No. 656,102. Patented Aug. 14, 1900.

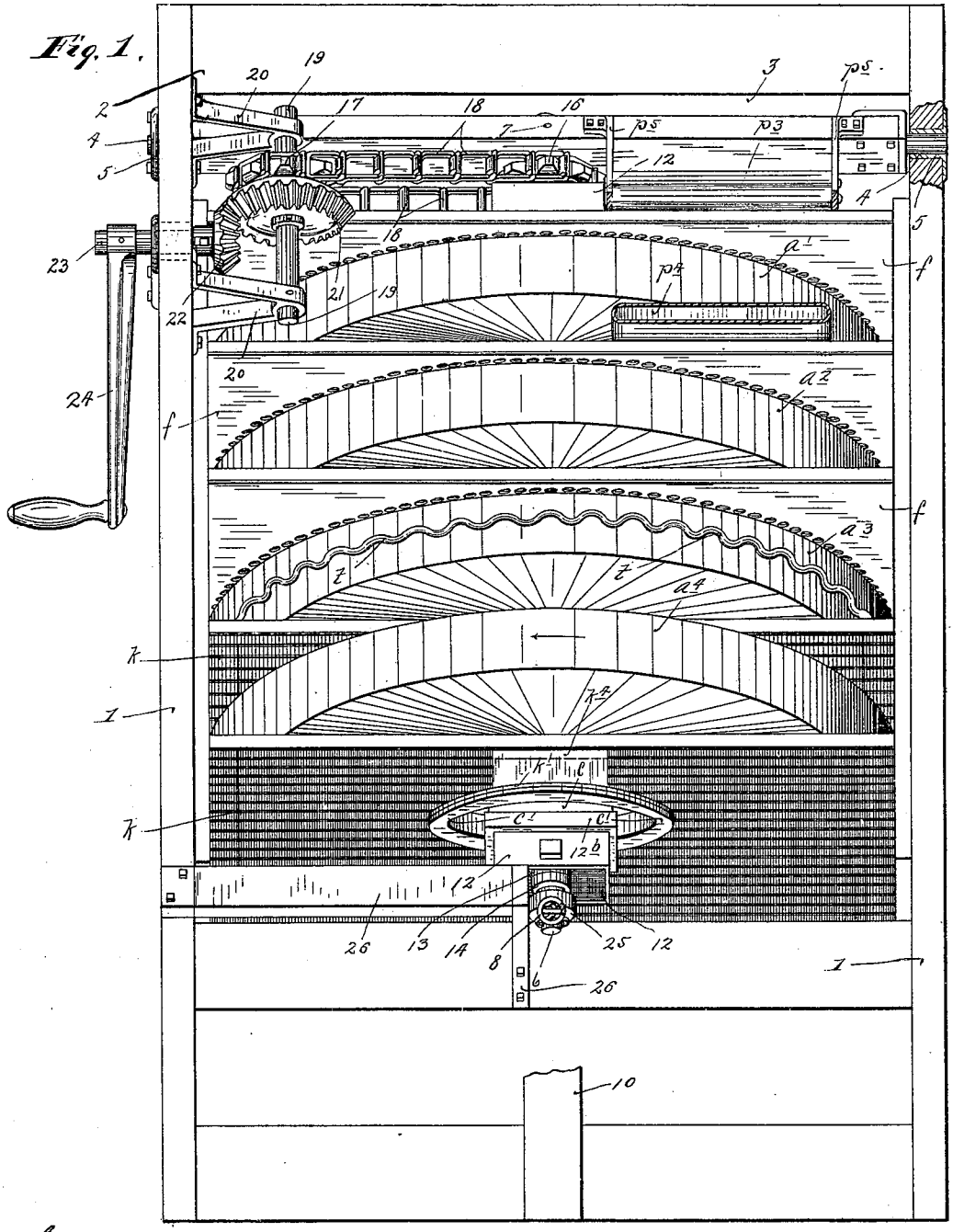
O. O. FJELD.

GRAIN SEPARATOR.

(Application filed Mar. 21, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses.
Harry Kilgore.
F. D. Merchant.

Inventor.
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(No Model.) 4 Sheets—Sheet 2.

Fig. 2.

