

No. 831,421.

PATENTED SEPT. 18, 1906.

S. DUNKELBERGER.
GRAIN SEPARATOR.

APPLICATION FILED AUG. 5, 1905.

4 SHEETS—SHEET 1.

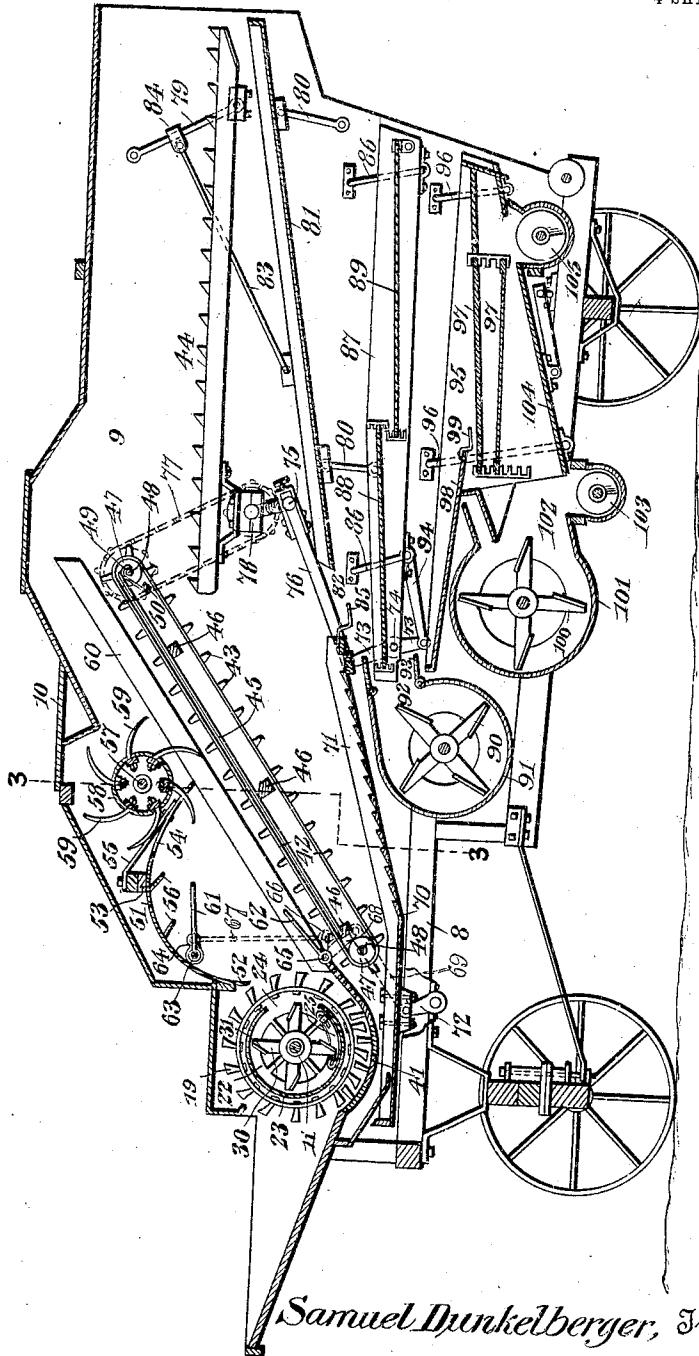


Fig. 1.

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4 SHEETS—SHEET 2

Fig. 2.

