No. 640,261. Patented Jan. 2, 1900.

G. C. BEEMAN.

GRAIN SEPARATOR.

(Application filed June 20, 1899.)

(No Model.) 4 Sheets—Sheet 1.

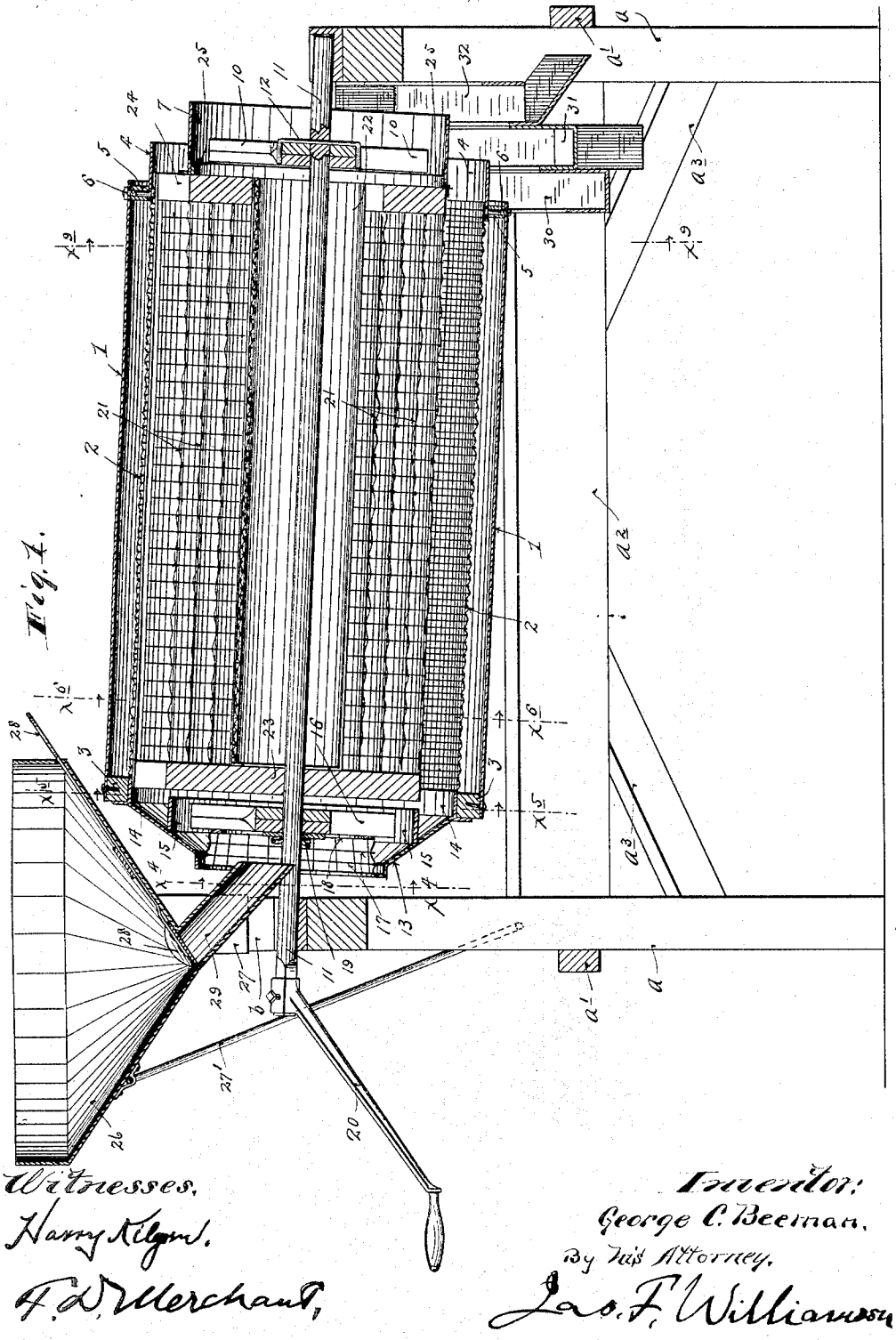


Fig. 1.

Witnesses,
Harry Kilgore,
F. D. Merchant.

Inventor:
George C. Beeman,
By his Attorney,
Jas. F. Williamson

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(No Model.) 4 Sheets—Sheet 2.

Fig. 2.