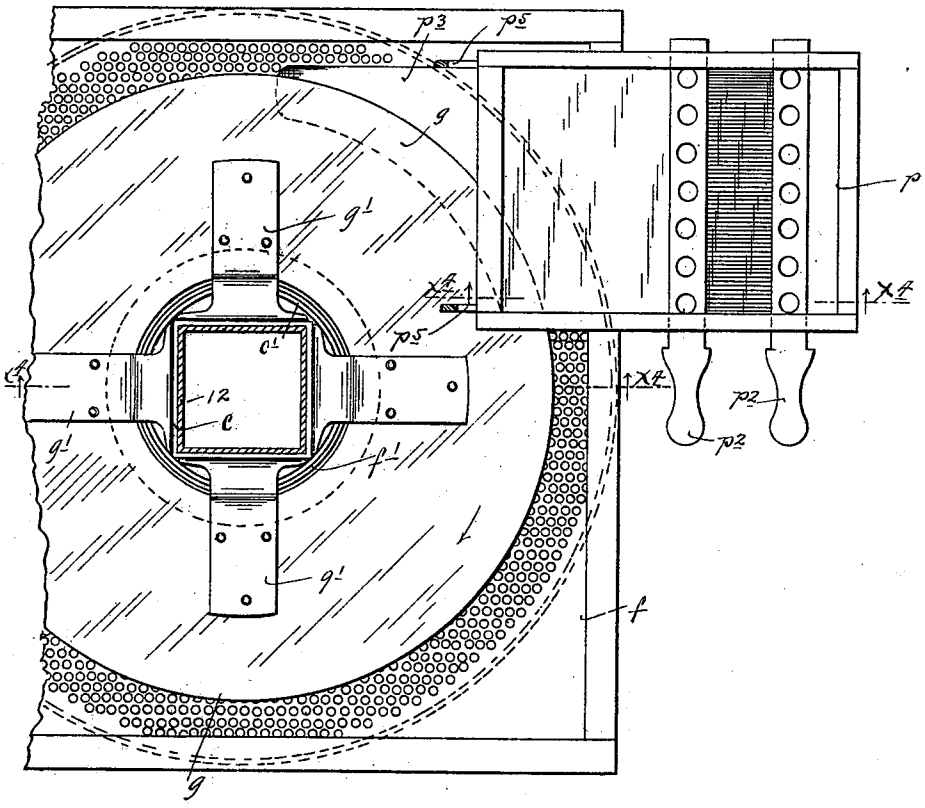
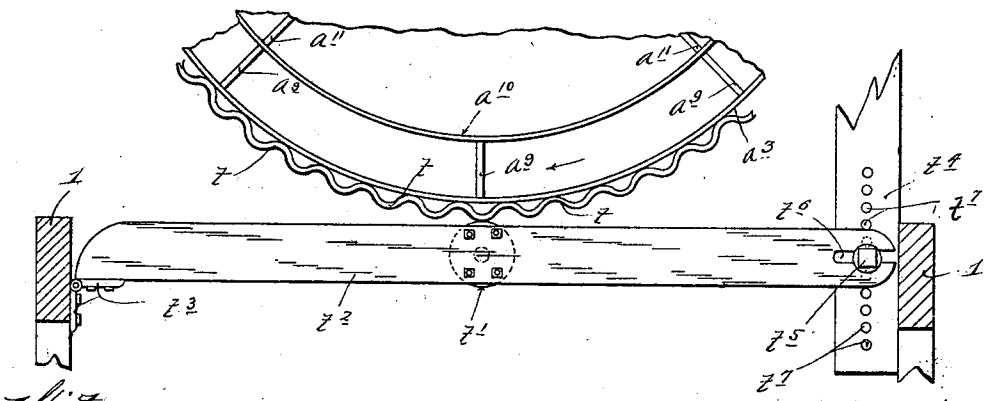


Fig. 3.



