No. 775,418. PATENTED NOV. 22, 1904.

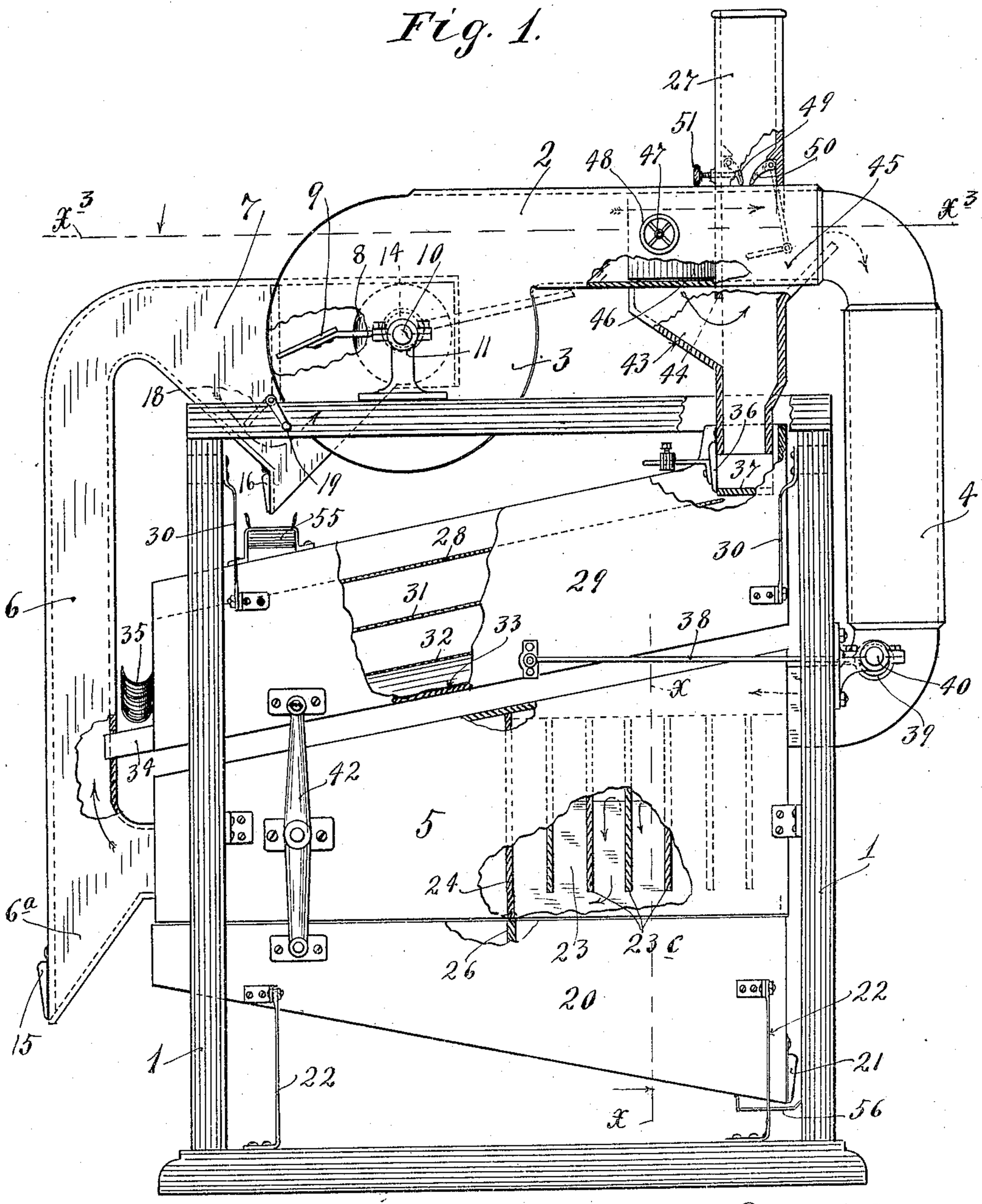
E. R. DRAVER.