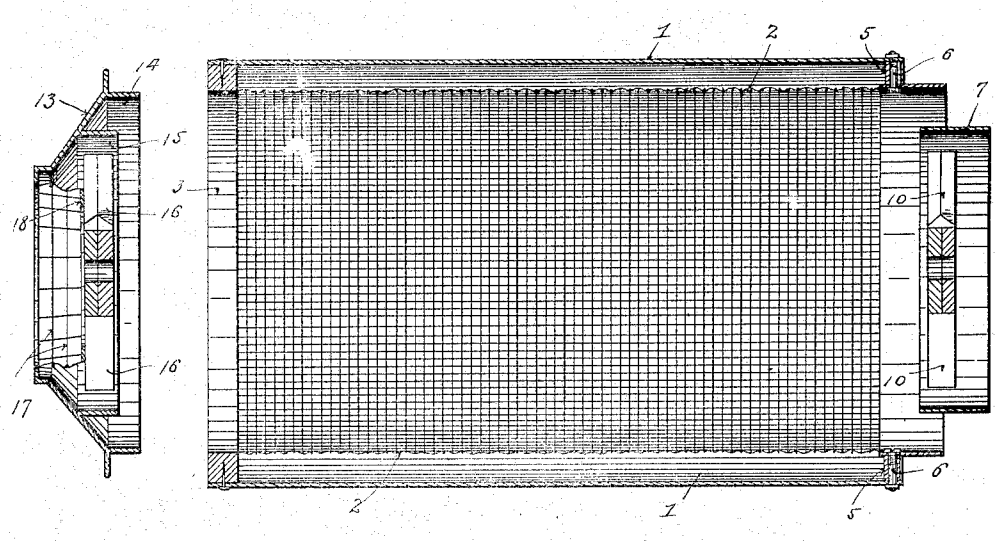
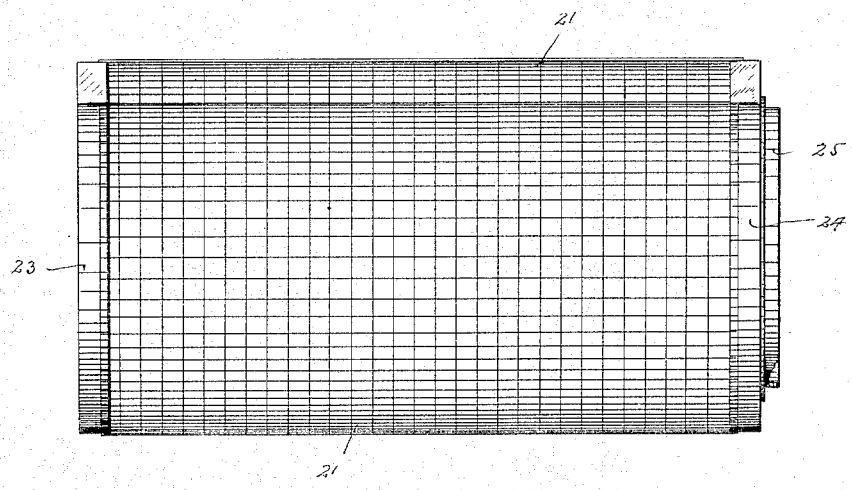


Fig. 3.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 4.

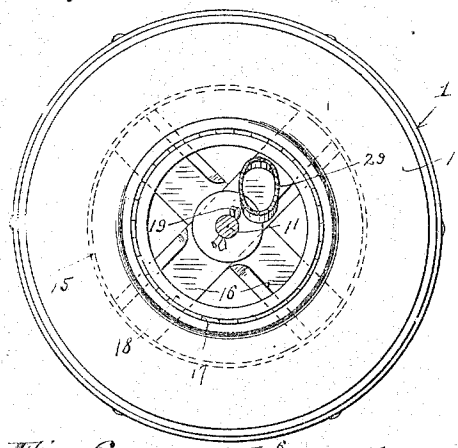


Fig. 5.

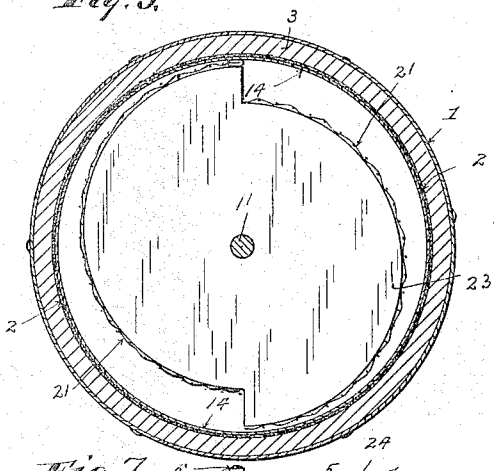


Fig. 6.