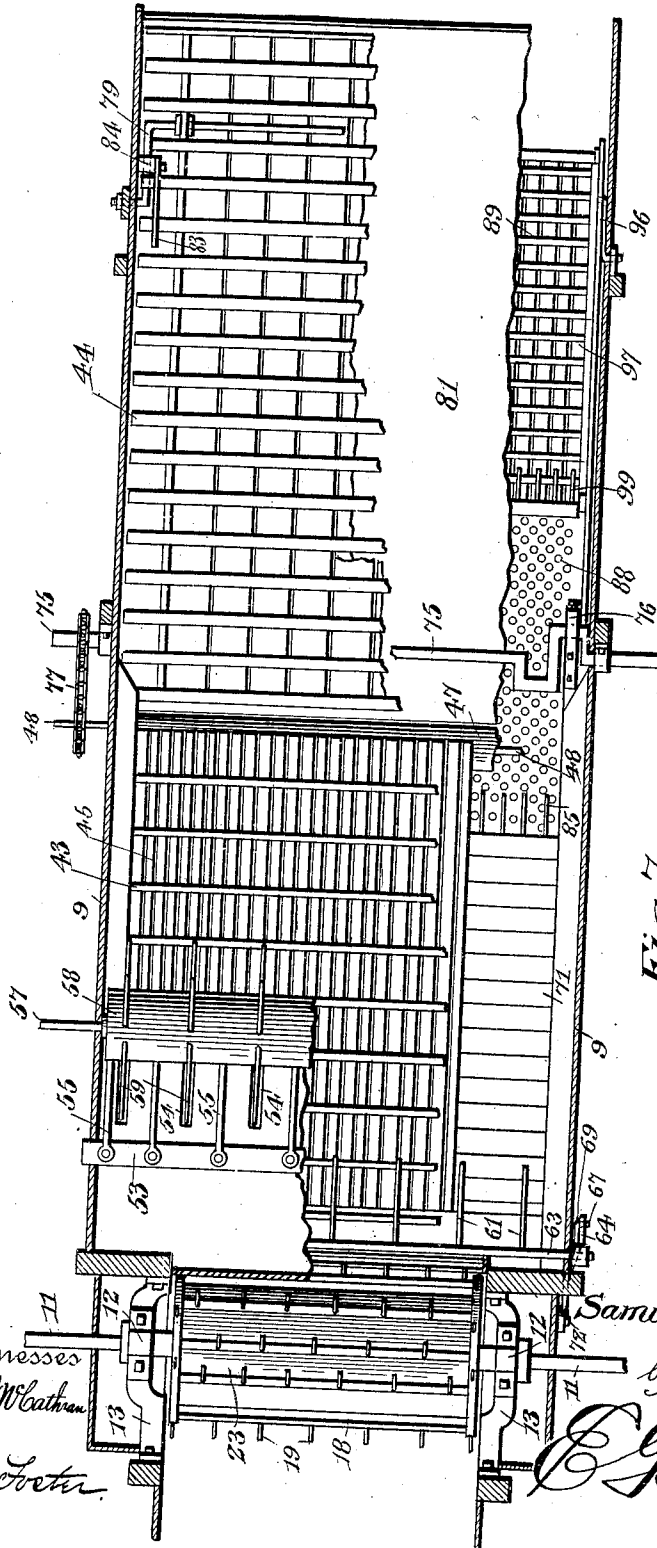
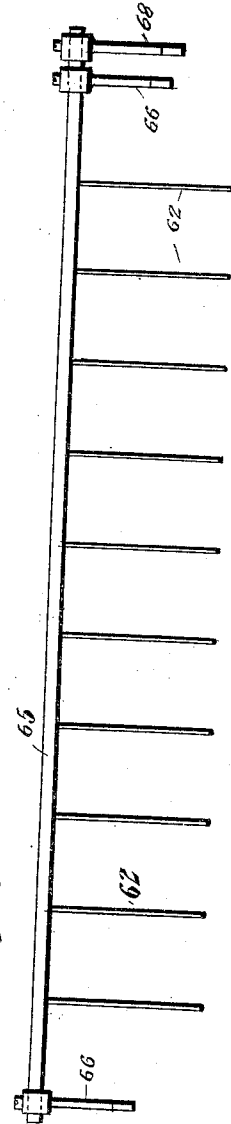


Fig. 7.



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4 SHEETS—SHEET 3.

Fig. 3.

