No. 668,175. Patented Feb. 19, 1901.

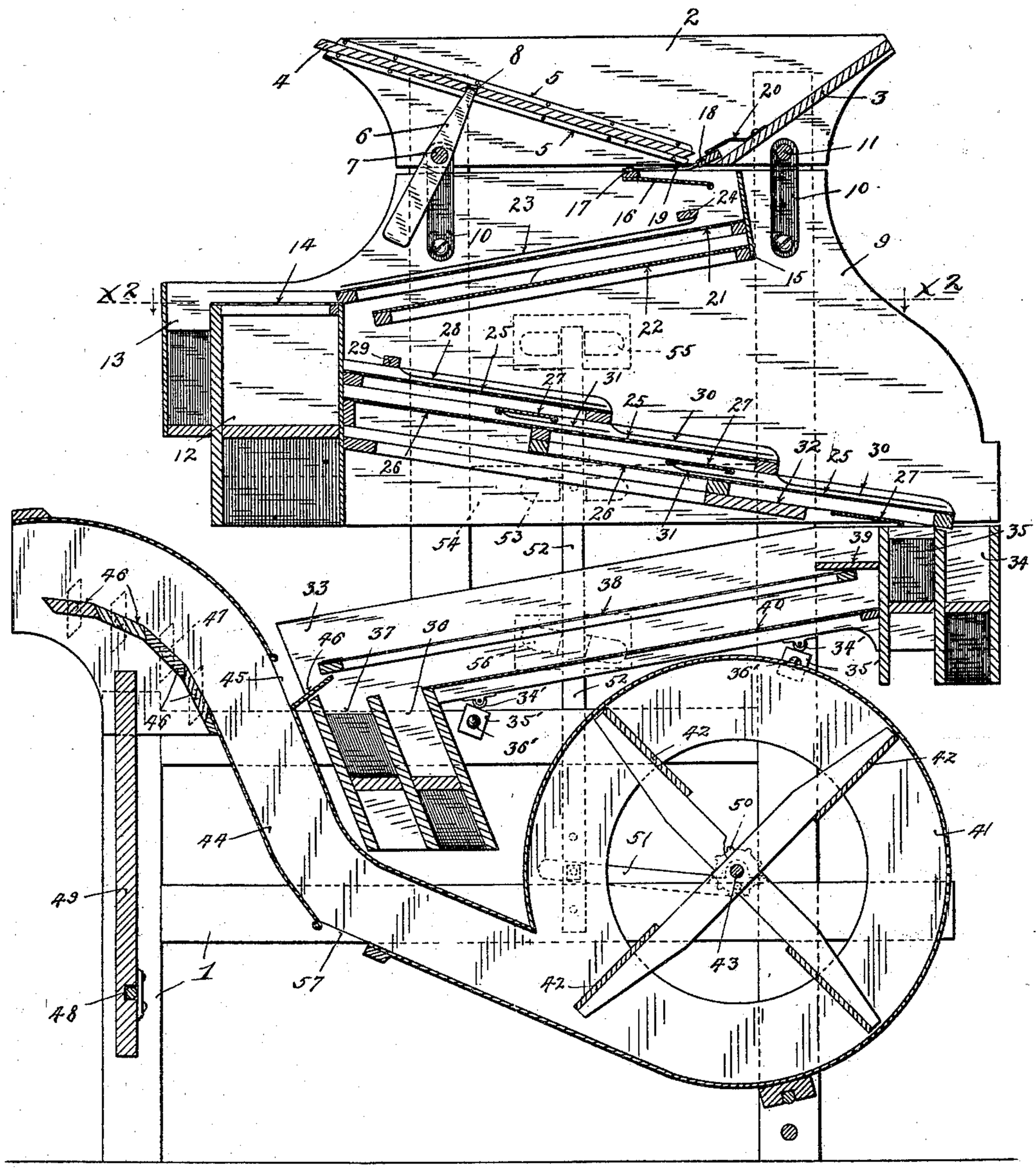
# A. S. FROSLID.

## GRAIN SEPARATOR.

(Application filed Jan. 27, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.