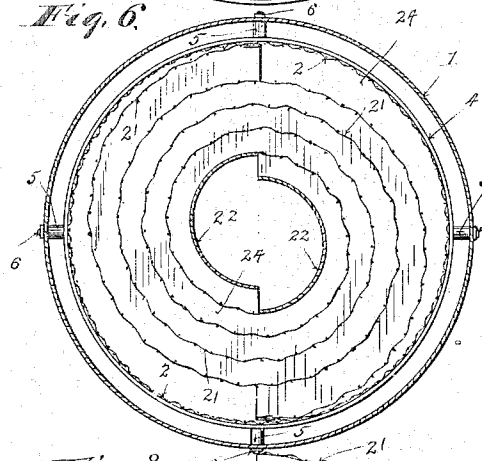


Fig. 7.

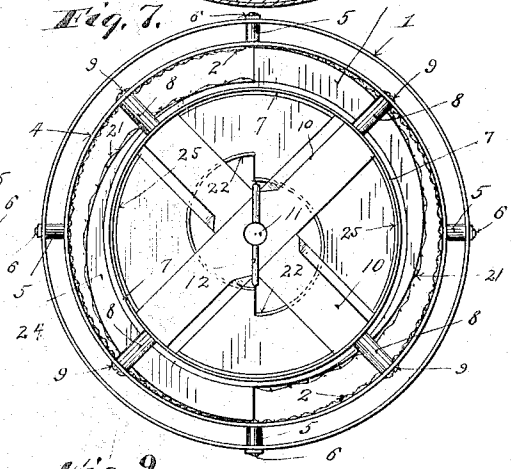


Fig. 8.

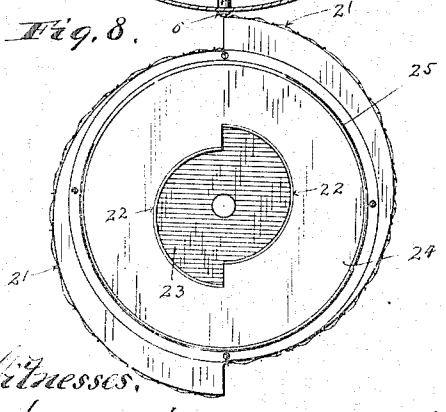
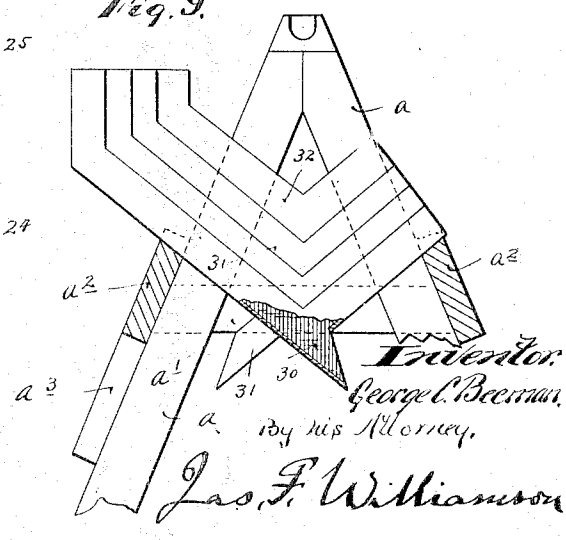


Fig. 9.



Witnesses,

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(No Model.) 4 Sheets—Sheet 4.

Fig. 10.

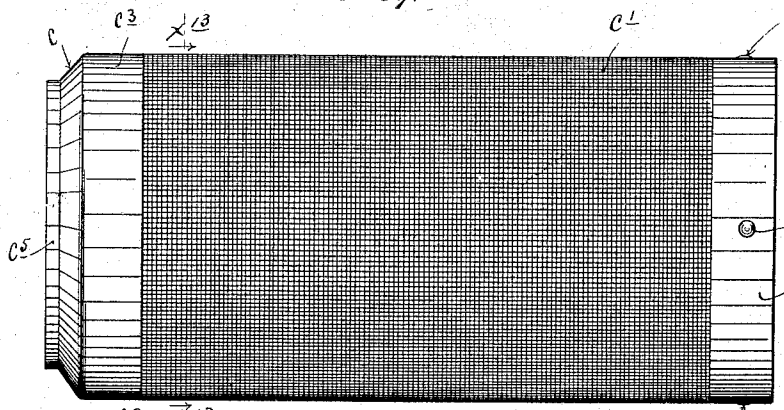


Fig. 11.