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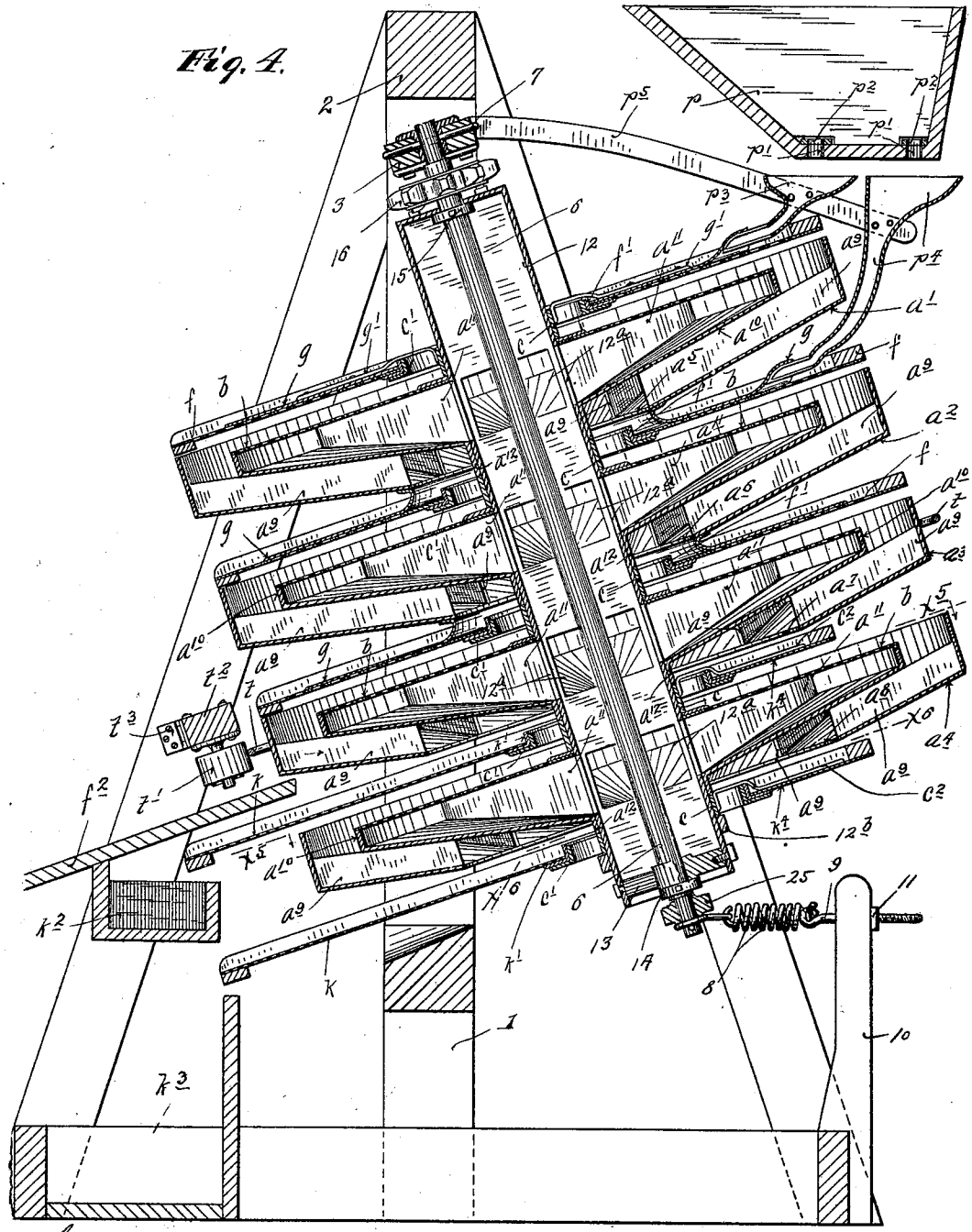
4 Sheets—Sheet 3.

Fig. 4.



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(No Model.) (Application filed Mar. 21, 1899.) 4 Sheets—Sheet 4.

Fig. 5.