COMBINED GRAIN SEPARATOR AND DUST COLLECTOR.

APPLICATION FILED JUNE 25, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.



Witnesses
A. H. Opsahl.
N. D. Wilgus.

Inventor
E. R. Draver
By his Attorneys.
Williamson & Merchant

No. 775,418. PATENTED NOV. 22, 1904.

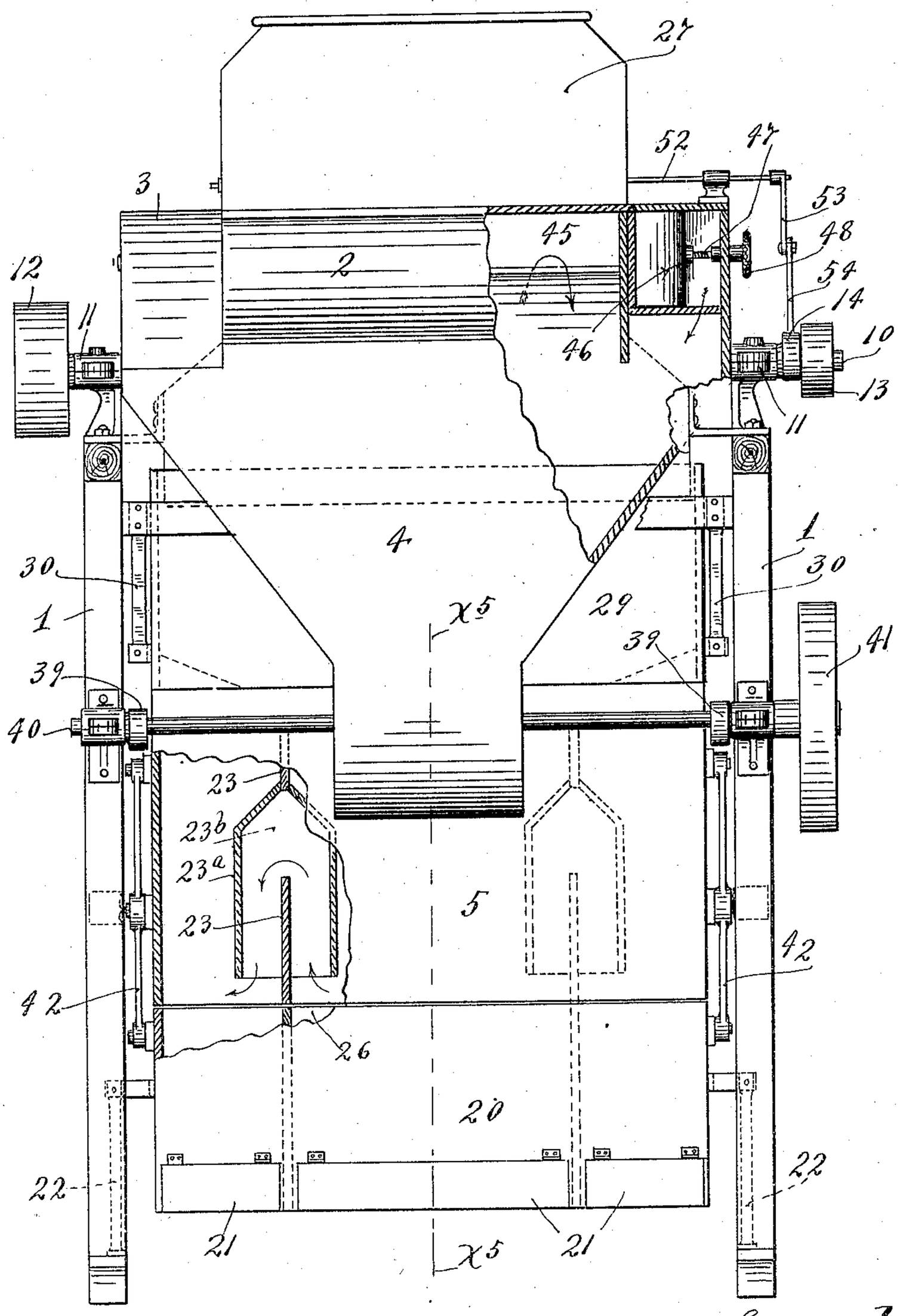
E. R. DRAVER.