Witnesses.
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F. D. Merchant

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By his Attorney.
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(Application filed Jan. 27, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

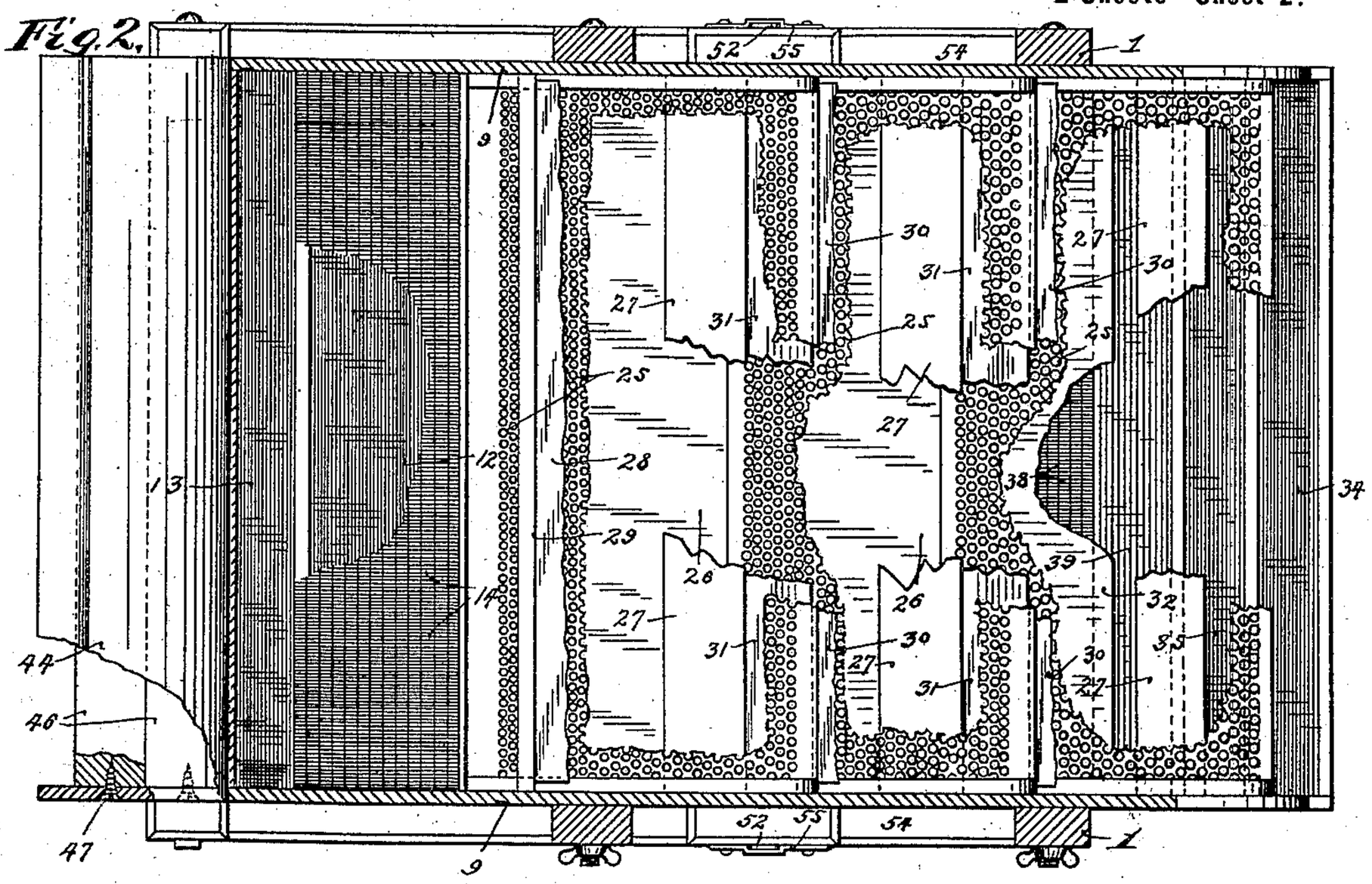
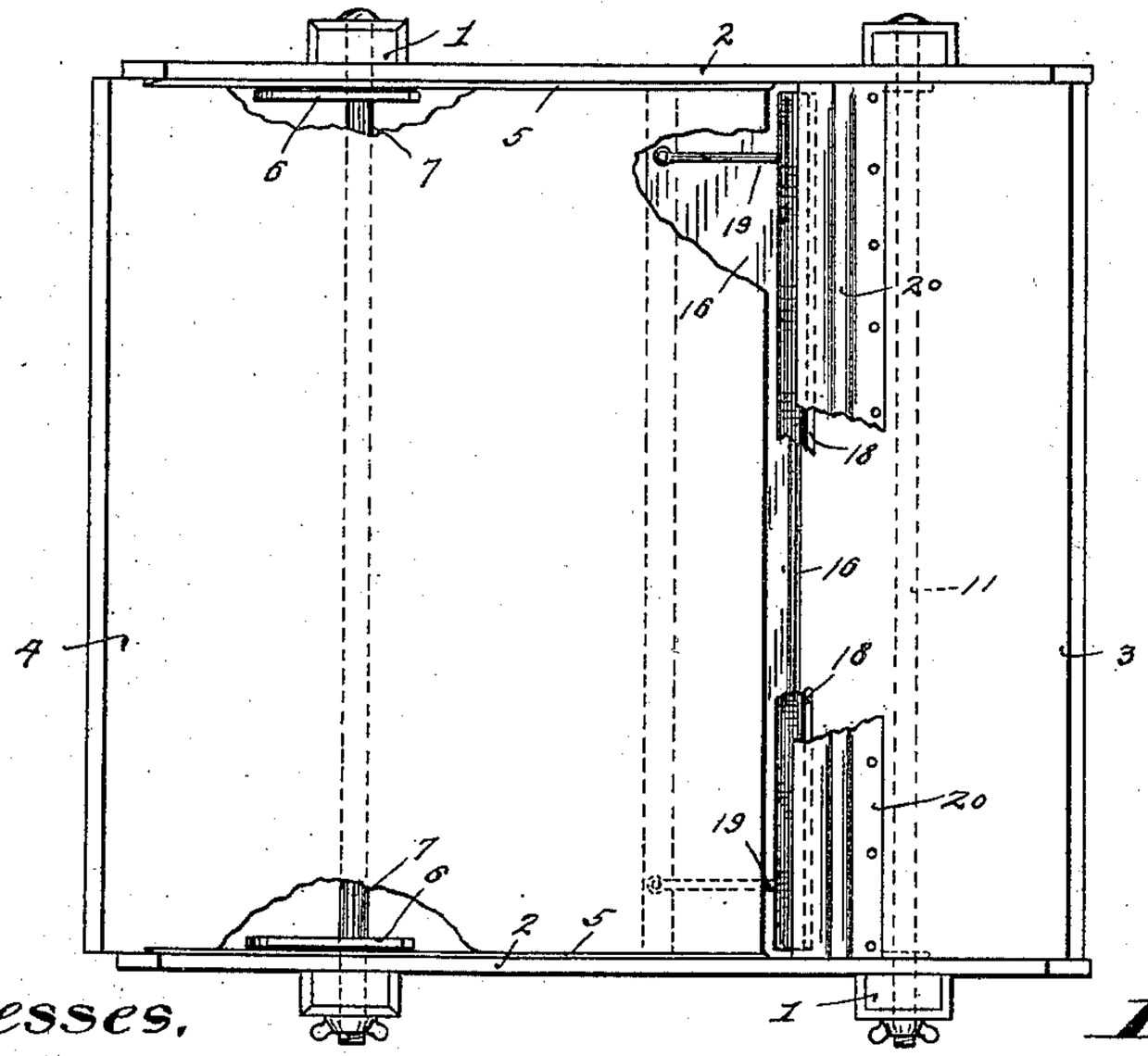