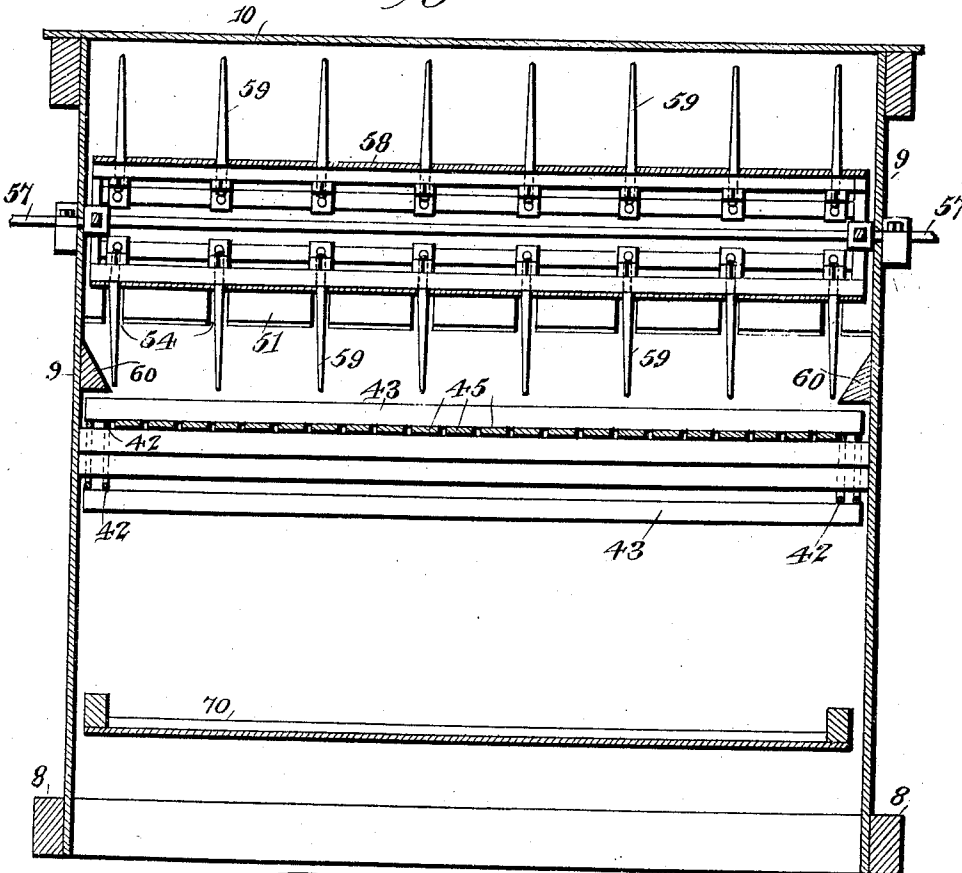


Fig. 4.

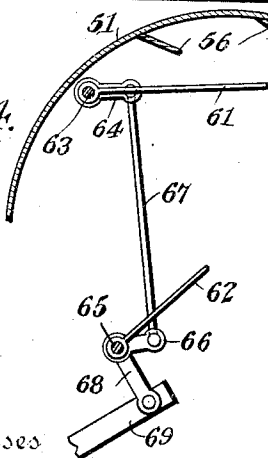


Fig. 6.

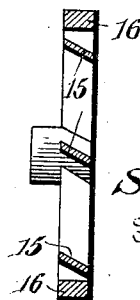
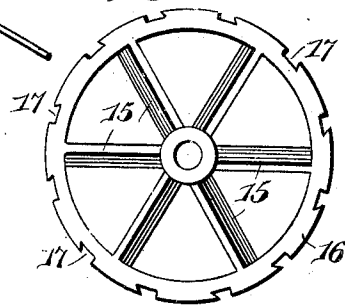


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 8.

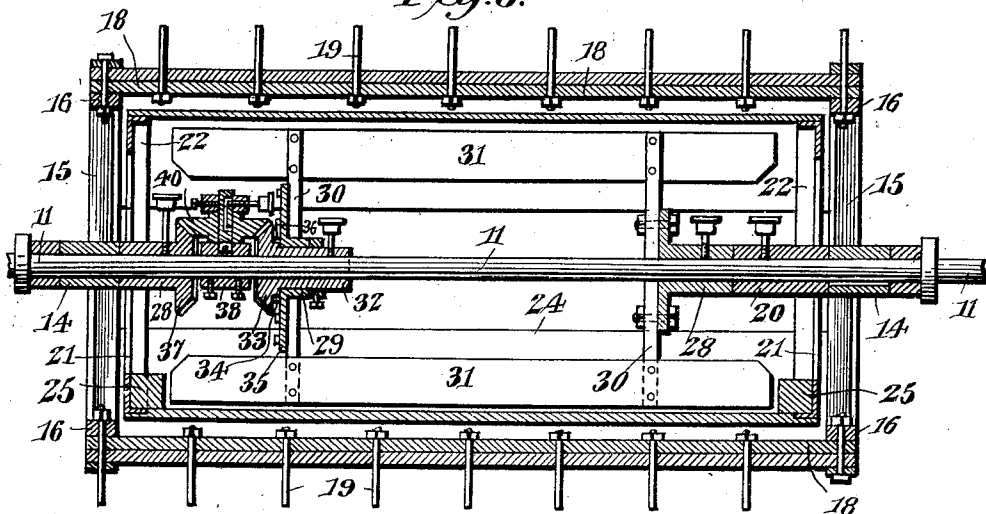


Fig. 9.

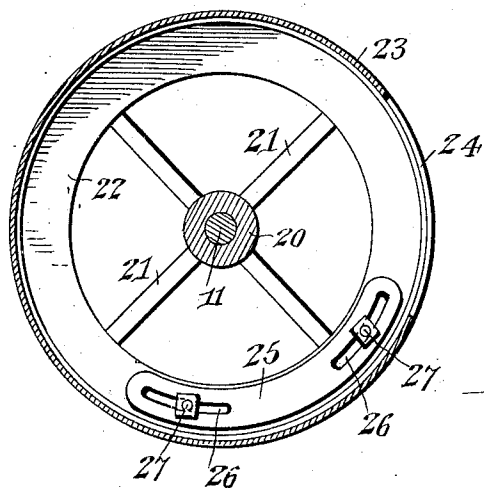


Fig. 10.

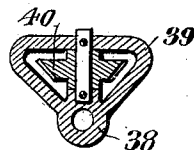


Fig. 11.

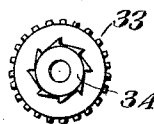
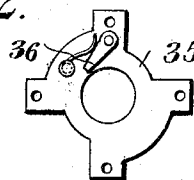


Fig. 12.



