

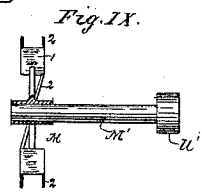
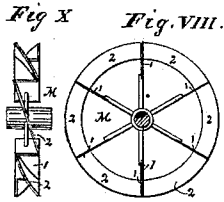
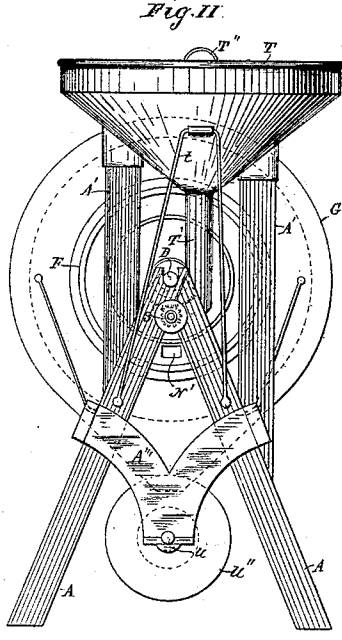
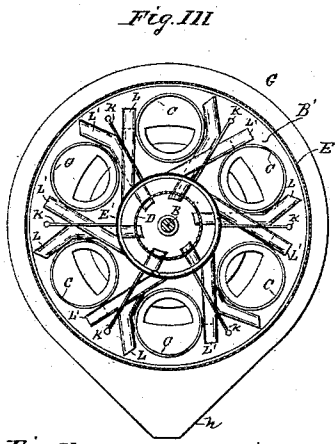
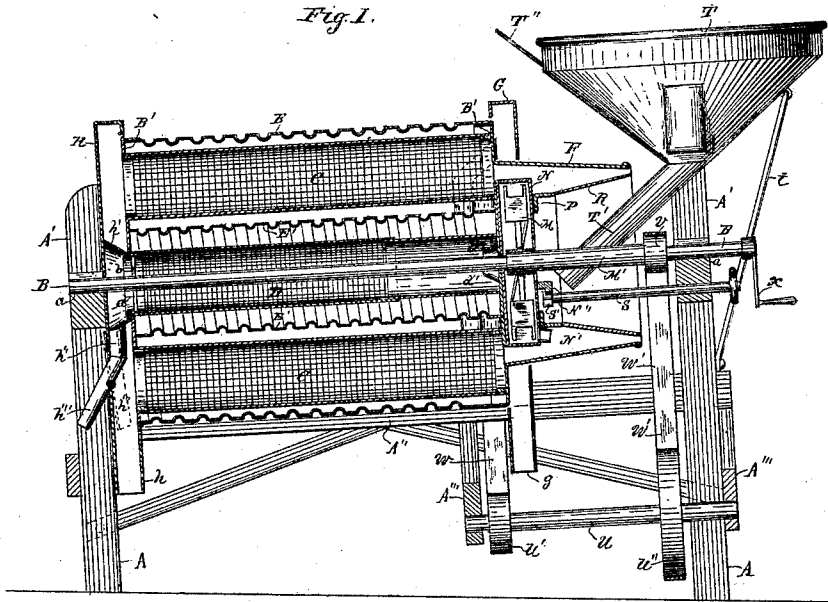
(No Model.)

2 Sheets—Sheet 1.

G. C. BEEMAN.
GRAIN SEPARATOR.

No. 413,161.

Patented Oct. 22, 1889.



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UNITED STATES PATENT OFFICE.

GEORGE C. BEEMAN, OF MINNEAPOLIS, MINNESOTA.

GRAIN-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 413,161, dated October 22, 1889.

Application filed March 9, 1889. Serial No. 302,703. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. BEEMAN, a citizen of the United States, and a resident of the city of Minneapolis, county of Hennepin, State of Minnesota, have invented a certain new and useful Improvement in Grain-Separators, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to that class of grain-separators known as "rotary screens;" and it has for its object to obtain a machine of the largest possible capacity in the smallest possible form. In other words, I obtain a machine of such compact form that it requires but little space, and at the same time will very rapidly and thoroughly clean large quantities of grain. I attain this end by a radical departure in the principle of construction.