COMBINED GRAIN SEPARATOR AND DUST COLLECTOR.

APPLICATION FILED JUNE 25, 1903.

NO MODEL. 4 SHEETS—SHEET 2.

Fig 2.



Witnesses.
A. H. Opsahl.
N. D. Wilgus

Inventor.
F. R. Draver
By his Attorneys.
Williamson & Merchant

No. 775,418. PATENTED NOV. 22, 1904.

E. R. DRAVER.

COMBINED GRAIN SEPARATOR AND DUST COLLECTOR.

APPLICATION FILED JUNE 25, 1903.

NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.

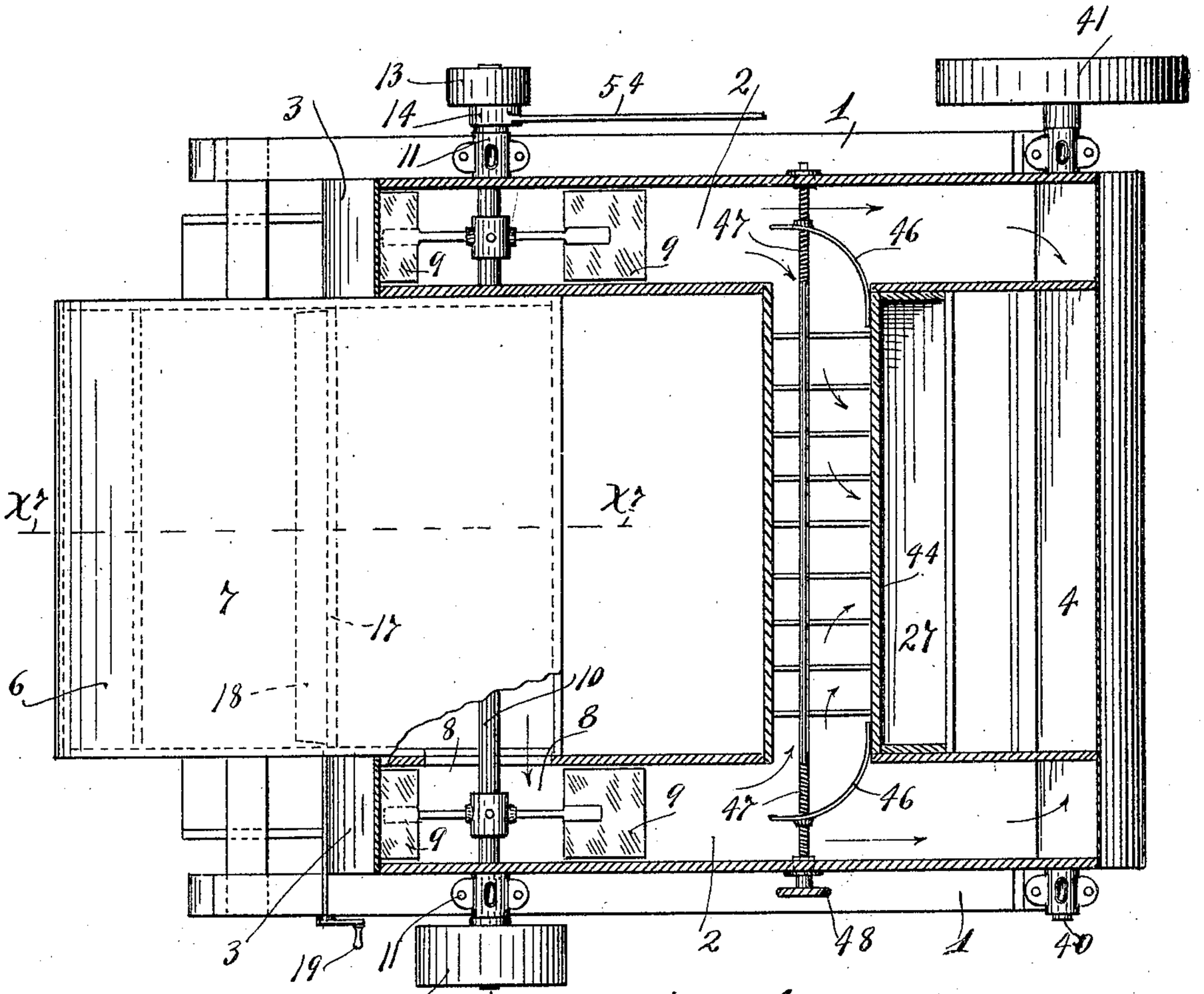
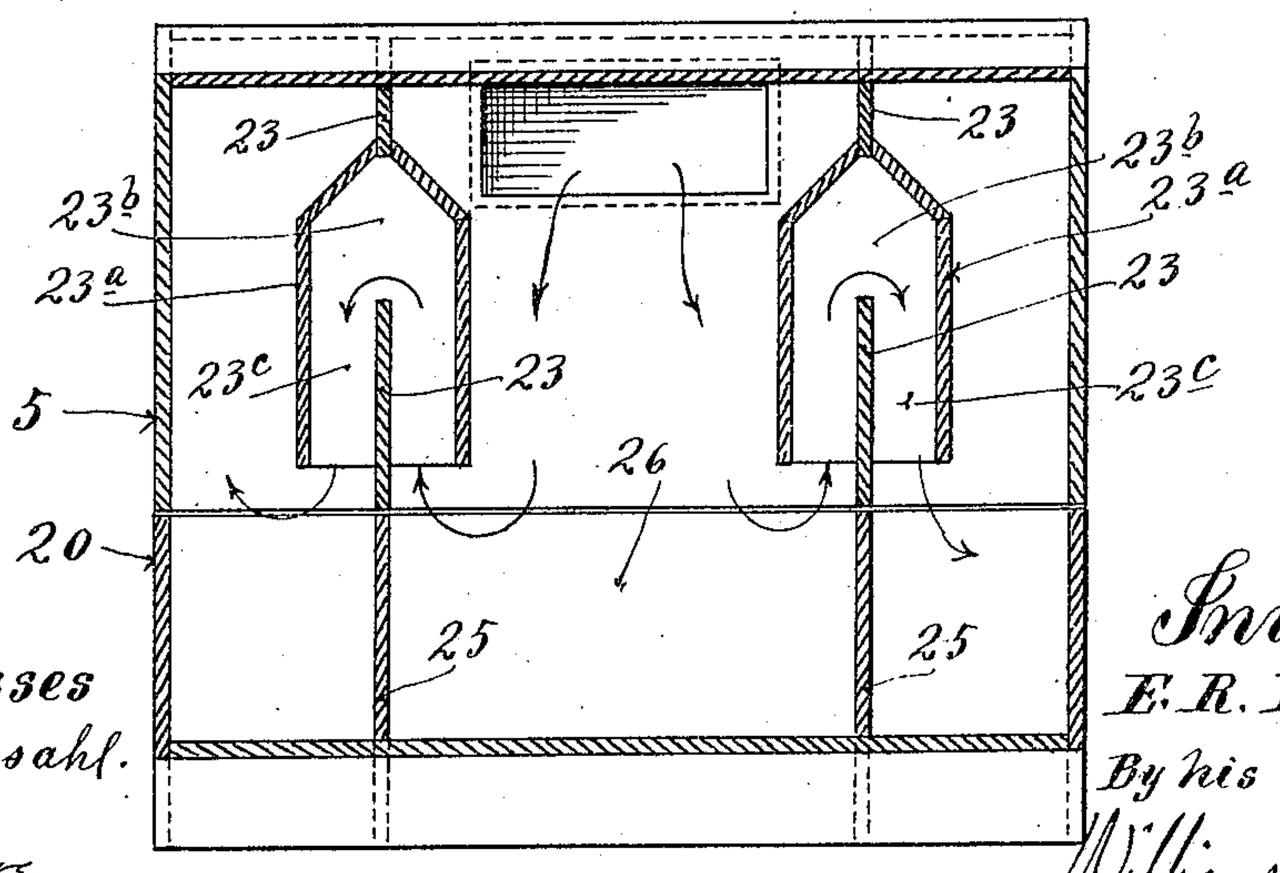


Fig. 4.