Fig. 3.

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By His Attorney.

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# UNITED STATES PATENT OFFICE.

ANTON S. FROSLID, OF MINNEAPOLIS, MINNESOTA.

## GRAIN-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 668,175, dated February 19, 1901.

Application filed January 27, 1899. Serial No. 703,539. (No model.)

*To all whom it may concern:*

Be it known that I, ANTON S. FROSLID, 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 grain-separators, and has for its primary object the production of an improved machine of this character especially adapted for effecting the separation of wheat and oats and the foreign materials usually mixed therewith.

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

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

Figure 1 is a vertical section taken centrally and longitudinally through the machine. Fig. 2 is a horizontal section taken through the machine approximately on the line $x^2\,x^2$, Fig. 1, some parts being broken away; and Fig. 3 is a plan view of the hopper or upper portion of the machine with some parts broken away.

The main frame 1 of the machine is shown as made up of a plurality of horizontally and vertically extended beams, which are suitably connected to form a skeleton-like support for the parts of the machine to be hereinafter noted.

The feed-hopper is rigidly secured between the sides and at the upper portion of the framework 1, and, as shown, it involves side plates 2 and inclined bottom sections 3 and 4, the latter of which is mounted to slide in suitable guides 5, secured on the sides 2. The movable bottom section 4 is adapted to be moved by means of a pair of levers 6, that are pivoted on a transverse rod 7 and work one close to each side plate 2 with their upper ends in engagement with notches 8, cut or formed in the said bottom section 4. The lower ends of these levers 6 are adapted to be engaged at the same time, one by each hand of the operator.

Mounted for vibratory movements longitudinally of the machine and located immediately below the hopper is a sieve-carrying shoe or support 9, which, as shown, is suspended by links 10, pivoted thereto at their lower ends and pivoted at their upper ends, the pair at one end of the machine on the transverse rod 7 above noted and the pair at the other end of the machine on a similar transverse rod 11 at the left-hand end of the machine. The vibrating or shaking sieve shoe or frame 9 is provided with a pair of transversely-extended discharge-spouts 12 and 13, the former of which is covered by a woven-wire screen 14. As shown and preferred, the screen or sieve 14 has long and narrow meshes to adapt it for a function to be hereinafter noted.

At its upper portion and just to the right of the opening or discharge-passage between the bottom sections 3 and 4 of the feed-hopper the shoe 9 is provided with an approximately vertical and transversely-extended guard-plate 15, and just to the left, but spaced apart from this guard-plate 15, said shoe 9 is further provided with a slightly-inclined and horizontally-extended feed-deck 16, which, as shown, is secured at its left-hand edge to a transverse slat 17.

At this point a graduated feeding device of novel construction will be explained. This novel feeding device involves a transverse feed-bar 18, which, as shown, is connected by a pair of spring-arms 19 to the transverse slat 17, heretofore noted as being carried by the shoe 9. The feed-bar 18 is thus mounted to vibrate edgewise across the opening or feed-passage formed between the bottom sections 3 and 4, and when thrown toward the right it works against the upper surface of the lower edge of the bottom section 3 and under a transversely-extended shield or cover-plate 20, which is secured at one edge to the said bottom section 3. The action of this novel force-feeding device will be given in the description of the operation.

Extending from the guard-plate 15 to the right-hand edge of the screen or sieve 14 is an inclined sieve or screen 21, and extending

below and approximately parallel to said screen 21, but terminated short of the discharge-spout 12, is an inclined imperforate deck 22, both of which parts 21 and 22 are of course carried by the shoe 9. Overlying the sieve or screen 21 is a flexible flap 23, which, as shown, is secured at its upper edge to a transverse slat 24, carried by the shoe 9.

In the shoe 9, to the right of the discharge-spout 12 and inclining reversely to the upper sieve 21, are mounted a series of sieves or screens 25, set one below the other and overlapping in respect to each other. The two lower members of said series of sieves 25 are provided with imperforate extensions or decks 26, that extend to the upper ends of the respective overlying sieves. Between each successive pair of said sieves 25 are located what may be called "lap-decks," shown as made up of the elements 27 and 31. The element 27 is a rigid deck-section of imperforate material and the element 31 is a flap of imperforate flexible material attached to the element 27. On account of their respective functions the decks 26 may be called the "head" or "main" decks, for receiving the stock which passes through the upper or head portions of the respective overlying sieves 25 and delivering the same to the head ends of the respective sieves 25, of which the said decks are upward extensions. The lap-decks, made up of the elements 27 and 31, are so disposed that they receive the stock which passes through the lower portion of each of the overlying sieve members 25 and deliver the same to a point near the center of the next lower member of said sieves 25.