Rotary separators composed of single or concentric cylinders are necessarily limited in capacity, because the actual separation in all rotary screens necessarily occurs in the trough or bottom of the cylinder, where there is only a limited surface with which the grain can be brought in contact; hence there must be a correspondingly-limited feed. Otherwise, if more is fed in, it will simply pile up and keep rolling over and over in the trough of the screen. This difficulty cannot be overcome by simply increasing the diameter of the cylinder, because the area of available screening-surface in the trough does not increase in proportion to the diameter of the cylinder, the reason for which is the increased depth of the corresponding larger segment, which, if filled, would carry the largest part of the grain on the lower layers or piled up out of contact with the screening-surface. The grain must roll across the wider segment before contact, taking more time. Instead of following this concentric construction I use a series of independent small cylinders having screening or separating surfaces and group the multiple cylinders about a common center in such a manner that the periphery of each cylinder is entirely outside and separated from every other. This principle of multiple small cylinders in groups with separating-surfaces is, in the broad point of view, the distinctive feature of my invention. Many other ele-

ments are added in embodying the foregoing principle of construction in its most efficient form. The groups may be supported in any suitable way and be separated by any suitable partitioning diaphragms. All of the groups may be of the same grade in communication with a common inlet and a common outlet, or one or more of the group may differ from the others in grade with separate inlets and outlets, or they may all have screening-surfaces of like grade or fineness and be so arranged that some one or more shall receive the screenings from the others and effect a further separation. The separating-surfaces of these cylinders may either be wire screens or an imperforate shell with gathering-cups or indentations therein. The effect of the multiple small-diameter cylinders is to give multiple shallow segments or troughs, bringing all the grain, of necessity, into direct contact with the separating-surface immediately. The aggregate available separating or screening surface thus obtained is far greater than would be the effective surface of a single cylinder having a diameter equal to the sum of the diameters of all the group. At the head of the group of cylinders may be placed, and in my preferred form I do place, a receiving-screen of comparatively coarse-grade meshes, and behind the same, somewhere between the receiving-screen and the multiple cylinders, may be placed a fan, this receiving-screen and blast serving to eliminate the chaff and other coarse foreign matter before the grain passes to the multiple cylinders. The fan may be adjustable and its blast confined to a definite channel, so as to be made to pass below or above the receiving-screen or so as not to come in contact therewith at all, at will. When the machine is so organized that some one of the multiple cylinders receives the screenings from the others for a further separation, it is necessary to get the first screenings back to the head of the machine for passage into the upper end of the second-grade cylinder, and even where a second-grade cylinder is not used it is desirable to draw the screenings off from the upper end of the machine. To accomplish this function requires some form of conveyer, and I have designed

one for the purpose which will do the work without material addition to the bulk or complexity of the machine. I employ simply an imperforate shell or cylinder with spiral corrugations swaged into its periphery. Where the machine is organized without a second-grade separator, a single one of these conveyers incloses the entire group and serves also as a case thereto. If a second-grade separator is used, an additional smaller conveyer incloses the same, the second-grade separator and its conveyer being concentric to the outside conveyer-case.

I will now give a detailed description of the constructions shown, therein like references referring to like parts throughout.

Figure I is a longitudinal vertical section of the machine. Fig. II is a front elevation of the same. Fig. III is an end view of the multiple cylinders with the front end plate removed. Fig. IV is a side elevation of same with a part of the conveyer-case broken away. Fig. V is a vertical longitudinal section of the front end of the machine with conveyer-case, outer cylinders, and fan-case removed. Fig. VI is a front end view, and Fig. VII a vertical section, of the fan-case and fan detached. Figs. VIII, IX, and X are views in front elevation, side elevation, and section, respectively, of the fan detached. Figs. XI and XII are views in plan and front elevation, respectively, of a section of the receiving-screen detached. Figs. XIII and XIV are views in plan and side elevation, respectively, of the retaining device for holding said screen-sections in working position; and Fig. XV is a front end view of a modification, showing single-grade machine with less number of multiple cylinders.