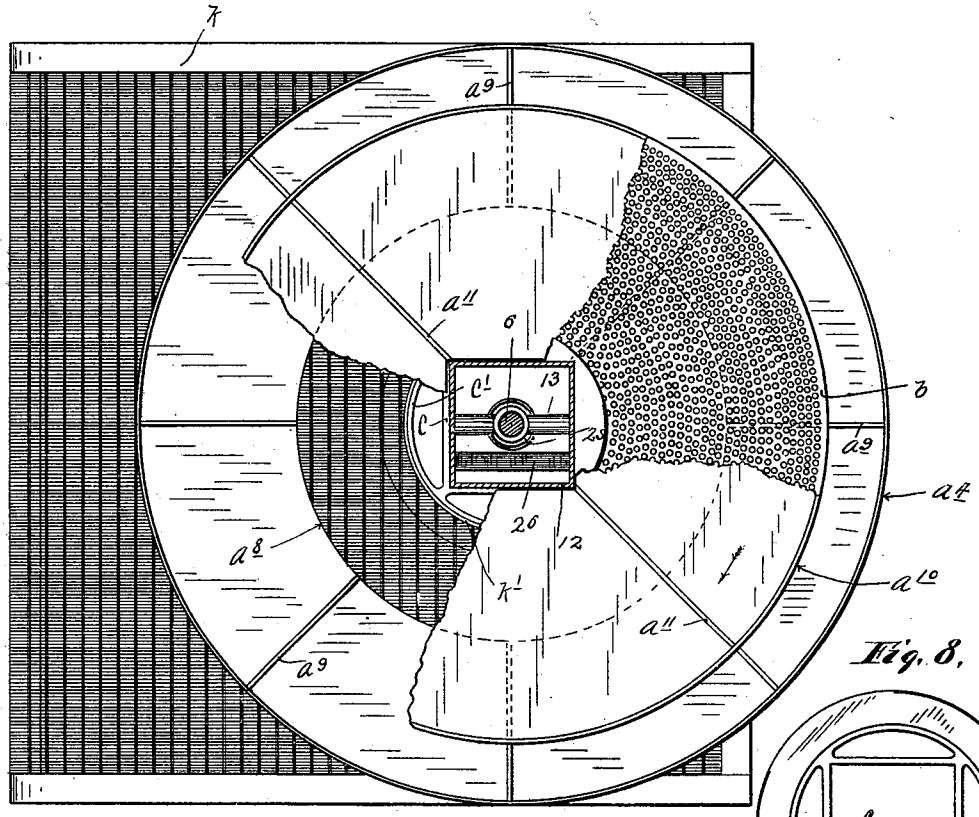


Fig. 8.

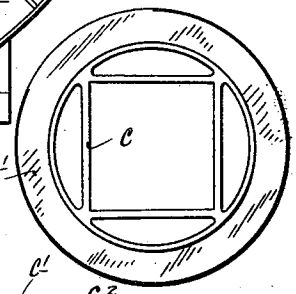


Fig. 6.

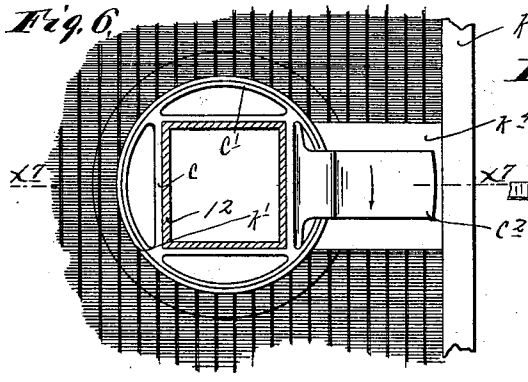
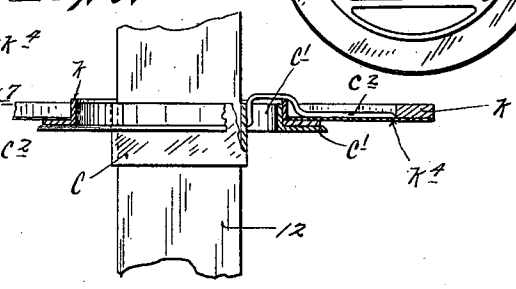


Fig. 7.



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By his Attorney.
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UNITED STATES PATENT OFFICE.

OLUF O. FJELD, OF MAYVILLE, NORTH DAKOTA.

GRAIN-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 656,102, dated August 14, 1900.

Application filed March 21, 1899. Serial No. 709,870. (No model.)

To all whom it may concern:

Be it known that I, OLUF O. FJELD, a citizen of the United States, residing at Mayville, in the county of Traill and State of North Dakota, have invented certain new and useful Improvements in Grain-Separators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to separators, and has for its especial object to provide a machine of increased efficiency particularly adapted to effect the separation of wheat and oats and other foreign seeds and materials with which they are usually mixed.

To the above end my invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

The machine in its preferred form is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Figure 1 is a view in front elevation of the said machine. Fig. 2 shows the machine in plan, but with some parts sectioned and others being broken away. Fig. 3 is a detail in plan of a portion of one of the so-called "elevators" and means for vibrating the stack of separators. Fig. 4 is a transverse vertical section taken approximately on the irregular line x^4 x^4 of Fig. 2. Fig. 5 is a transverse section taken approximately on the line x^5 x^5 of Fig. 4. Fig. 6 is a transverse section showing a portion of the machine, taken substantially on the line x^6 x^6 of Fig. 4. Fig. 7 is a detail, partly in side elevation and partly in section, on the line x^7 x^7 of Fig. 6; and Fig. 8 is a detail in plan showing one of the sieve-vibrating collars.