Samuel Dunkelberger, Inventor

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UNITED STATES PATENT OFFICE.

SAMUEL DUNKELBERGER, OF NEWTON, KANSAS.

GRAIN-SEPARATOR.

No. 831,421.

Specification of Letters Patent.

Patented Sept. 18, 1906.

Application filed August 5, 1905. Serial No. 272,914.

To all whom it may concern:

Be it known that I, SAMUEL DUNKELBERGER, a citizen of the United States, residing at Newton, in the county of Harvey and State of Kansas, have invented a new and useful Grain-Separator, of which the following is a specification.

This invention relates to means for separating grain from straw; and the principal object is to provide novel means for effecting the mechanical separation of the grain from the straw, thus eliminating the necessity of depending almost entirely upon gravity for such separation.

Another important object is to provide means for effecting a preliminary and complete separation of the grain, chaff, and finer particles from the coarse straw, then the elimination of the finer straw, leaving the cleaner-shoe to separate merely the chaff and lighter material, thereby avoiding the danger of overloading said cleaner-shoe and the consequent return of large quantities of grain to the threshing mechanism.

A further object is to provide mechanism of the above character that will keep the grain from again dropping on and into the straw after having been once separated therefrom.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a longitudinal sectional view through the separator. Fig. 2 is a horizontal sectional view therethrough, the parts being broken away. Fig. 3 is a cross-sectional view on the line 3 3 of Fig. 1. Fig. 4 is a detail sectional view showing the deflector and vibrating fingers, together with the connections between the said fingers. Fig. 5 is a view in elevation of one of the heads of the threshing-cylinder. Fig. 6 is a cross-sectional view through the same. Fig. 7 is a plan view of one of the rock-shafts and vibrating fingers carried thereby. Fig. 8 is a longitudinal sectional view through the cylinder and associated fan mechanism. Fig. 9 is a cross-sectional view through the casing. Fig. 10 is a detail sectional view of one of the gear-wheels, together with its carrier. Fig. 11 is a view in elevation of the gear-wheel, associated with the fan and the clutch member carried thereby. Fig. 12 is a view in elevation of the clutch member carried by the fan.

Similar reference-numerals designate cor-

responding parts in all the figures of the drawings.

In the embodiment illustrated a suitable frame 8 is employed, to which is secured the machine-casing, including side walls 9 and a deck 10. In the front portion of the casing is journaled the usual cylinder-shaft 11, that extends across the casing and has its ends rotatably mounted in boxings 12, carried by supports 13. Mounted on the shaft 11 is a cylinder having heads consisting of hubs 14, provided with radially-disposed spokes 15, carrying at their outer ends rings 16, having seats 17. The hubs 14 are keyed or otherwise secured to the shaft, and the spokes 15, as clearly shown in Figs. 5 and 6, are set at an inclination, so that upon the rotation of the cylinder air will be injected into said cylinder through the ends or heads thereof. The rings 16 are connected by tooth-bars 18, carrying the usual threshing-teeth 19.

Loosely journaled on the shaft 11 within the threshing-cylinder is a fan-casing consisting of hubs 20, disposed between the hubs 14 of the cylinder, the shaft 11 rotating freely in said hubs. Spokes 21 are carried by the casing and in turn support annular rings 22, to which is fastened an annular wall 23, provided with an opening 24, constituting a discharge-spout. Weights 25, secured in the corners of the casing, as shown in Figs. 8 and 9, serve to maintain the casing against rotation with the shaft, said weights being adjustable in the casing, having slots 26, through which holding-bolts 27 are passed. Thus the position of the discharge-spout 24 can be varied. Loosely journaled upon the shaft within the casing is a fan having hubs 28 and 29, said hubs carrying outstanding arms 30, to which the fan-blades 31 are attached. The hub 29 is loosely journaled on a sleeve 32, carrying a bevel-gear 33, which gear is provided with a clutch member in the form of a ratchet-wheel 34. Another clutch member, consisting of a plate 35, secured to the adjacent end of the fan, has a spring-pressed dog 36, which coöperates with the teeth on the ratchet-wheel 34. Another gear-wheel 37 is carried by the adjacent hub 28 of the fan-casing, said gear-wheel 37 being beveled and disposed in opposed relation to the gear-wheel 33. Secured to the shaft between its opposing walls is a collar 38, having a yoke 39, in which is journaled a bevel gear-wheel 40, said wheel meshing with the gear-wheels

33 and 37. It will thus be apparent that when the shaft 11 is rotated the threshing-cylinder will be rotated with the same, while the fan 31 will also be revolved but at a greater speed than the cylinder, the same being due to the gear disclosed. At the same time if the speed of the cylinder is suddenly checked the fan can continue to revolve, the dog 36 riding freely over the teeth of the ratchet-wheel 34, thus preventing the straining and breakage of the parts. The fan-casing being held against rotation by the weights will direct the blast of air outwardly and rearwardly through the cylinder. This structure is not claimed broadly in the present application, but in a copending application, Serial No. 272,248.