The legs A, the uprights A', the horizontal stringers A'', and the hangers A''' constitute the frame of the machine. The pairs of legs spread at the bottom and converge at the top and are provided at their junction with journal-boxes or shaft-seats *a*, having open or removable tops. The posts A' are rigidly secured to the legs A and extend above their junction.

B is a shaft adapted to rest at its opposite ends in the seats *a*.

B' are cylindrical heads rigidly secured to the shaft B in any suitable way—as by radial spokes *b*.

C D are the multiple open-ended cylinders, with separating-surfaces secured in the heads B'. Of these D is a second-grade cylinder, as shown, centrally arranged with reference to the others and surrounding the shaft B.

E is the outer spirally-corrugated conveyer-case, removably mounted at its opposite ends on the head-plates B. E' is the similar inner conveyer inclosing the cylinder D.

F is a conical mouth fixed to the front end plate B', of smaller diameter than the conveyer-case.

G is a removable annular shaft-drum or hollow cap fitting tightly over the mouth F and forming a close joint with the conveyer-case, constituting, with the end plate B', when in position, a screenings-chute, discharging the same through its outlet *g*. H is a somewhat similar removable cap or half-drum having a central perforation for the passage of the shaft B, supported from the tops of the lower end posts A', and fitting tightly over the lower end of the conveyer-case, constituting, with the lower end plate B', a cleaned grain-chute, discharging the same through its outlet *h*. The cylinders C all terminate in this outlet-drum through openings in the lower end plate; but the central cylinder projects out through the end plate and is provided with an annular imperforate flange *d*, which telescopes with a central inwardly-projecting imperforate annular flange *h'* in the end plate. This flange *h'* is provided with a radial spout *h''*, projecting downward inside the drum H, which in turn communicates with a discharge-spout *h'''*, pivoted in the wall of the drum H, with its extremities on the opposite sides thereof adapted in one position to deliver the discharge from the interior cylinder along with the discharge from the outer cylinders, and in another position to carry it out through the drum and keep it separate, according as desired.

K are the partitioning-diaphragms, consisting, as shown, of radial imperforate plates secured to the end plate B' and extending outward near to, but stopping short of, the conveyer-case, the function of which is to prevent the screenings from one cylinder falling against the outside surface of the adjacent cylinder. These of course could be dispensed with where imperforate separating-surfaces (such as gathering-cups) were used instead of the screens.

L are the inlet-chutes for conducting the screenings from the first-grade cylinders C to the inner or second-grade cylinder D. These chutes are crooked pipes with beveled mouths starting from the wall of the conveyer-case at its upper end, or a flange telescoping therewith and terminating on the inside of the cylinder D at its upper end.

L' are the outlet-chutes, extending from the upper end of the inner conveyer E' through the upper end plate B' and terminating in the drum G.

The screenings do not fall directly onto the separating-surface (screen, as shown) as they enter the inner cylinder, but onto an imperforate surface *d'*, constituting the upper section thereof, thus avoiding the effect of impact and securing a better distribution on the separating-surface. The inlet-chutes L terminate within *d'* at points nearly opposite each other, and to avoid clogging or interference on this account a deflecting cone-shaped shield *d''* is secured to the inside of the upper end plate D around the shaft B.

M is the fan, rigidly secured to the inner end of a sleeve M', which is loosely mounted on the upper part of the shaft B.

N is the fan-case, which in turn is loosely mounted on the sleeve M'. The case is provided with a front blast-outlet N' and a segment N''. The fan and its case are entirely within the conical mouth-piece F and directly adjacent to the upper end plate, and are retained in position by an annular head P, which in turn is supported from the outer end of the mouth-piece by rigid ribs Q connected therewith. These ribs are either provided with longitudinal slots or grooves or made of wires in pairs, so as to leave such a space between them.

R is the receiving-screen. It is composed of separate sections r, which are conical in shape and provided on their peripheral edges with outwardly-projecting flanges r', adapted to engage the grooves or slots in the ribs Q and rest therein as seats. The purpose of making this receiving-screen in sections is ease of removal and substitution. Otherwise the machine would have to be taken entirely off of its frame to change the receiving-screen.