As a brief forecast of the features of my present machine it may be stated that I employ a series or stack of sieves or screens, all of which are given vibratory movements and certain of which are also given rotary movements, while others are guided and held against rotation. Over certain of these vibrating sieves or screens flexible aprons or disks are mounted to work, preferably to rotate. These are the statements not of the essential arrangement, but rather of the preferred construction, to be hereinafter described.

The construction illustrated will now be considered. The vibrating parts of the machine are mounted on and supported by a suitable supporting-frame 1, which consists of side brackets tied at their upper portions by cross-beam 2. An oscillating supporting-bar 3 is supported transversely of the frame 1 by means of trunnions 4 on the ends thereof, which work in suitable seats or bearings 5, secured to the sides of the said frame. A supporting-shaft 6 is rigidly secured at its upper end to the central portion of the oscillating bar 3, as shown, by means of a pin 7. To the lower end of this shaft 6 one end of a spring 8 is attached, the other end of which spring is, as shown, secured to an eyebolt 9, that is passed through a projection 10 from the frame 1 and is provided with a nut 11, by means of which it may be moved endwise to adjust the tension of the said spring. This supporting-shaft 6 is thus mounted with freedom for vibratory movements at its lower end, and by this means and other mechanism hereinafter described this shaft is held in an inclined position and is given vibratory movements longitudinally of the frame 1.

A hollow sleeve 12, which, as shown, is square in cross-section, is supported by and mounted to rotate on the supporting-shaft 6, and to accomplish this mounting the said sleeve is provided at its lower end with a spider or open bracket 13, the hub of which works on the lower end of said shaft 6, and the said shaft 6 is provided with collars 14 and 15, which engage, respectively, the hub of said bracket 13 and the upper end of said sleeve 12. A sprocket 16 is secured on the upper end of the sleeve 12, and over this sprocket and a coöperating sprocket 17 a sprocket-chain 18 is mounted to run. The sprocket 17 is carried by a shaft 19, mounted in suitable brackets 20, that are secured to one side of the frame 1. To impart rotation to the shaft 19, it is shown as provided with a bevel-wheel 21, with which a bevel-pinion 22 on a counter-shaft 23, suitably mounted in the frame 1, coöperates. The shaft 23 is shown as provided with a hand crank or lever 24, by means of which it may be turned and, through the connections just de-

scribed, caused to impart a rotary motion to the sleeve 12.

To hold the depending end of the shaft 6 against the lateral strain put upon the same by the driving connections just described, I provide the free end of the said shaft with a small wheel or roller 25, which works against and over the longitudinally-extended side of a guide-bracket 26, supported by the frame 1.

Mounted on and rotated by the hollow sleeve 12 is a series (as shown, four) of receptacles a', a^2, a^3, and a^4. These receptacles, on account of the function which they perform, I term "elevating-pans." The bottoms of these pans are cut away at their centers, as shown, respectively, at a^5, a^6, a^7, and a^8, so as to leave annular passages around the sleeve 12. The bottoms of the pans a', a^2, a^3, and a^4 are inclined downward toward their openings a^5, a^6, a^7, and a^8, and extending from the said openings to the outer rims of these pans are radial and vertically-extended partitions or flights a^9. Spaced apart from but secured concentrically within each of the said pans, being secured directly to the partitions a^9, is a supplemental elevating-pan a^{10}, which also has an inclined bottom and is provided with radial partitions a^{11}, that run from the sleeve 12 to the rim of the said pan. The bottoms of the said pans a^{10} are provided with depending collars a^{12}, that are square in cross-section and fit over the sleeve 12, so as to form a support for the pair of connected pans, which, taken together, make up the complete elevator. A perforated disk-like screen b is placed as a cover over each of the four supplemental elevating-pans a^{10}, and to cause these screens to rotate with the said pans they are provided with central perforations that closely fit the square sleeve 12. The square sleeve 12 is provided with a series of openings or perforations 12^a, that open through the sides thereof between the screens b and the bottoms of the supplemental pans a^{10}. A squared collar c is slipped onto the sleeve 12 between each of the elevating-pans a', a^2, a^3, and a^4, and these sleeves serve to properly space the said pans apart. Each squared collar c is provided with an annular collar c', which is rigidly secured thereto, as best shown in Fig. 8, and is preferably formed of light angle-iron, as best shown in Fig. 7. Just below the lowermost pan a^4 another of these complex supporting-collars $c\,c'$ is placed on the sleeve 12, and the section c of this collar bears directly on a flange 12^b, that is rigid on the said sleeve 12 and supports the stack of pans.