Coöperating with the threshing-cylinder is the usual concave 41, and located in rear of the same is straw-carrying means. This means includes spaced endless belts 42, having transverse slats 43, and a rack 44, disposed in rear of the belts with its front end below the rear portion of said belts. A grate is located beneath the upper stretch of the endless carrier and consists of spaced longitudinally-disposed bars 45, supported on cross-bars 46, the belts passing about pulleys 47, arranged at the ends of the grate and carried by shafts 48. A guard-plate 49, secured to a transverse bar 50, partially surrounds the upper shaft 48 and serves to prevent straw winding thereupon. Located over the front lower portion of the endless carrier is an upwardly-curved deflector 51, having a depending front end 52, disposed directly adjacent to the free ends of the cylinder-teeth 19. The deflector is supported by a cross-bar 53 and has a downwardly-extending rear end that is slotted, as shown at 54, the portions of said rear end between the slots being sustained by braces 55, connected thereto and to the bar 53. Rearwardly-extending inclined depending check plates or ribs 56 are carried by the deflector between the front and rear ends thereof.

Rotatably mounted above the rear end of the deflector 51 is a beater consisting of a shaft 57, having a drum 58, that is provided with outstanding curved fingers 59, which fingers operate through the slots 54 in the rear end of the deflector, said fingers being movable directly over the endless straw-carrier. The edges of said carrier are protected by strips 60, secured to the sides of the casing and overlapping the ends of the slats, as shown in Fig. 3. Located between the threshing-cylinder and beater are upper and lower sets of rearwardly-extending fingers 61 and 62, the upper set being arranged in the curvature of the deflector and being carried by a rock-shaft 63, having a crank-arm 64. The lower set of fingers 62 is mounted on a rock-shaft 65, also having a crank-arm 66, these crank-arms being connected by a link 67, as fully

illustrated in Fig. 4. The lower shaft 65 is furthermore provided with another crank-arm 68, having a link connection 69 with a grain-pan 70, located beneath the threshing mechanism and having an upwardly and rearwardly inclined rear end 71, disposed beneath the endless carrier. The grain-pan is supported at its front end by upstanding rocker-arms 72, and at its rear end by upstanding levers 73, pivotally mounted, as indicated at 74, between their ends.

A crank-shaft 75 is journaled in the central portion of the machine, and certain of the cranks thereof have pitman connections 76 with the rear end of the grain-pan. This crank-shaft has also a link-belt connection 77 with the upper shaft 48 of the endless carrier, as illustrated in Fig. 2. The straw-rack 44 at its front end has a journal-bearing 78 directly with one of the cranks of the shaft 75, the rear end of said rack being supported by depending swinging links 79. Pivotally mounted on the upper ends of swinging links 80 is a downwardly and forwardly inclined return-bottom 81, located beneath the rack 44 and having its lower end disposed in substantial alinement with but spaced from the rear end of the grain-pan 70, forming a throat 82. The movement of the grain-pan is secured by means of a link 83, pivoted thereto and having an adjustable connection 84 with the link 79 of the rack. Rearwardly-extending tines 85, carried by the rear end of the grain-pan 70, project forwardly across the throat 82.

Suspended by swinging links 86 is a chaffer-shoe 87, having screens 88 and 89, the screen 89 being disposed in rear of the screen 88 and in a lower plane than the same, its front end being arranged beneath the rear end of the screen 88. The said screen 88 is finer than the screen 89 and has its front portion disposed beneath the throat 82. Both of these screens are adjustably mounted, as clearly shown in Fig. 1. A fan 90 is journaled in a casing 91, said casing having a discharge-throat 92, delivering air across the screens 88 and 89 and through the chaffer, the direction of the blast being adjustable and regulable by suitable wind-boards 93. The movement of the chaffer-shoe is secured by a link 94, pivoted to said shoe and to the lower end of the lever 73.

A cleaner-shoe 95 is suspended by swinging links 96 beneath the chaffer, and located in said shoe are suitable screens 97. A rearwardly and downwardly inclined guiding-board 98, carried by the cleaner-shoe 95, is located beneath the screen 88 of the chaffer and delivers to the upper screen 97, said board having at its lower end agitating-tines 99. A fan 100 is located in a casing 101, whereby the air is directed to the cleaner-shoe in a manner well understood. A grain-

conveyer 103 receives the cleaned grain from the downwardly and forwardly inclined bottom 104 of the cleaner-shoe, and a portion of the usual return mechanism is illustrated in the form of a screw conveyer 105, disposed in rear of the bottom 104.