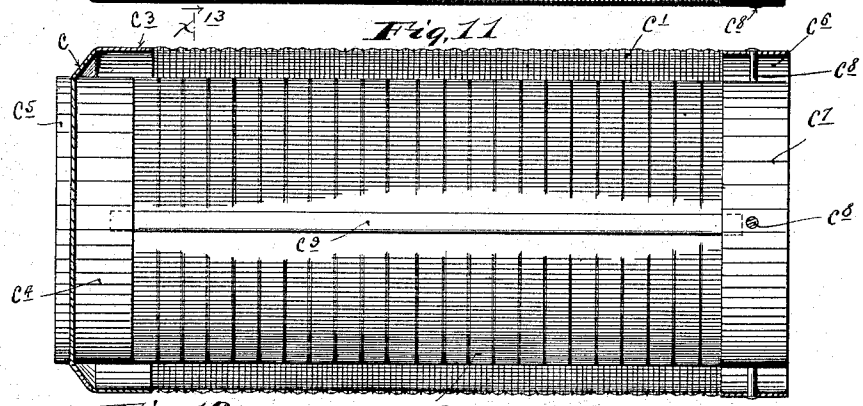
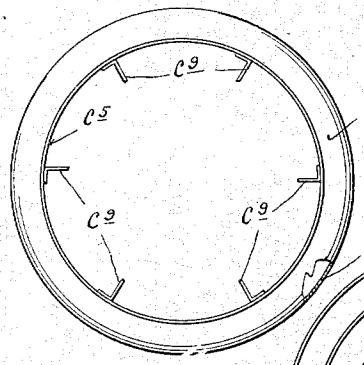


Fig. 12.



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Fig. 13.

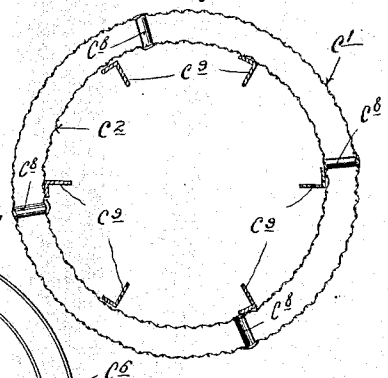
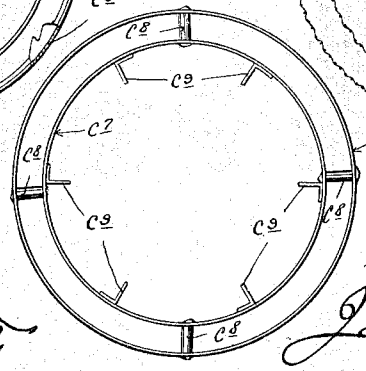


Fig. 14.



Witnesses,
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UNITED STATES PATENT OFFICE.

GEORGE C. BEEMAN, OF MINNEAPOLIS, MINNESOTA.

GRAIN-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 640,261, dated January 2, 1900.

Application filed June 20, 1899. Serial No. 721,188. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. BEEMAN, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, 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 invention relates to rotary grain-separators, and has for its object to improve this type of machines with a view of securing increased efficiency.

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

The invention is illustrated in the accompanying drawings, wherein like notations refer to like parts.

Figure 1 is a view in longitudinal central vertical section through the entire machine as the parts appear when the machine is organized for handling succotash to separate the oats from the wheat and other materials. Fig. 2 is a view in longitudinal section on the same plane as in Fig. 1, showing the imperforate shell with the parts fixed thereto and also showing the head-end cap removed. Fig. 3 is an outside elevation with some portions broken away, showing the inside or spiral screen detached. Fig. 4 is a cross-section on the line x^4 x^4 of Fig. 1. Fig. 5 is a cross-section on the line x^5 x^5 of Fig. 1. Fig. 6 is a cross-section on the line x^6 x^6 of Fig. 1. Fig. 7 is an elevation showing the lower or foot end of the separator detached from its supporting-frame. Fig. 8 is an elevation showing the lower or foot end of the inside or spiral screen detached. Fig. 9 is a cross-section through the supporting-frame on the line x^9 x^9 of Fig. 1, the separator proper being removed. Fig. 10 is an outside elevation showing a modified form of inside devices—to-wit, concentric screens, &c.—adapted to interchange with said spiral screen for coöperation with the imperforate shell and the cylindrical screen fixed thereto when it is desired to use the separator for separating flaxseed or other similar seeds from other material. Fig. 11 is a longitudinal central section through part of the device shown in Fig. 10, the outside member of the two screens being sectioned and the inside member shown in full with some portions broken away. Fig. 12 is a front or head end elevation of the device shown in Fig. 10. Fig. 13 is a cross-section on the line x^{13} x^{13} of Fig. 10, and Fig. 14 is an elevation showing the foot end of the device shown in Fig. 10.