S is a longitudinally-adjustable shaft mounted in the front legs of the frame, carrying on its inner end a small pinion S'. This shaft is adapted to project into the mouth-piece F and have its pinion engage with the segment on the fan-case for adjusting the case and its blast-outlet with reference to the receiving-screen.

T is the feed-hopper, removably mounted on the upper ends of the posts A', and is provided with the inclined spout T', projecting into the mouth-piece F directly over the receiving-screen. It may be tied to frame by stay-rods t. It may have a sliding cut-off, as T''.

u is a counter-shaft mounted in the hangers A''' and provided with small pulley u' and the large pulley u''.

v is a small pulley on the sleeve M'. w is a belt passing around the outer conveyer-case and the small pulley u'.

w' is a belt from pulley u'' to pulley v, driving the fan at a relatively high speed.

The power is applied to the shaft B. X is a crank for turning it by hand. In large machines a pulley would be used coupled to a source of power.

The fan M is of a special construction, adapting it to force the blast in the line of its axis. To this end the radial blades 1 are connected by spiral peripheral blades 2, extending from the front corner of one blade to the rear corner of the next adjacent blade. The spiral peripheral blades act as a propeller, forcing the air forward along the periphery of the fan-case and out through its opening N'. It should be noted that the outer lips or rim of the sectional receiving-screen R do not form a close joint with the rim of the mouth-piece F, but that the two are separated by an

annular space, affording an opening and outlet to such of the light stuff as may fall through the receiving-screen and be blown out by the fan; also, that the upper end of the outer multiple cylinders C are in communication with the mouth-piece F through openings in the upper end plate B'.

The operation is evident. The uncleaned grain is fed into the mouth of the machine from the hopper, falling first onto the receiving-screen. The coarse foreign stuff is lodged and falls outward down the inclined screen, and the chaff and fine light stuff are forced by the blast out over the rim of the mouth-piece. The grain falls through the sieve on the rearwardly-extending inclined walls of the mouth-piece, and thence into the upper end of the outer multiple cylinders. Thence the first-grade grain passes out through their open lower ends into the outlet drum-head or chute H, while the screenings are guided to the conveyer-case by the radial diaphragms. The conveyer carries them to its upper end and forces them into the chute L, whence they fall into the interior cylinder D. Thence the second grade passes into the chute h'' and out separately or together with first grade, as may be desired, while the second screenings fall onto the small conveyer E' and are carried to its upper end and forced out through the chute L' into the upper outlet-drum G.

In the modifications shown in Fig. XV the central cylinder and conveyer, and consequently the conveyer-chutes L and L', &c., are dispensed with, the multiple cylinders being arranged for a single-grade machine. Otherwise the construction and operation are the same.

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

1. The combination, with a revoluble shaft, of a separating-cylinder mounted thereon, multiple small-diameter separating-cylinders grouped about the central cylinder outside thereof and outside each other, imperforate partitions between the separating-surfaces of the different cylinders, and a conveyer-case inclosing the whole group of cylinders and in communication with the central cylinder, adapted to receive the screenings from the outside cylinders and force them into the central screen, substantially as described.

2. The combination, with a revoluble shaft, of a central separating-cylinder mounted thereon, a central imperforate conveyer or shell with spiral corrugations surrounding said central cylinder, multiple small-diameter separating-cylinders grouped about said central conveyer outside thereof and outside each other, imperforate partitions between the separating-surfaces of the outside cylinders, and an exterior conveyer case or shell with spiral corrugations inclosing the whole group of cylinders and in communication with the central cylinder, substantially as described.

3. The combination, with a revoluble shaft, of a central cylindrical screen mounted thereon, a central imperforate conveyer-shell inclosing said central screen, multiple small-diameter cylindrical screens grouped about said central conveyer outside thereof and outside each other, an exterior conveyer-shell inclosing the whole group of screens, chutes connecting the upper end of the exterior conveyer with the upper end of the central screen, and radial partitions between the outside screens, extending outward from the periphery of the central conveyer near to, but stopping short of, the exterior conveyer, substantially as described.

4. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said separating-cylinders, and a sectional receiving-screen removably mounted in said mouth-piece, substantially as described.

5. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said cylinders, screen-section seats in said mouth-piece, and a sectional receiving-screen having its separate sections removably mounted in said seats, substantially as described.

6. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said cylinders, a receiving-screen in said mouth-piece, and a blast-fan between said receiving-screen and separating-cylinders, adapted to blow the chaff and light material out at the head of the machine, substantially as described.

7. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said cylinders, a receiving-screen in said mouth-piece, an adjustable fan-case in said mouth-piece, and a blast-fan in said case, substantially as described, whereby the blast may be made to pass under, over, or clear of said receiving-screen at will.

8. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said cylinders, a receiving-screen in said mouth-piece, a cylindrical fan-case in said mouth-piece between the receiving-screen and the separating-cylinders, having a blast-outlet near its periphery approximately in line with its axis, a blast-fan therein having straight radial blades, and spiral peripheral blades connecting the inner and outer corners of adjacent radial blades, substantially as described.

9. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said cylinders, a receiving-screen in said mouth-piece, a partially-revoluble fan-case in said mouth-piece back of the receiving-screen, having a blast-outlet near its periphery approximately in line with its axis, and a blast-fan in said case having straight radial blades and spiral peripheral blades connecting the inner and

outer corners of adjacent radial blades, substantially as described.

10. The combination, with a revoluble shaft, of separating-cylinders mounted thereon, a mouth-piece in communication with said cylinders, a receiving-screen in said mouth-piece, a partially-revoluble fan-case with blast-fan in said mouth-piece, having a toothed section attached thereto, and a hand-shaft mounted on main frame, having a pinion at one end adapted to engage with said ratchet for adjusting said case, substantially as described.

11. The combination, with a revoluble shaft, of multiple separating-cylinders rigidly mounted thereon, a mouth-piece surrounding the upper end of said shaft in communication with said cylinders, a blast-fan loosely mounted on said shaft within said mouth-piece and provided with a driving-pulley, a counter-shaft on the main frame provided with a large and a small pulley, an inclosing shell or case surrounding said multiple cylinders, a belt from said case to said small pulley, and a belt from said large pulley to said fan-driving pulley, substantially as described.

12. The combination, with a revoluble shaft, of a central separating-cylinder mounted thereon, multiple separating-cylinders grouped about said central cylinder, but entirely outside thereof and outside of each other, a conveyer for conducting the screenings from the interior cylinder to the head of the central cylinder, and a separate outlet for the discharge from said central cylinder, substantially as described.

13. The combination, with the revoluble shaft, of the central screen, the multiple screens grouped about the central screen, each outside of every other, the lower end drum-head adapted to fit over the group of screens, the inwardly-projecting flange thereon and separate outlet-chute therefrom, and the outwardly-projecting flange on the end of the central screen, adapted to telescope therewith, substantially as described.

14. The combination, with the revoluble shaft, of the central screen, the exterior multiple screens, each outside of every other, the exterior conveyer-case, the radial inlet-chutes therefrom to the head of the central screen, and the deflector on the inside of said central screen for preventing the discharge from said radial chutes interfering with each other, substantially as described.

15. The combination, with the revoluble shaft, of the central screen having an imperforate upper section, the outside multiple screens, each outside of every other, the exterior conveyer-case, and the inlet-chutes from the head of said conveyer-case to the head of the imperforate section of the central screen for avoiding impact and securing better distribution of the central screen, substantially as described.

16. The combination, with a revoluble shaft, of a series of separating-cylinders supported

thereby and a conveyer-case provided with spiral corrugations surrounding said series of cylinders, substantially as set forth.

17. The combination, with a revoluble shaft, of a separating-cylinder mounted thereon, multiple small-diameter separating-cylinders grouped about the central cylinder outside thereof and outside each other, and a con-

veyer-case inclosing the whole group of cylinders and in communication with the central cylinder, substantially as and for the purpose described.

GEORGE C. BEEMAN.

In presence of—
JAS. F. WILLIAMSON,
EMMA F. ELMORE.