Witnesses
A. H. Opsahl.
N. S. Kilgore.

Inventor.
E. R. Draver.
By his Attorneys.
Williamson & Merchant

No. 775,418. PATENTED NOV. 22, 1904.

E. R. DRAVER.

COMBINED GRAIN SEPARATOR AND DUST COLLECTOR.

APPLICATION FILED JUNE 25, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.

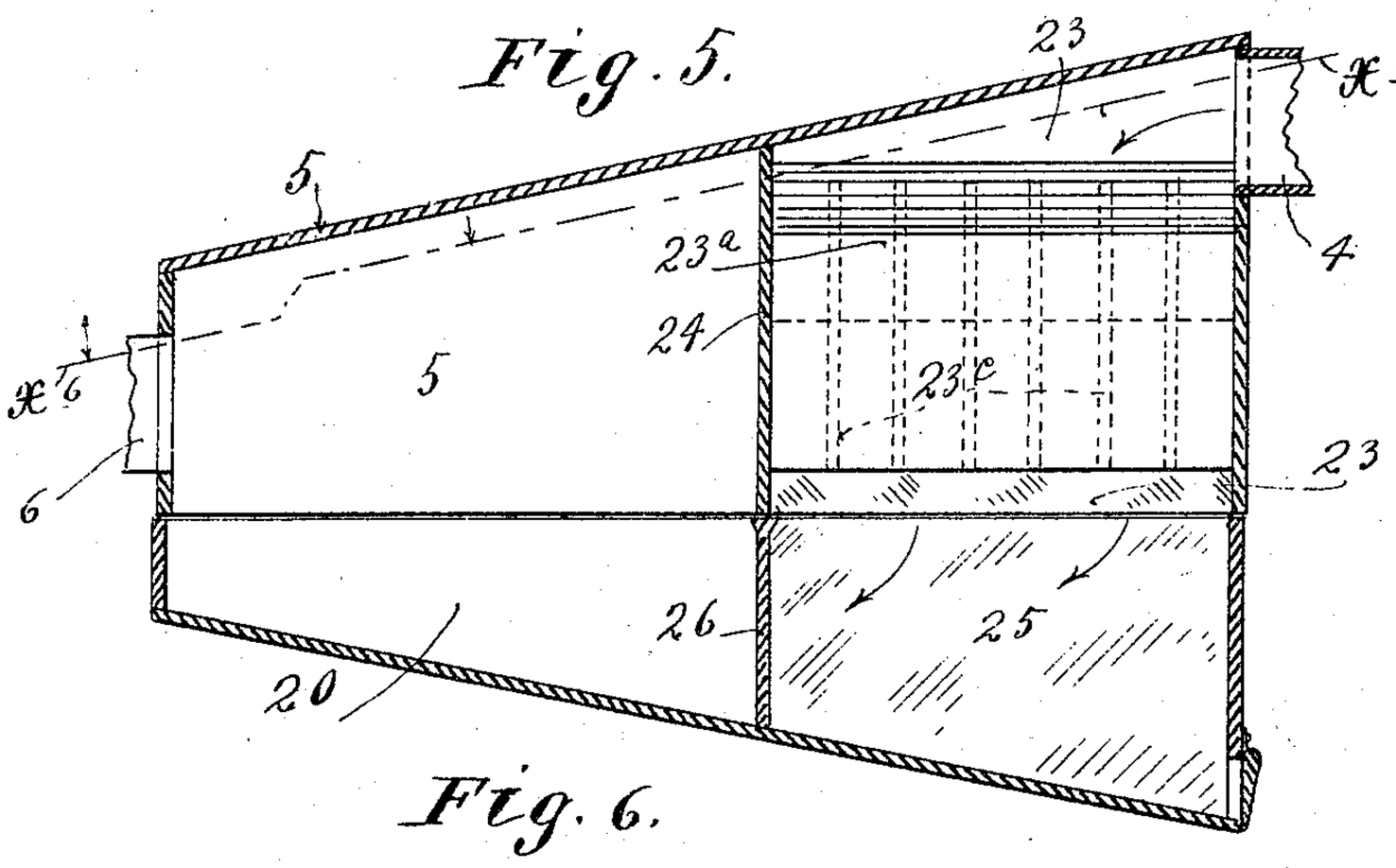


Fig. 6.

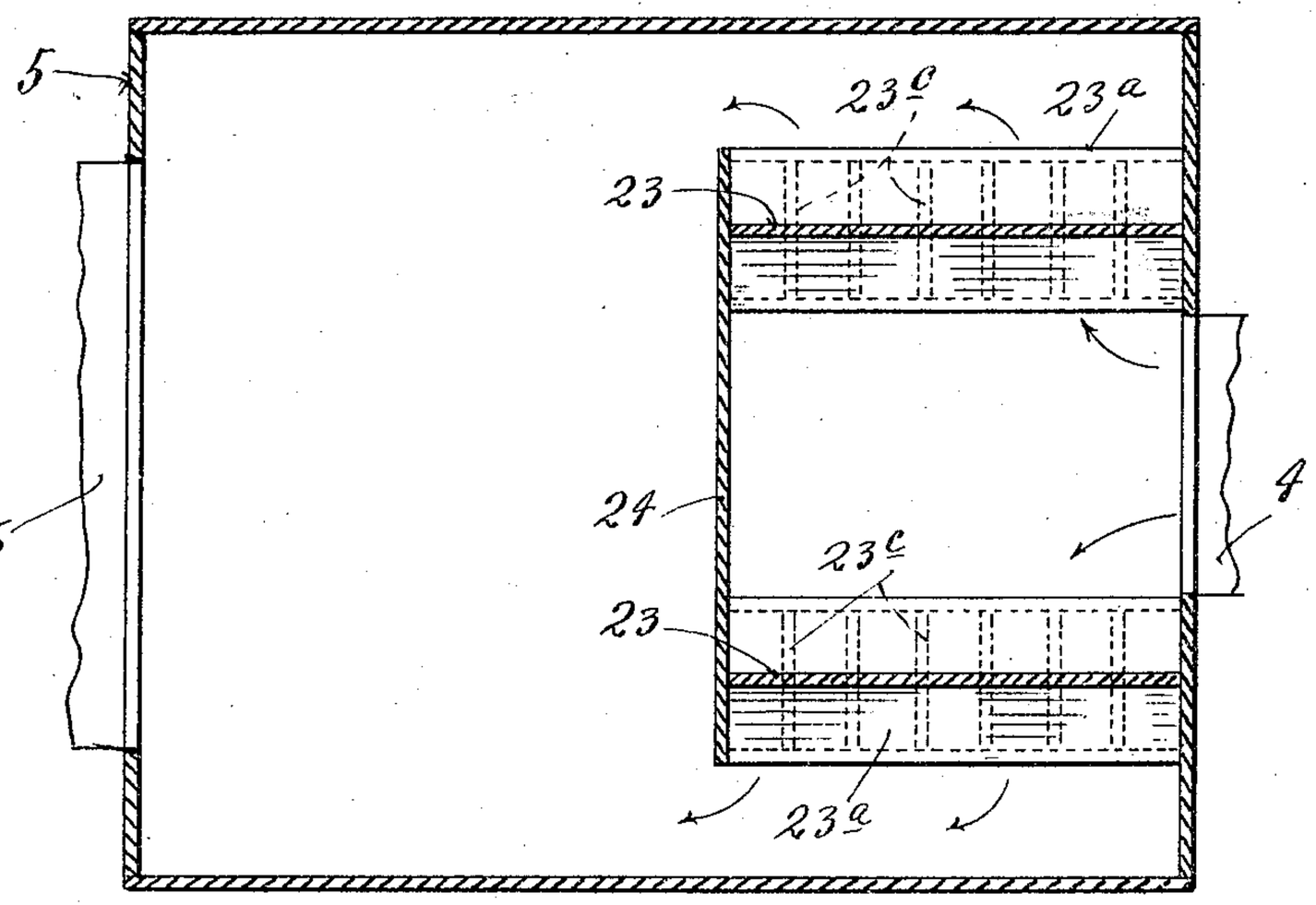
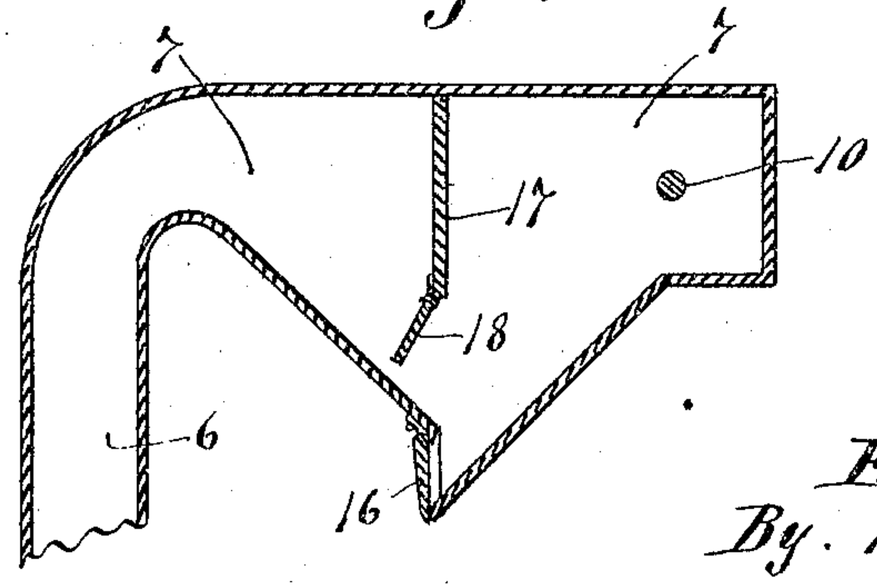