It is well known that in many sections of the country, especially in the Northwest, it is customary to grow wheat and oats together. The mixed grains are called "succotash." One of the common problems before the designer of separators is therefore to provide an efficient machine for separating these two elements of succotash with speed and economy. The machine herein disclosed has for one of its chief purposes to accomplish this result. The parts which coöperate when using the machine to separate the elements of succotash are illustrated in Figs. 1 to 9, inclusive, and will first be described.

The main frame may be of any suitable kind, but is shown as made up of two pairs of upwardly-convergent legs a, the members of which are tied together at their apices in any suitable way and are also shown as tied together about midway of their height by cross-bars a'. The two pairs of legs are tied together by longitudinal bars a^2, reinforced by diagonal braces a^3. The head pair of legs are provided with a pair of upwardly-projecting parallel arms or standards b for a purpose which will later appear.

Having regard now to the separator proper, an outside imperforate shell 1, of cylindrical form, open at its ends, is provided with a receiving-screen 2, of cylindrical form, located therein, concentric therewith, and spaced apart therefrom. As shown, the receiving-screen 2 is attached at its upper or head end to a wooden ring 3, rigidly secured in any suitable way to the shell 1, and at its lower end the said receiving-screen 2 is rigidly secured in any suitable way to a short cylindrical rim 4 of less diameter than the shell 1 and secured thereto and spaced apart therefrom by spacing-thimbles 5 and draw-bolts 6 or in any other suitable way. The rim 4 projects outward beyond the lower end of the

shell 1, and within the same and spaced apart therefrom is secured another rim 7 of less diameter than the rim 4. The rim 7 is secured to and spaced apart from the rim 4 by means of spacing-thimbles 8 and screws 9 working through said thimbles and into the outer ends of the radial arms of a wooden spider made up of a pair of cross-bars 10, mortised together and provided with a central passage for the supporting-shaft 11. The said shaft 11 projects at its opposite ends beyond the separator and is mounted in suitable bearings provided for the purpose at the apices of the legs *a* of the main frame. The said shaft 11 is provided, as shown, with a device 12 for interlocking with the cross-bars 10 of the spider for rigidly connecting the shaft and all the parts secured thereto. As shown, this interlocking device 12 is in the form of a heavy wire or small rod passed through the shaft 11 and made rigid therewith by brazing or otherwise and having its outer ends turned inward parallel with the shaft and adapted to engage over the cross-bars 10 at their convergent angles, as best shown in Figs. 1 and 7. This locks all the parts supported by the shaft together for common rotary movement with the shaft. At its upper or head end the separator is provided with a removable cap 13, which is in the form of the frustum of a cone and provided with a pair of concentric flanges (marked 14 and 15 respectively) projecting lengthwise of its axis toward the foot of the separator and suitably spaced apart from each other. The outermost flange 14 is set inward from the outer rim or edge of the cap 13 and telescopes with the upper end of the receiving-screen 2 with sufficient friction to hold its position. The inner flange 15 coöperates with the part of the foot rim 7 which projects inward from the spider-arms 10 to serve as holders for certain of a series of interchangeably-usable inside screens which it may be desired to employ for coöperation with the outside shell 1 and receiving-screen 2, as will presently more fully appear. The flange 15 of the conical cap 13 has rigidly attached thereto in any suitable way the outer ends of the cross-bars 16, constituting the head-end spider. The spider-arms 16 are mortised together and provided with a suitable passage for the shaft 11 in the same way as the cross-bars 10 of the foot-spider before noted.

In the head-end cap 13 is located a short coarse-meshed or chaffing screen 17, the inner end of which is shown as fixed to a ring or band 18, made fast to the outer face of the spider cross-bars 16 and the outer edge of which is shown as fixed to the outer edge or open end of the cap 13. This chaffing-screen 17 is so set that it flares or slopes outward toward the head end of the machine for purposes which will later appear. When the head-end cap 13 is in working position, as shown at Fig. 1, it is secured to the shaft from outward endwise movement thereon in any suitable way, such as by a spring friction-washer or a suitable cotter 19, as best shown in Figs. 1 and 4. The shaft 11 is of course provided with suitable means for the application of power to effect the rotation of the separator. The machine shown being designed as a hand-machine, the said shaft is provided with a crank-handle 20. The larger machines may be provided with a pulley on the shaft 11 for the application of power.