To a transverse slat 29, overreaching the head end of the upper member of said sieves 25, is attached an imperforate flexible flap 28, which serves as a rider to that member—to wit, the upper member of said sieves 25. To the lower end of the upper sieve 25 is attached another similar flap 30, which serves as a tailings extension for the upper member of said sieves 25 and as a rider for the intermediate or underlying member of said sieves 25. To the lower end of the intermediate member of said sieves 25 is attached another similar flap 30, which in a like way serves as a tailings extension for said intermediate sieve 25 and as a rider to the underlying or lowermost member of said sieves 25. Directly under the lowermost member of said sieves 25, at a point near its lower end, is located the imperforate deck-section 27, which serves a similar function to the corresponding element 27 in the so-called "lap-decks" between the other pairs of said sieves 25. The rigid elements 27 of said lap-decks are supported a short distance above the underlying main decks 26 and sieves 25, which they lap, in order to afford a free passage for the stock from said main decks 26 under the lap-decks in the travel of the stock toward the heads of the next lower sieves 25. The flexible sections 31 of said lap-decks serve as extensions to that portion of the lap-deck formed by the rigid element 27 and also serve as riders to the head ends of the sieve members 25 underlying the same. Underlying the head portion of the lower member of said sieves 25 is an imperforate or main deck-section 32, which delivers the stock falling thereon over its lower edge for further action or treament from the parts carried by the lower shoe of the machine.

Mounted for vibratory movements longitudinally of the machine, just below the sieve-shoe 9, is another sieve-shoe 33. This sieve-shoe 33 is provided with antifriction rollers or wheels 34′, that work on adjustable and inclined supporting-blocks 35′, by which said shoe is entirely supported. In this preferred construction the blocks 35′ are adjustable, but are rigidly held where set by short nutted bolts 36′, passed therethrough and the sides of the main frame 1. At its right-hand end the shoe 33 is provided with a pair of transversely-extended discharge-spouts 34 and 35, and at its left-hand or lower end it is further provided with a pair of transversely-extended discharge-spouts 36 and 37. A long inclined screen 38 extends from the upper to the lower end of the shoe 33, the same being inclined in the same direction as the upper screens 21. In the drawings an imperforate section 39 extends from the left-hand side of the discharge-spout 35 and projects over the upper end of the screen 38. An imperforate deck 40 extends below the screen 38 from the side of the spout 35 to the right-hand side and upper portion of the spout 36.

Below the shoe 33 a fan comprising a fan-case 41, fan-blades 42, and a shaft 43 is located. The fan-case 41 has a discharge spout or section 44, which is extended upward, so that it passes the end of the screen 38. Adjacent to the end of said sieve 38 the spout 44 is provided with an opening 45 and with an inclined wing or projection 46ª, the projected edge of which underlies the lower end of the said sieve 38. After the spout 44 passes the opening 45 it is curved or bent toward a horizontal position. At its smaller and lower curved surface the discharge end of the spout 44 is provided with a series of overlapping pivoted sections 46, which sections 46 are, as shown, pivotally secured by means of screws 47. Thus the pivoted sections 46 are adapted to be set as shown by the full lines or as shown by the dotted lines in Fig. 1. When the screws 47 are properly tightened, the sections 46 will be frictionally held wherever set. The purpose of these pivoted sections 46 will be brought out in the description of the operation. Pivotally mounted and frictionally held between the sides of the frame 1 by means of a draw-bolt 48 is an adjustable divider-plate 49, the upper and free edge of which terminates below the pivoted sections 46 and is adapted for coöperation therewith.

It has already been stated that the sieve or screen 14 is a wire screen having long and

narrow meshes. The screen 38 is similar in its construction to the screen 14. The sieves or screens 21 and 25 are preferably formed from thin sheet metal, having round perforations for their meshes.