In actual practice the threshing-cylinder is of larger proportion than that ordinarily employed. Consequently it is heavier and stronger and a greater amount of power is stored therein in order that said cylinder may run more evenly and is not as easily affected by uneven feeding. Therefore bundles of grain are more equally distributed and more thoroughly threshed. The straw is rapidly discharged from the cylinder with the coöperation of the fan inside the same, said straw, together with the chaff and other material, being blown rearwardly in a thin sheet through and between the vibrating sets of fingers 61 and 62, which fingers give a waving motion to the said sheet of straw. The advantage of this action is that if the cylinder is sluggish with an abnormal amount of grain the straw will not be thrown so much in one pile after passing through the cylinder, consequently being distributed a greater distance on the grate and effecting a better separating action. After passing through said fingers the straw is directed by the deflector and beater onto the grate, which is set at an inclination in the path of movement of said straw. The greater portion of the grain, together with the chaff and fine straw, passes on through the grate, while said grate is continuously being cleaned by the belt-slats passing over the same. The separation continues in rear of the endless conveyer by the dropping of the straw endwise onto the rack, said rack being comparatively coarse and insuring the separation of any grain that may remain in the straw in its course to the rear end of the machine. The separation of the grain, fine straw, chaff, and the like from the coarse straw is thus completed, part being upon the grain-pan, the remainder upon the return-bottom. All this material is brought to the throat 82 by said pan and bottom, where the stream is thoroughly agitated and broken up by the tines 85. From the throat the grain passes into a rearward blast of wind and into and through the adjustable chaffer-screen 88. Now while the grain is passing through the wind and screen 88 it is also carried rearwardly from the throat 82 and is delivered in a partially-cleaned condition at the forward end of the final cleaning-sieves 97, where the cleaning is completed. The coarser straws, sticks, weeds, &c., of the fine material is carried rearwardly over the chaffer-screens 88 and 89, relieving the cleaning-shoe 97 of excessive amounts of material and lessening the work to be performed by the same. In this structure, therefore, no grain is allowed to drop on top of any straw after its separa-

tion has commenced. All the grain is acted upon by the air-blasts, is blown rearwardly and partially cleaned, and then is deposited on the cleaning-shoe, where only a medium or light blast is required to finally separate the refuse from the grain. The break between the screens 88 and 89 is important, as the straw falls endwise in passing from one screen to the other and the wind striking the straw while falling insures separation. Of course the number of these breaks or falls in the chaffer-shoe can be readily increased by increasing the number of the screens. It will be observed by the arrangement disclosed that the grain-pan and return-bottom are caused to operate simultaneously in opposite directions, thus allowing the tines 85 in the throat 82 to catch and agitate the material delivered by the bottom. Moreover, the various reciprocating parts driven by the crank-shaft 75 are arranged to counterbalance each other in order that shocks and jars to the mechanism may be avoided.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a grain-separator, the combination with a rotatable threshing member, of a fan rotatably mounted therein, a casing loosely journaled in the member, a fan loosely journaled in the casing, and means for driving the fan and threshing member at different speeds, said means including gearing associated with the fan and casing.

2. In a grain-separator, the combination with a shaft, of a rotatable threshing member fixed to the shaft, a fan rotatably mounted on the shaft, a gear loosely journaled on the shaft, a weight holding the gear against rotation with the shaft, a gear associated with the fan, and another gear meshing with said gear, said latter gear being rotatable with respect to and with the shaft.

3. In a grain-separator, the combination with a shaft, of a rotatable threshing member carried thereby, a fan journaled on the shaft, a weighted fan-casing loosely journaled on the shaft within the member and outside the fan, a gear carried by the weighted casing, a gear rotatable with the shaft and with respect to the same, said gear meshing with the gear of the casing, and another gear meshing with the shaft-gear and connected to the fan.

4. In a grain-separator, the combination

with a shaft, of a threshing-cylinder fixed to the shaft, a fan-casing having hubs disposed inside the cylinder and loosely journaled on the shaft, a weight for holding the casing against rotation with the shaft, a fan loosely journaled on the shaft between the casing-hubs, said fan having a gear fixed to the casing, a carrier fixed to the shaft between the gears, and a gear journaled on said carrier and meshing with the fan-casing gears.

5. In a grain-separator, the combination with a threshing-cylinder including spaced tooth-bars, of means for delivering a blast of air outwardly across the bars, said means including air-directing means located within the cylinder and inclined spokes that drive the air into the cylinder through the ends thereof and into said directing means.

6. In a grain-separator, the combination with a threshing-cylinder, including spaced tooth-bars, of a fan mounted within the cylinder for delivering a blast of air outwardly across the bars, and spokes located at the ends of the cylinder and set at an inclination to deliver air inwardly to the ends of the fan.