For coöperation with the parts already noted when using the machine to separate the elements of succotash I provide what may be called for convenience of distinction, because of its functions, a "gathering-screen," which is of spiral form in cross-section. As shown, this gathering-screen is made up of two concentric spiral leaves or sections 21, which start from diametrically opposite points near the axis, but spaced apart therefrom and from each other, and terminate at diametrically opposite points at their outer edges. These outer edges of the spiral sections 21 may be called the "gathering lips or edges," for the reason that when in working position they stand near to the inner surface of the receiving-screen 2 for gathering up the unseparated stock from said receiving-screen 2 and rolling toward the center of the spiral screen all the stock which is not passed through the meshes thereof. As shown, the innermost portions of the two spirals are formed by imperforate sections 22, one or the other of which always forms the bottom of the central trough under the rotary motion of the separator. The inner edges of the spirals constitute the delivery lips or edges for delivering the stock gathered on the spiral screen to the central trough formed by the innermost sections thereof—to wit, the portions 22. Instead of having the imperforate sections 22 the two spiral leaves 21 of the spiral screen may be a wire screen throughout the entire length of the spiral, or instead of being of wire-cloth the inside terminal sections 22 might be of zinc, perforated to pass any remaining grains of wheat or other similar material, while retaining the oats or other material intended to be collected by the spiral screen. In constructing this inside or spiral screen the spiral leaves 21 are secured at their ends in any suitable way to suitable end pieces or heads 23 and 24. Of these end pieces 23 and 24 the upper or head member of the screen 23 is solid or continuous, being provided only with a central passage for the shaft 11; but the lower or foot member 24 has an opening around its axis corresponding in shape to the cross-section of the central trough formed by the spiral section 22, as best shown in Fig. 8. The foot-end piece 24 of the spiral screen is provided with a cylindrical flange 25, adapted to telescope with the rim 7 of the separator for holding said spiral screen in working position at its lower end. At its upper end the spiral screen is supported directly from the shaft 11 by its head-end piece 23,

thus leaving a clearance or open space between the flange 15 of the separator-cap 13 and the head of the spiral screen, through which the stock falls onto the receiving-screen 2.

A suitable feed-hopper 26 is provided with sockets 27, which telescope over the head-standards *b* of the main frame when in working position, as best shown in Fig. 1. The said hopper 26 is also provided with a pivoted bail 27′, the free ends of which are hook-shaped and engage with suitable seats in the legs *a* for locking the hopper in working position. Said hopper 26 has a suitable feed-gate 28 and is provided with an inclined delivery-spout 29, adapted to extend into the head-end cap 13 within the chaffing-screen 17 when the parts are in working position, as shown in Fig. 1. The spaces between the shell 1, the rims 4 and 7, and the central shaft at the foot end of the machine are open and serve as outlets to the materials which are delivered from the foot of the machine. The bearing for the lower end of the shaft 11 is lower than the bearing for the head end of the same on the supporting-frame, so that the separator proper stands on a downward incline from the head to the foot of the machine when the parts are in working position.

The lower end of the shell 1 overreaches an off-leading chute 30, fixed to the main frame, as best shown in Figs. 1 and 9. The rim 4 at the foot-end of the machine overreaches a similar off-leading chute 31 on the main frame, and the rim 7 overreaches a corresponding chute 32 at the foot end of the frame.

Supposing the parts above described to be in working position, the operation is as follows: The unseparated stock is delivered from the hopper 26 through the spout 29 onto the chaffing-screen 17 in the head-cap 13 at the head end of the machine. This coarse or chaffing screen 17 will catch the broken straws, sticks, unshelled heads, and other large coarse foreign material and direct the same outward through the head end of the separator. The succotash or other commingled grains and seeds will pass through the chaffing-screen 17 and be directed by the cap 13 over the flange 15 onto the so-called "receiving-screen" 2. Said receiving-screen has meshes of the proper size to hold wheat and oats, excepting such thereof as is of very small size unfit for first-grade stock. The very fine wheat, more or less of the very fine oats, and other foreign materials of less size than proper-grade wheat and oats will pass through the meshes of the receiving-screen. Under the rotation of the separator the unseparated stock on the receiving-screen 2 will be carried upward to a point beyond the upper edge of one of the gathering-lips of the spiral-screen sections or leaves 21 and will then roll backward and be caught by said edges or lips and be thereby directed into the spiral screen. The said gathering lips or edges of the spiral-screen sections 21 set close to the inner surface of the receiving-screen 2. The meshes of the spiral screen are of the proper size and shape to pass wheat and everything else, except proper-grade oats. Hence under the rotation of the separator the wheat and all else, except proper-grade oats, will pass through the meshes of the spiral screen and fall downward onto the receiving-screen. The wheat of proper grade will be caught and held by the receiving-screen and be thereby directed out at the foot of the machine over the rim 4 into the chute 31. The proper-grade oats will be rolled to the center of the spiral or gathering screen onto the trough-sections 22 and be thereby directed out over the rim 7 into the chute 32 at the foot of the machine. The small fine or lower-grade wheat and oats and other small foreign materials will pass through the meshes of the receiving-screen 2 onto the imperforate shell 1 and out therefrom into the chute 30 at the foot of the machine.