The sieve-bearing shoes 9 and 33 are simultaneously vibrated in reverse directions through the following ordinary driving connections, the parts of which will be but briefly indicated. The fan-shaft 43 is shown as provided with a sprocket-wheel 50, to which a pitman 51 is pivoted at a point eccentric to its axis. The extended end of the pitman 51 is pivoted to the depending end of a vibrating lever 52, which is pivotally fulcrumed to a bracket 53 on a horizontal bar 54 of the frame 1 and works pivotally through brackets 55 and 56, respectively, on the shoes 9 and 33. In practice it is preferable to duplicate the connections just described on the opposite side of the machine.

The fan-spout 44 is further provided with a discharge-orifice 57 in its lower portion, through which grain may fall by gravity, as hereinafter more particularly described.

Operation: The machine above described is capable of use for the separation of a great variety of grains and seeds. It was especially designed, however, for the separation of wheat from oats or the treatment of what is called "succotash." The important feature of novelty in the machine is the combination of parts made up of the series of overlapping sieves 25, main decks 26, and the lap-decks for cooperation with said main decks 26 and sieves 25, and which lap-decks, as shown, are made up of the elements 27 and 31. Hence the action of the machine will be traced with special reference to the said novel combination of parts. Under the vibration of the shoe 9 the feed-bar 18 will be reciprocated in the feed-opening of the hopper, and thereby the stock will be forced outward from the hopper and downward onto the feed-deck 16. From the feed-deck 16 under the shaking motion on the shoe 9 the stock will be fed in an even thin stream onto the head or upper end of the upper or chaffing screen 21. Thence the stock will travel down said screen, and under the coöperation of said screen 21 and its flexible rider 23 the very coarse foreign material—such as chaff, broken straws, sticks, &c.—and also some of the very largest oats will pass as overtail to the coarse spout-screen 14. Through the screen 14 any oats received thereon will fall, while the chaff and broken sticks, heads, &c., will be carried over to the spout 13. The succotash will pass through the chaffing-screen 21, or the most part thereof, and fall onto the deck 22. From the deck 22 the succotash is delivered to the head end of the upper member of the series of sieves 25. The wheat, being smaller than the oats and heavier than the oats, will under the shaking motion of the shoe 9 tend to form the under strata of the stock when the commingled mass of succotash falls onto the head portion of said upper member of said sieves 25. Hence under the treatment of the succotash at the head end of the first sieve 25 wheat chiefly will pass through the sieve. This wheat, falling on the main deck 26, will be directed thereby to the head end of the next lower sieve 25, when a like process will be repeated. Thence it passes from the second deck 26 to the head end of the third sieve 25 and through the same to the delivery-deck 32 for the clear wheat. The succotash which remains on the head sieve 25 continues to travel over the said sieve and a considerable portion—in fact, nearly the whole—of the oats will be delivered as overtail from the lower end of the head sieve 25 to the flap 30, attached thereto. The remaining wheat and some oats will have passed through the lower portion of said upper sieve 25 onto the lap-deck, made up of the elements 27 and 31, as hitherto noted, and will be delivered by said lap-deck to the central portion of the intermediate or next lower sieve 25. Here for a short distance the succotash will receive a treatment similar to the original stock at the head end of the first sieve 25, and the wheat which passes through will be permitted to commingle on the second deck 26 with that which came over the first deck 26 and through the head end of the second sieve 25. The succotash will continue to travel over the lower portion of the second sieve 25, and a considerable percentage of the oats will be carried over or overtailed onto the last flap 30, where it commingles with the overtail from the head sieve as it passes off from the first member of the flaps 30. The succotash which passed through the lower portion of the second sieve 25 is caught by the second lap-deck and delivered thereby to some point below the head end of the lowermost sieve 25. Here an action similar to those already described for the original stock at the head end of the head sieve and the succotash delivered from the first lap-deck to the central portion of the second sieve 25 is repeated on the succotash which is delivered from the second lap-deck to the last sieve 25. Nothing but wheat will pass through and be permitted to join the clean stock, which is already on the delivery-deck 32. The succotash under its continued travel over the lower portion of the last sieve 25 will receive a further separation, the oats passing off as overtail from the last sieve, along with all the overtail from the upper members of said sieves 25, into the offleading or oats spout 34. The succotash which passes through the lower portion of the last sieve 25 will be caught on the deck-section 27 underlying the same and be delivered to the spout 35, whence it may be directed to any point desired—such, for example, as an elevator for conveying the same to a recleaner.