7. In a grain-separator, the combination with a shaft, of a fan-casing mounted thereon and having open ends, a fan located within the casing, and a cylinder having spaced tooth-bars and spokes, said spokes being arranged outside the casing and being set at an inclination to deliver air inwardly through the open ends thereof to the fan.

8. In a grain-separator, the combination with threshing mechanism, of straw-carrying means associated therewith, and a deflector located over the straw-carrying means and having a transverse depending check rib or plate located between its front and rear ends.

9. In a grain-separator, the combination with threshing mechanism, of straw-carrying means disposed in rear of the same, and a curved deflector arranged in rear of the threshing mechanism and over the carrying means, said deflector having a plurality of depending rearwardly-inclined check ribs or plates.

10. In a grain-separator, the combination with threshing mechanism, of straw-carrying means disposed in rear of the same, a deflector located in rear of the threshing mechanism and having a slotted rear portion located over the straw-carrying means, a beater journaled over the slotted portion and having fingers that operate through the slots thereof, a supporting-bar for the deflector arranged over an intermediate portion of the same, and braces connected to the bar and to the portions of the deflector between the slots to secure said portions in position.

11. In a grain-separator, the combination with threshing mechanism including a rotatable cylinder, of straw-carrying means arranged in rear of the same, an upwardly-curved deflector having a depending front

end disposed directly adjacent to the upper rear portion of the cylinder, and a depending rear end located over the carrying means, said rear end being longitudinally slotted, depending rearwardly-extending check plates or ribs carried by the deflector, and a beater journaled at the end of the deflector and having fingers that operate through the slot of said deflector and over the straw-carrying means.

12. In a grain-separator, the combination with threshing mechanism, of straw-carrying means located in rear of the same, upper and lower sets of vibrating fingers disposed in rear of the threshing mechanism and permitting the passage of material between them, and means for vibrating the fingers to cause a wavy movement to the material passed therebetween.

13. In a grain-separator, the combination with threshing mechanism, of straw-carrying means located in rear of the same, an upwardly-curved deflector located over the straw-carrying means, upper and lower sets of vibrating fingers disposed in rear of the threshing mechanism between the deflector and carrying means, said fingers permitting the passage of the material, and means for vibrating the fingers in corresponding directions to cause a wavy movement to the material passed therebetween.

14. In a grain-separator, the combination with threshing mechanism including a rotatable cylinder, of straw-carrying means located in rear of the same, upper and lower sets of vibrating fingers disposed in rear of the threshing mechanism and permitting the passage of the material between them, means for vibrating the fingers, and a fan located in the cylinder to deliver the material rearwardly therefrom between the sets of fingers.

15. In a grain-separator, the combination with threshing mechanism, of straw-carrying means located in rear of the same, an upwardly-curved deflector arranged in rear of the threshing mechanism and over the carrying means, depending rearwardly-inclined fingers located in the curvature of the deflector and in the path of movement of the material delivered from the threshing mechanism, and means for continuously vibrating the fingers during the operation of the threshing mechanism.

16. In a grain-separator, the combination with a threshing-cylinder, of straw-carrying means located in rear of the same, an upwardly-curved deflector arranged over the carrying means, a fan mounted within the cylinder to deliver material therefrom against the deflector and upon the carrying means, and vibrating fingers arranged in the curvature of the deflector and in the path of material delivered from the cylinder.

17. In a grain-separator, the combination with threshing mechanism including a cylinder

der and concave, of a straw-carrier disposed in rear of the threshing mechanism, an upwardly-curved deflector arranged over the carrier and having longitudinal slots in its rear end, a rotary beater journaled above the rear end of the deflector and having fingers that operate through the slots thereof, upper and lower sets of vibrating fingers disposed between the carrier and deflector in rear of the threshing mechanism, means for vibrating the fingers, and a fan located within the threshing-cylinder and delivering the material therefrom between the fingers against the deflector and carrier.

18. In a grain-separator, the combination with a threshing-cylinder and concave, of an upwardly-inclined grate disposed in rear of the same and including spaced longitudinally-disposed bars, a straw-carrier operating over the grate and comprising shafts journaled at the ends of said grate, spaced belts passing around the shafts and having spaced cross-slats operating over the grate-bars, a guard-plate extending about the upper shaft, and means for directing material from the threshing-cylinder and concave onto the grate.

19. In a grain-separator, the combination with threshing mechanism, of a straw-carrier disposed in rear of the same, a grain-pan located beneath the threshing mechanism, a straw-carrier, upper and lower rock-shafts disposed in rear of the threshing mechanism, vibrating fingers carried by the rock-shaft, cranks secured to the rock-shafts, and connections between the cranks and the grain-pan.

20. In a grain-separator, the combination with a machine-casing, of threshing mechanism located therein, straw-carrying means located in rear of the mechanism and including an endless belt and a movable rack, a rotary crank-shaft journaled in an intermediate portion of the casing, connections between the cranks of the shaft and the rack for effecting a back-and-forth movement of the latter, and a gear connection between the shaft and the rear portion of the belt.