From the foregoing statements it must be obvious that of the stock delivered from the hopper onto the receiving-screen 2 that portion which does not pass directly through the screen onto the shell 1 is successively gathered up over and over again by the spiral screen in the progress of said stock downward over the said receiving-screen 2. As before stated, the gathering-lips of the spiral screen stand close to the inner surface of the receiving-screen 2, so as to catch all of the stock which is carried up and rolled back from the inner surface of the receiving-screen. Hence in this way all the succotash must come into the spiral gathering-screen and will there be subjected to a long course of travel over the screen-surface in rolling toward the center of the same and at the same time moving down the incline lengthwise of the machine. As the meshes of the spiral screen will not pass the proper-grade oats, it is obvious that these oats will be collected by the spiral screen and directed off through the lower end of the same, as above stated.

It should further be noted that in view of the action of the spiral screen relative to the receiving-screen the surface of the receiving-screen is never loaded. Otherwise stated, the stock which falls onto the receiving-screen is gathered up so rapidly by the spiral screen that there is no chance for the stock to accumulate in the trough of the receiving-screen. For this reason the separating-surface of the receiving-screen is highly efficient. Whatever does fall onto the receiving-screen which should pass therethrough—to wit, through the meshes thereof—is unimpeded in its progress. Hence large capacity is secured for any given amount of separating-surface.

It should further be noted that the fine or lower-grade oats which may pass through the meshes of the spiral screen tend to fall endwise onto the receiving-screen 2 and for this reason will pass through the meshes of the receiving-screen onto the imperforate shell 1. The result is that the machine not only se-

cures a complete separation from the succotash of the proper-grade oats, but also a complete separation of the desired grade of wheat. None of the oats remains on the receiving-screen.

The presence of the chaffing-screen at the head end of the machine is of special value in its relation to the spiral screen. Unless the straws, broken sticks, unshelled heads, and other foreign material of large size were first eliminated before the stock came onto the receiving-screen 2 and into the spiral screen the straws and such materials would tend to accumulate in the spiral screen and prevent the efficient action thereof.

By actual usage I have demonstrated the efficiency of the machine hereinbefore described for the purposes had in view, and I have found that the same has very large capacity for any given size thereof as compared with any other form of machine so far as known to me now in use for doing the same kind of work. All the statements of fact herein made as to the action or operation of the machine are based on actual results secured from working machines.

It should be noted that the spiral screen would coöperate with the receiving-screen 2, whether or not the outside imperforate shell 1 was present. In other words, a good machine could be secured for separating succotash without the use of the shell 1. The spiral screen of itself would work more or less successfully, provided the stock should be fed into the same over its gathering lips or edges, so as to become subject to the action of the spiral. The spiral screen will work for a single separation whether the screen be perforate or imperforate; but the capacity will be less if the screen is imperforate.