From the foregoing statements and an analysis of the principles involved in the action described it will be seen that I have harmonized two principles regarded as of high im-

portance by all experts in this line of work, but hitherto considered to be irreconcilable. These are (*a*) shortness of travel over any given sieve or separating-surface in order to insure high quality of work, or, otherwise stated, the screen-surface should be short, because the best grade of stock passes through at the head of the sieve; (*b*) length of travel over any given sieve or separating-surface to insure completeness of separation or thorough work, or, otherwise stated, the screen should be long to prevent overtailing of stock which should pass through the sieve. These two principles, it will be seen, I have successfully incorporated in the combination of parts made up of the overlapping sieves 25, the main decks 26, and the lap-decks, shown as made up of the parts 27 and 31. Hence, as a result, I get both speed and quality. Otherwise stated, with a comparatively small amount of separating-surface I get a comparatively large capacity along with a high quality of work. This is something that has not before been accomplished, so far as I know, in any machine of this class. The proper treatment of succotash has long been regarded as one of the most difficult problems among experts in this line of work. To get thorough separation along with large capacity constitutes a highly-important improvement in the art.

The further action on the wheat or stock which is delivered from the upper to the lower shoe, does not require any detailed treatment, as there is but little, if any, novelty in the combination of parts which act thereon. The wheat or stock delivered from the deck 32 to the deck 39 of the lower shoe will pass thence over the long meshed screen 38, and under the shaking motion of the lower shoe the smaller grains of wheat will pass through the screen and onto the deck 40 and be directed thereby to the second-grade wheat-spout 36. The larger grains will pass down over the sieve and be overtailed into the blast-trunk 44, while that of intermediate size or grade or some thereof may be caught at the spout 37. The first or high grade wheat on passing through the trunk 44 is subject to the blast, and the dust and other light impurities will be blown off thereby, while the wheat itself will be dropped down through the openings 57 onto the floor or other receptacle for the same. The pivoted sections 46 of the blast-spout may be set to give any desired intensity of blast onto the stock which is being treated therein. By adjusting the grain-board 49 the precipitated grain may be further subdivided into different grades. The lower shoe 33, under its vibrating motion, also received a rising-and-falling motion under the coöperation of the rollers 34 and the blocks 35.

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

1. In a grain-separator, the combination with a series of overlapping sieves receiving the passed stock, one from the other, the lower sieves projecting successively in a given direction, of a corresponding series of main or head decks underlying each higher sieve for receiving from the head portion of the overlying or higher sieve and delivering to the head of the next lower sieve, and a corresponding series of lap-decks underlying the lower portion of each higher sieve and overlying the upper portion of each lower sieve, said lap-decks inclining in the same direction as said main decks and sieves, for receiving from the lower portion of the overlying sieve and delivering to the central portion of the lower or underlying sieve, substantially as and for the purposes set forth.

2. In a grain-separator, the combination with a series of overlapping sieves 25 arranged substantially as described, of a series of head or main decks 26 underlying each higher sieve for receiving from the upper portion thereof and delivering to the head of the next lower sieve, and the series of lap-decks composed of the rigid sections 27 and the sections made up of the flexible flaps 31, for receiving from the lower section of the upper screen, and delivering to the lower section of the next screen substantially as described.

3. In a grain-separator, the combination with a shaking-shoe 9, of the series of overlapping sieves 25, the series of main decks 26 underlying each higher sieve for receiving from the upper portion thereof and delivering to the head of the next lower sieve, the series of lap-decks made up of the rigid sections 27 and the flexible flap-sections 31 underlying the lower portion of each higher sieve and overlying the head portion of each lower sieve, and the series of flexible riders or flaps 28 and 30, all arranged and operating substantially as and for the purposes set forth.

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

ANTON S. FROSLID.

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