21. In a grain-separator, the combination with a machine-casing, of threshing mechanism located therein, straw-carrying means located in rear of the mechanism and including an endless belt and a movable rack, a grain-pan located beneath the straw-carrying means, a rotary shaft journaled in an intermediate portion of the casing, and connections between the cranks of the shaft and the adjacent ends of the rack and grain-pan, and a belt connecting the shaft and the adjacent portion of the straw-carrier belt.

22. In a grain-separator, the combination with threshing mechanism, of straw-carrying means, a grain-pan cooperating therewith, means for reciprocating the grain-pan, vibrating fingers disposed between the

threshing mechanism and the carrying means, and operative means for the fingers having a connection with the grain-pan and operated therefrom.

23. In a grain-separator, the combination with threshing mechanism, of a straw-carrying belt located in rear of the same, a crank-shaft, a straw-carrying rack disposed in rear of the belt and having its front end connected to certain of the cranks of the shaft, a grain-pan disposed beneath the threshing mechanism and belt, connections between the rear end of the pan and certain of the cranks of the shaft, vibrating fingers disposed between the threshing mechanism and belt and having operative connections with the grain-pan, and a belt connection between the rear portion of the straw-carrier belt and the crank-shaft.

24. In a grain-separator, the combination with straw-carrying means including a rack, of a swinging link supporting a portion of the rack, means for moving the rack, and a return-bottom movably supported beneath the rack and having a connection with the link, said connection being adjustable longitudinally along the link to vary the length of movement of the return-bottom.

25. In a grain-separator, the combination with straw-carrying means, of a movable grain-pan, a return-bottom movably mounted beneath the carrying means and having its front end spaced from the rear end of the grain-pan and in substantial alinement therewith, and means for simultaneously swinging the pan and bottom in opposite directions to vary the distance between the adjacent ends thereof.

26. In a grain-separator, the combination with straw-carrying means including a rack, of a crank-shaft supporting a portion of said rack, a swinging link also supporting a portion of the rack, a grain-pan, a pitman connection between the crank-shaft and grain-pan, a return-bottom swingingly supported beneath the rack and having its lower front end disposed in rear of the pan, and a link connection between the return-bottom and the link of the rack, said connection being adjustable longitudinally of the link to vary the movement of the return-bottom with respect to the grain-pan.

27. In a grain-separator, the combination with threshing mechanism, of a straw-carrier including a rack, a crank-shaft having a connection with the rack, a grain-pan having a connection with the crank-shaft, a return-bottom swingingly supported beneath the rack and having its lower front end disposed in spaced relation to the rear end of the grain-pan, means for swinging the pan, a chaffer-shoe swingingly supported beneath the return-bottom and the space between said bottom and grain-pan, chaffer-screens carried by the shoe and disposed one behind the

other, the rear screen being disposed lower than the front screen, a cleaner-shoe swingingly suspended beneath the chaffer-shoe, screening means carried by the cleaner-shoe, and means for creating and directing blasts of air through the chaffer and cleaner shoes.

28. In a grain-separator, the combination with threshing and straw-carrying mechanisms, of a grain-pan and a return-bottom located beneath the same, said pan and return-bottom having their ends spaced apart to form a throat, a shaking-shoe located beneath the throat and beneath the return-bottom, separate screens in the shoe, said screens being disposed one behind the other and having their inner ends disposed in overlapping relation, means for adjustably supporting the inner ends of the shoe to vary the vertical distance between said ends, and a cleaner-shoe located beneath the shaking-shoe and receiving the material that passes through the screens thereof.

29. In a grain-separator, the combination with a grain-pan and a return-bottom forming a throat, of an open-bottomed chaffer-shoe having a plurality of screens disposed one behind the other, and one lower than the other, the foremost of said screens being disposed below the throat and said screens being

relatively and vertically adjustable in the shoe to vary the distance between them, a cleaner-shoe located below the chaffer-shoe, a screw arranged on the cleaner-shoe below the return-bottom and below the chaffer-shoe, and a return-bottom carried by the cleaner-shoe and disposed below the foremost chaffer-screen, said latter delivering to the cleaner-shoe screen.

30. In a grain-separator, the combination with threshing and straw-carrying mechanisms, a grain-pan and a return-bottom disposed beneath the same and spaced apart to form a throat, of a chaffer-screen located beneath the throat, a shaking-shoe carrying the chaffer-screen, means for supporting the screen in the shoe at different distances from the throat, means for directing a blast of air through the shoe, and a cleaner-shoe having its front end located beneath the rear end of the adjustable chaffer-screen.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

SAMUEL DUNKELBERGER.

Witnesses:

JOHN H. LINN,
PETER P. CARBIENER.