. The small seeds will pass through the lower sieve 43 onto the deck 40 and will be delivered off from the lower end of the latter.

The oats and rye will nearly all be discharged off from the lower ends of the sieves of the gang and will be discharged from the machine through the spout 47, but some of the wheat, mixed with oats or rye or both and some small seeds, will pass through the lower portions of the gang of sieves and, with the repeat board 53 adjusted as shown in Fig. 1, will be directed onto the repeat screen. The small seeds will pass through said repeat screen and will be discharged from the machine through the spout 49, but the commingled wheat, oats and rye will be delivered to the repeat spout 45 and, by the conveyor 46, will be delivered into the receiving portion of the elevator leg 6 through the inlet port 6′. All of this repeat stock delivered to the elevator will, by the elevator, be delivered to the repeat spout 39 and, by the latter, will be delivered onto the deck 35 where it will be commingled with the main stock running to the gang.

With the extreme adjustment of the repeat board 53 shown in Fig. 1, no part of the stock falling from the gang rearward of the upper edge of the deflecting board 41′ will be delivered directly to either one of the grading sieves 42—43. When, however, the repeat board is adjusted rearward or toward the right in respect to Fig. 1, all of the grain falling through the gap formed between the upper edge of the deflecting board 41′ and the front edge of the repeat board 53 will drop onto the imperforate screen extension 43′ and will be delivered directly to the lower grading screen 43, by which the small seeds will be separated from the wheat. The adjustment of the repeat board will depend upon the character of the separation that is being produced by the machine. The adjustment of said repeat board should be such that all of the oats falling from the gang will be delivered either onto said repeat board or off from the lower end of the gang. When the machine is operating as just stated, there will be some wheat carried with the oats onto the repeat board and, hence, the necessity for returning such commingled portion of wheat and oats, or wheat and oats and rye, back to the gang for reseparation. That portion of the stock that is delivered rearward of the deflecting board 41′, but which contains no oats or rye but some small seeds, need not be returned to the gang but the separation may be completed by the sieve 43 and, hence, the adjustment of the repeat board 53 should be such as to throw such portion of the stock onto the screen extension 43′. Obviously, the repeat board arranged as described may be set for all conditions. It may, as already stated, be set so that all of the stock not delivered onto the upper grading sieve 42, and which is not, as is the clean oats and rye, carried off from the lower end of the sieve gang, will be delivered to the repeat screen or repeat device for return to the sieve gang or for recommingling with the main stock passing to the machine. From the above noted extreme position, the repeat board may be adjusted by infinitesimal steps so as to open up a large passage for delivering stock precipitated through the gang onto the extension of the lower grading screen. The adjustable repeat board and repeat device described is especially adapted for use in connection with machines having upper and lower grading screens, sometimes designated as a double-seed screen, but is not limited to that particular use.

As is well known, a fan of a given size, running at a certain speed, will pull a certain total amount of air and will take the greatest portion of that amount of air from the place affording the least resistance. With the arrangement of fans above described and illustrated in the drawings, the two fans have a very important relation to each other and the air intake passages 9 and 22 and their controlling valves or dampers 23 and 24 have a very important relation to the said fans but more particularly to the suction fan 19. For instance, with both of the valves 23 and 24 wide open, there will be a greater flow of air to the fan 19 through the air intake passage 22 than through the air intake passage 9 because of the greater remoteness and more obstructed air travel from the passage 9 to said fan than from the passage 22 to said fan. With the valve 23 wide open, the proportionate amount of air drawn up through the grain

to the air passage 9 may be increased by closing of the valve 24 so as to choke off more or less of the passage of air upward through the air passage 22. By adjustments of the two valves 23 and 24, the proportionate amount of air drawn in through the two passages 9 and 22, may be varied in all sorts of ways, so as to get, among other things, just the right amount of draft upward through the material passing from the feed roller 19 to carry off the dust and light particles, such as screenings, without carrying off any of the grain or at least without carrying off any of the good wheat. Even without the valve 23, and solely by the adjustment of the valve 24, most of the adjustments above indicated or required may, however, be produced. Of course, the current of air drawn in through the air passage 9 and through the settling chamber 7 should be strong enough to carry the light dust to the fan 19 but weak enough to permit precipitation of the heavier particles, such as screenings, into the trough 8.

It is also a well known fact that in cleaners and separators having under blast fans delivering strong currents of air through the grain passing through the gang sieves, the blast of air, serving to straighten out the oats and barley and permitting them to tail over the gang sieves, is bound to carry a considerable amount of dusty air, which is usually thrown out into the room, making a very dusty and dirty condition. In this improved machine, however, such dust-laden air is drawn upward and through the air passage 22 to the suction fan 19, thus making the machine dustless. Hence, working as above described, the suction fan 19 naturally seeks to get its first air from the tailings of the sieve gang and thus to pick up the dusty air from the gang, and, second, gets the remaining portion of its air from the point of greater air resistance, to wit, the air passage 9, which draws the air upward through the commingled stock that is being delivered to the scalping sieve 33.