When it is desired to use the machine to separate flaxseed or other similar small seeds from other foreign matters, I remove the spiral screen hitherto described and substitute the devices illustrated in Figs. 10 to 14, inclusive. As shown, these devices comprise a pair of concentric screens c' c^2, the upper or head ends of which are secured, respectively, to the outer and inner members of a pair of concentric flanges c^3 c^4, projecting axially from an imperforate annulus or capring c and suitably spaced apart from each other. The annulus c is also provided with an outwardly-projecting flange c^5. At their foot ends the concentric screens c' c^2 are secured, respectively, to a pair of concentric imperforate bands or rings c^6 c^7, which are secured together and properly spaced apart by stay studs or rivets c^8, as best shown in Fig. 11. When in working position, the outer edge of the inner band c^7 telescopes over the inner edge of the rim 7 of the separator and the inner flange 15 of the head-end cap 13 of the separator telescopes over the flange c^5 of the annulus c, thereby holding the same in position in substantially the same way as the gathering or spiral screen hitherto fully described. Of the said concentric screens c' and c^2 the outer member c' is square-meshed, while the meshes of the inner screen c^2 are oblong. The inner screen c^2 is provided on its inner surface with a series of flights c^9, shown as of angular form and as soldered or otherwise secured to the end bands c^4 and c^7. When in working position, the operation of the said parts (marked c' to c^9, inclusive) is as follows: Inasmuch as the head-flange c^5 of the flaxseed-screens telescopes with the flange 15 of the separator-cap 13 the unseparated stock as delivered from the chaffing-screen will pass onto the innermost member c^2 of the two concentric screens c' and c^2 of the flaxseed-separator. Under the rotary action the unseparated stock, or such thereof as does not pass directly through the innermost screen c^2 when first received thereon, will be caught by the flights c^9 and carried up thereby to a point beyond the horizontal plane passing through the axis of the machine, or, otherwise stated, until the said flights assume a downward incline sufficient to drop the stock. The flaxseed being flat and slightly convex will tend to collect flatwise on the flights c^9 and after being carried up thereby will drop therefrom and pass through the air edgewise until intercepted by the bottom of the trough of said screen c^2. Hence as the meshes of the screen c^2 are comparatively long and narrow the flaxseed will pass through onto the outer or fine square-meshed screen c', while all the other foreign material of coarser grade not passing through the screen c^2 will be tailed off therefrom at the lower end. The meshes of the outer screen c' are of the proper size and shape to pass all the foreign material received thereon with the flax—such as grass-seeds, &c.—but to hold the flax. Hence the flaxseed will pass off as tailings from the outer screen c', while the small foreign material—such as grass-seed, &c.—will pass through the screen c' and through the fixed screen 2 of the separator onto the shell 1 and be tailed off into the chute 30.

By actual practice I have also demonstrated the efficiency of the flaxseed-separator above described.

It will of course be understood that other interchangeable inside screens might be provided for coöperation with the constantly-used parts of the separator hereinbefore described.

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

1. In a rotary separator, the combination with a receiving-screen, of a gathering-screen within said receiving-screen, which gathering-screen is spiral in cross-section and which receiving-screen is provided with an opening for the admission of stock into one end thereof, while under rotation, and with an opening in its other end for the discharge of the stock,

whereby a continuous feed of the stock therethrough and separation thereof is afforded, substantially as described.

2. In a rotary separator, the combination with a receiving-screen mounted to rotate on an inclined axis, of a gathering-screen inside said receiving-screen, which gathering-screen is spiral in cross-section and delivers to a central collecting-spout, and which receiving-screen is provided with admission and discharge openings respectively in its upper and lower ends, and a feed device for supplying a continuous feed of the stock to said receiving-screen while it is under rotation, substantially as described.

3. In a rotary separator, the combination with a receiving-screen, of a gathering-screen inside said receiving-screen, which gathering-screen is spiral in cross-section, and is made up of two approximately concentric spiral leaves or sections starting from diametrically opposite points near the axis of said receiving-screen for affording a central gathering-spout and terminating at diametrically opposite points on the inner surface of said receiving-screen for coöperation therewith, substantially as described.

4. In a rotary separator, the combination with a receiving-screen mounted to rotate on an inclined axis, of a gathering-screen within said receiving-screen, which gathering-screen is made up of two or more spiral sections terminating at their inner edges in imperforate trough-sections that make up a complete central gathering spout or trough, and which receiving-screen is provided with supporting heads or caps, the upper of which has an opening for the admission of the stock into said receiving-screen and the lower of which has openings both for the discharge from said trough or spout and from said receiving-screen, substantially as described.

5. In a rotary separator, the combination with an outside imperforate shell and central shaft, of end caps or heads of spider-like form connecting said shell and said shaft, and means for detachably locking the shaft to one or both of said caps or heads, for causing the shell to turn with said shaft, substantially as described.

6. In a rotary separator, the combination with a receiving-screen, of end caps or heads to said receiving-screen, which caps or heads are both provided with passages for the stock, and one of which is removable from the screen, and a removable inside screen within said receiving-screen, removable therefrom when the said removable head or cap is removed, substantially as described.

7. In a rotary grain-separator, the combination with the outside imperforate shell and the central shaft, of the receiving-screen fixed to said shell and spaced apart therefrom, the end caps or spiders, the lower or foot member of which is fixed to said shell, and the upper or head member of which is removable from said shell, and an inside screen having end flanges adapted to engage with corresponding flanges on one or both of said spiders or caps, for securing the same in working position, substantially as described.

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

GEORGE C. BEEMAN.

Witnesses:
MABEL M. MCGRORY,
F. D. MERCHANT.