Located immediately over each of the pans a', a^2, and a^3 is a vibrating screen or sieve f, the frame of which is rectangular and works between the sides of the supporting-frame 1 or some other suitable guide, which prevents the same from turning or rotating with the elevating-pans. These vibrating screens f are cut away at their central portion and are provided with bearing-collars f', that are placed one over each of the collars c'. With this construction when the stack of pans is rotated the collars c' freely rotate within the collars f', and the vibratory or oscillating movements of the said pans and shaft 12 longitudinally of the machine will impart similar vibrations to these vibrating but non-rotary screens f. Working over the upper surfaces of each of the vibrating screens f is a rotating disk or cover g, which is preferably of flexible material, such as canvas, oil-cloth, or similar material. These flexible covers g are cut away at their central portions, and the inner margins of the two lower members are attached to the bottoms of the pans a' and a^2, that stand directly over them, so that they are caused to move with the same. The uppermost flexible cover g is caused to rotate with the sleeve c and the elevating-pans by means of radial arms g', the outer ends of which are attached to the said cover and the inner ends of which are attached to the adjacent squared sleeve c. These flexible covers g should be somewhat less in diameter than the transverse dimension of the vibrating screens f, over which they work, so as to give some chance for the grain or chaff to pass over the said screens after it has been worked outward from under the flap, as will be hereinafter more clearly shown. The perforations in these screens are perfectly round, the screens being formed by perforating thin metallic plates; but of course they might be otherwise formed to better meet the conditions of other classes of work.

Mounted immediately below each of the elevating-pans a^3 and a^4 is a vibrating screen the frame of which is rectangular and is guided and held against rotation by the sides of the supporting-frame 1 or other suitable guide. These screens k are perforated and provided with bearing-collars k', that work on the coöperating collars c' of the adjacent complex collars $c\,c'$ in the same manner as previously described in connection with the screens f. For the work for which this machine was designed the screens k are preferably wire-woven screens having long meshes, and the lower member should be of finer mesh than the upper member. The upper and lower screens k discharge, respectively, into catch-spouts or receptacles k^2 and k^3, and the three upper screens f discharge onto an inclined deck f^2.

The vibrating screens k are both provided at their upper ends and central portions with blank or imperforate sections k^4, which prevent the grain from passing through the screens at points directly back of the squared collars c, at which points the grain will tend to accumulate to some extent. Each of the two lower collars c is provided with a projecting scraper or arm c^2. These scrapers or arms c^2 are caused to pass over the blank sections k^4 when the elevators are rotated, and thus serve to dislodge the grain which may have collected on these blank sections

k^4. The scrapers or arms c^2 also serve to clean the engaged portions of the screens k.

With the arrangement illustrated the elevating-pans and other rotary parts should be rotated in the direction indicated by the arrows marked on Figs. 2, 5, and 6.

The grain may be supplied from any suitable source; but, as illustrated, is supplied from a hopper p, which, as shown, is provided in its bottom with two series of perforations p', which series are adapted to be opened and closed independently each by a perforated slide p^2, mounted for endwise movement in the said hopper. A pair of intermediate funnel-mouthed feed-spouts p^3 p^4 are supported by an arm p^5, which is carried by and rigidly secured to the oscillating supporting-bar 3. The enlarged upper extremities of these feed-spouts stand in position to receive the grain, one from each series of perforations p'. The lower and delivery ends of these feed-spouts are segmental, and they are positioned to discharge, the former onto the uppermost screen f, and the latter onto the second or intermediate screen f. The flexible covers g run over the discharge ends of the said spouts, so that the grain will be discharged between the same and their coöperating sieves f. The spouts p^3 and p^4 will of course, in view of the supporting-arm p^5, be caused to vibrate with the other vibrating parts of the machine.