The fan or blower 59 would tend to produce, within the machine, air pressure considerably in excess of atmospheric pressure, if it were not for the suction or partial vacuum-producing action of the suction fan 19 and the arrangement whereby the latter fan sucks or pulls the blast, after it has loosened up and performed its required actions on the grain on the gang sieves.

The lower gang sieve 36′ is what may be designated as a "flooding sieve". It is important to note that this lower flooding sieve, which is much shorter than any of the upper sieves of the gang, may be easily flooded by loading the upper gang sieves so that it will deliver the product, passing over the end thereof, into the "repeat grain". It is a well known fact that, by loading a sieve heavily, or, in other words, "flooding it", the lighter materials, such as oats and barley, will be caused to come to the top, while the heavier materials, such as wheat, will more readily pass through the meshes of the sieves, and thus it is possible to get the wheat perfectly clean of oats and to rapidly carry off the said lighter materials, thus obtaining very high capacity and efficiency. The lighter materials, such as oats and barley, having commingled therewith some wheat, with the repeat grain, will be delivered to the elevator and from thence back to the machine for further cleaning.

What I claim is:

1. In a separator of the kind described, the combination with a gang of vibratory sieves, of upper and lower grading screens below said gang, a repeat screen underlying said gang of sieves, and an adjustable repeat board between said gang of sieves and said repeat screen, operative to vary the extent of the delivery to said upper and lower grading screens of material passed through said gang, said lower grading screen having an imperforate receiving section extended under said adjustable repeat board.

2. In a separator of the kind described, the combination with a gang of vibratory sieves and means for delivering commingled material thereto, of a grading seed screen, a portion of which underlies the forward portions of said gang sieves, a repeat screen underlying the rear portions of said gang sieves, means for delivering the repeat material from said repeat sieve back to said gang of sieves, and an adjustable repeat board underlying said gang and overlying and delivering to said repeat screen, said repeat board being adjustable into one extreme position in which it delivers to said repeat screen all of the material passing through the gang sieves rearward of the zone of delivery to said seed screen.

3. The structure defined in claim 2 in which said repeat board is adjustable from its extreme position stated, by infinitesimally small adjustments into an opposite extreme position.

4. The structure defined in claim 2 in which there is a fixed repeat board over which said adjustable repeat board is movable when moved from its extreme position above stated.

5. The structure defined in claim 2 in which said repeat board is adjustable from its extreme position stated, by infinitesimally small adjustments into an opposite extreme position, and in which the gang of sieves delivers oats, barley and like rearward of said repeat screen and fixed repeat board.

6. In a separator of the kind described, the combination with a gang of vibratory sieves and means for feeding commingled material thereto, of upper and lower com-

bined grading and seed screens underlying and receiving from the front portions of said gang sieves, a repeat screen underlying the rear portions of said gang sieves, the lower of said combined grading and seed screens having a rearward extension overlying a portion of said repeat screen, and an adjustable repeat board located under the rear portions of said gang and overlying a portion of said repeat screen and a portion of the rear extension of said lower combined grading and seed screen.

7. The structure defined in claim 6 in which said gang of sieves deliver oats, barley and the like rearward of said repeat board and repeat screen.

8. The structure defined in claim 6 in which said repeat board is adjustable to one extreme position in which it entirely cuts off the delivery of material from said gang to the rear extension of said lower combined grading and seed screen.

9. The structure defined in claim 6 in which said gang of sieves deliver oats, barley and the like rearward of said repeat board and repeat screen, said repeat board being adjustable to one position in which it entirely cuts off the delivery of material from said gang to the rear extension of said lower combined grading and seed screen.

10. In a separator of the kind described, a casing having front and rear air intake passages and an intermediate settling chamber, a suction fan arranged to draw air from said casing at a point between said settling chamber and said rear intake passage, a gang of sieves operative below said casing and so arranged that air will be drawn from the delivery end of the gang up and through the rear air intake passage of said casing, means for delivering commingled material through the current of air drawn to said front air intake passage and from thence to said gang of sieves, a combined grading and seed screen underlying and receiving from the front portions of said gang of sieves, and a repeat device including a repeat screen and a repeat board underlying the rear portion of said gang sieves, said repeat board being adjustable to and from a position in which it will receive and deliver to the repeat screen all of that part of the material that passes through said gang beyond said combined grading and seed screen.

11. In a separator of the kind described, a casing having front and rear air intake passages and an intermediate settling chamber, a suction fan arranged to draw air from said casing at a point between said settling chamber and said rear intake passage, a gang of sieves operative below said casing and so arranged that air will be drawn from the delivery end of the gang and through the rear air intake passage of said casing, means for delivering commingled material through the current of air drawn to said front air intake passage and from thence to said gang of sieves, upper and lower combined grading and seed screens underlying and receiving from the front portions of said gang sieves, a repeat screen underlying the rear portions of said gang sieves, the lower of said combined grading and seed screens having a rearward extension overlying a portion of said repeat screen, and an adjustable repeat board located under the rear portions of said gang and overlying a portion of said repeat screen and a portion of the rear extension of said lower combined grading and seed screen.

In testimony whereof I affix my signature.

CLARENCE T. THORBUS.