It will be noted by reference particularly to Fig. 2 that the discharge-spouts p^3 and p^4 are positioned to discharge the grain on that side of the rotary covers which are moving upward and have not yet reached their highest point. By this arrangement the grain is not only subjected earlier to the action of the sieves, but is kept in engagement with the sieves for a greater length of time. Furthermore, as the grain is discharged onto the screen while the disks or covers g are moving upward it will tend to run downward against the action of the rotating cover, and, the wheat being more slippery than the oats, the oats will be carried more rapidly than the wheat by the action of the rotary covers, and this will give the wheat a better chance to pass through the screens f.

As a simple and efficient device for vibrating the shaft 6, sleeve 12, and parts mounted thereon I provide one of the elevating-pans—as shown, the pan a^3—with a serrated flange, as shown, in the form of a wire t, bent on a waved line. This flange t bears against and runs over a small wheel or roller t', mounted at the intermediate portion of a bar t^2, which bar is hinged at one end, as shown at t^3, to one side of the frame 1 and is adjustably secured at its other end to a part t^4 of the frame 1 by means of a short bolt or pin t^5. As shown, the bolt or pin t^5 is passed through a slot t^6 in the end of the bar t^2 and through one of the series of perforations t^7 in the part t^4. Preferably the wheel or roller t' is covered with rubber, leather, or some other suitable material, which will cushion the action of the flange t thereon and prevent pounding of the parts.

The flange t is held in engagement with the wheel t' by the gravity of the parts mounted on the sleeve 12, and the spring 8 should be set under such tension as will give the proper pressure between the flange t and the roller t' without causing the said roller to sustain any great weight. It is evident that with the construction described when the sleeve 12 and parts carried thereby, including, of course, the serrated flange t and pan a^3, all of the suspended parts, including the screens f and k and elevating devices, will be given short vibrations or oscillations longitudinally of the frame of the machine. By adjusting the free end of the bar t^2 the amount of incline or pitch given to the screens may be varied to suit the conditions of the work.

The operation of the mechanism above described when used to separate commingled wheat, oats, and foreign material will be substantially as follows: For my first illustration I will assume the grain to be delivered only through the spout p^3 and onto the uppermost vibrating screen f. This screen f, it will be remembered, continually vibrates, but does not rotate, and the coöperating cover g is continually moved over the same by the continuous rotation of the so-called "elevators." The grain being thus delivered between the said parts f and g will be drawn or dragged along over the upper screen f, and its descent will be further hastened by the longitudinal vibrations of the said screen. The oats being longer than the wheat and being held flat by the rotary cover g, approximately ninety-five per cent. of the oats will, as I have found in practice, be discharged from the lower end and to one side of the first or uppermost screen f; but the wheat being shorter and rounder than the oats will be rolled instead of dragged by the rotary cover g and will all be passed through the perforations of this first or uppermost vibrating screen f. The wheat, together with the small seeds and other fine foreign material which is passed through the upper screen f, will fall onto the rotating screen b, within the uppermost elevator-section, and all this fine seed and foreign material will pass through this upper screen b into the upper supplemental pan a^{10}, while the wheat, together with approximately five per cent. of the oats, will pass over the said upper screen b and be caught by the upper elevating-pan a'. The small seeds and foreign material caught within the upper pan a^{10} will, under the rotary movement thereof, be carried upward by the flights or partitions a^{11}, and as it reaches the highest point in the rotation of the said pan will under the action of gravity be caused to run downward and through the perforations 12^a into the sleeve 12, from the lower end of which it will be discharged. In a similar manner the wheat and a small percentage of oats caught by the pan a' will be carried

upward and then discharged under the action of gravity onto the second vibrating screen *f*. The above-described separating action will then be repeated on this second screen *f* and rotating screen *b*. The remaining five per cent. of oats will nearly or all pass over and be discharged from the lower end of the second screen *f*, and if any small seed or foreign material still remains mixed with the wheat it will pass through the rotary screen *b* of this second elevator and in the manner already described be discharged through the lower end of the sleeve 12. We will now assume that the second feed-spout p^1 is delivering grain on top of the second screen *f*, in which case the partially cleaned or separated wheat which passed through the upper screen *f* would be mixed with this uncleaned supply from the spout p^2, and the separating action may now be traced from this point. This separation may be briefly traced as follows: Nearly but not quite all of the oats will pass over and be discharged from the lower end of the second screen *f*, while the wheat will all pass through the same and dropping onto the second rotary screen *b* will deposit the greater part of the small seeds and foreign material through said screen and into the second supplemental pan a^{10}. This wheat, together with a small amount of oats, will then be caught by the second elevating-pan a^2, carried upward thereby, and then discharged onto the third vibrating screen *f* in the manner already clearly indicated. All of the remaining oats or oats of ordinary size will pass over the third screen *f*, while all of the wheat, together with some small or broken oats and some small seeds or foreign material, will be passed through the third screen *f* and onto the third rotary screen *b*. Probably all of the remaining small seeds and foreign material will pass through this third rotary screen *b*, and from thence it will be discharged by the third elevating-pan a^{10} into the sleeve 12. The wheat, with whatever foreign material or small oats that may not have been already separated from the same, will be caught by the third elevating-pan a^3, carried upward, and discharged thereby onto the upper member of the vibrating and long-meshed screens *k*. This long-meshed screen *k* will permit all small seeds and any oats which may remain in the wheat and also the small or second-grade wheat to pass through its meshes and onto the lowermost rotary screen *b*; but this upper screen *k* will not permit the larger or No. 1 wheat to pass through it, and hence this No. 1 wheat will be discharged by the said screen into the catch-trough or receptacle k^2. If any fine seed or other foreign material still remain mixed with the grain passed through the meshes of the upper screen *k*, it will be passed through the perforations of the lower screen *b* and by the lowermost elevating-pan a^{10} be elevated and then discharged into the sleeve 12, as previously described in connection with the similar devices. The No. 2 wheat will be caught by the lowermost pan a^4, elevated, and discharged onto the lowermost member of the vibrating screens *k*. This No. 2 wheat will pass over and be discharged from the lower end of the said lower screen *k*, while any small oats which may have been carried onto this screen with the No. 2 wheat will pass through the meshes of the said screen.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a separator, the combination with a screen and a coöperating flexible apron or cover overlying the same, and between which parts the grain or material is delivered, of means for vibrating at least one of the said parts and means for rotating one of the said parts over the other, whereby the grain or stock is subjected to a vibratory and a rotary movement, while subject to the action of centrifugal force, substantially as described.

2. In a separator, the combination with a screen set on an incline, and mounted to vibrate, of a disk-like flexible cover, mounted to vibrate with and to rotate over the said screen, substantially as described.

3. In a separator, the combination with a hollow, rotary sleeve, or shaft, having lateral openings and mounted to rotate on an inclined axis, of an elevating-pan carried by said sleeve and delivering to the lateral openings thereof, a screen overlying said pan and onto which the grain is delivered, and a flexible apron or cover coöperating with the said screen, one of the said coöperating parts having a rotary movement with respect to the other, substantially as described.

4. In a separator, the combination with the hollow, inclined rotary sleeve with lateral openings, of the primary and supplemental elevating-pans, provided with the radial flights or partitions, the latter leading to said lateral openings and the former opening at its central portion, of the rotary screen covering said supplemental pan, the vibrating screen overlying said primary pan, and the flexible cover or apron mounted to rotate over said vibrating screen, substantially as described.

5. In a separator, the combination with a hollow sleeve or shaft with lateral openings, and means for rotating and vibrating the said sleeve, of an elevating pan or receptacle carried by said sleeve and delivering to said lateral openings, a screen overlying the said pan and mounted to vibrate therewith, and a flexible apron or cover overlying said screen and mounted to vibrate therewith, substantially as described.

6. In a separator, the combination with a hollow sleeve or shaft mounted to rotate on an inclined axis, and to vibrate, of a spring device partially supporting the same at its lower end, a pan or receptacle carried by said sleeve and delivering to the lateral openings thereof, a screen overlying said pan, and means for delivering the grain onto said screen, substantially as described.

7. In a separator, the combination with a

hollow rotary sleeve mounted to vibrate and provided with lateral openings, of a pan or receptacle carried by said sleeve and delivering to the lateral openings of said sleeve, a screen overlying said pan or receptacle, and means for vibrating said sleeve and receptacle, comprising a serrated or irregular flange movable with said shaft, and a roller or wheel over which the said flange is mounted to run, substantially as described.

8. In a separator, the combination with a screen mounted to vibrate but not to rotate, of a vibrating shaft supporting and turning through said screen to vibrate the same, and an apron or cover carried by such shaft and moving over the upper surface of said screen, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

OLUF O. FJELD.

Witnesses:
M. M. McGRORY,
F. D. MERCHANT.