Fig. 7.



Witnesses
A. H. Ossahl.
W. D. Wilgus

Inventor.
E. R. Draver
By. his. Attorneys
Williamson & Merchant.

No. 775,418. Patented November 22, 1904.

UNITED STATES PATENT OFFICE.

EMIL R. DRAVER, OF RICHMOND, INDIANA.

COMBINED GRAIN-SEPARATOR AND DUST-COLLECTOR.

SPECIFICATION forming part of Letters Patent No. 775,418, dated November 22, 1904.

Application filed June 25, 1903. Serial No. 162,976. (No model.)

To all whom it may concern:

Be it known that I, EMIL R. DRAVER, a citizen of the United States, residing at Richmond, in the county of Wayne and State of Indiana, have invented a certain new and useful Improvement in a Combined Grain-Separator and Dust-Collector; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention has for its object to provide a combined grain-separator and dust-collector of improved construction; and to this end it 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 characters indicate like parts throughout the several views.

Figure 1 is a side elevation of the complete machine, some parts being broken away. Fig. 2 is an end elevation of the machine, with some parts broken away, looking at the machine from the right toward the left with respect to Fig. 1. Fig. 3 is a horizontal section on the line x^3 x^3 of Fig. 1, some parts being broken away. Fig. 4 is a vertical section taken transversely through a portion of the machine on the line x^4 x^4 of Fig. 1. Fig. 5 is a vertical section from front to rear of the machine, taken approximately on the line x^5 x^5 of Fig. 2. Fig. 6 is an approximately horizontal section taken on the line x^6 x^6 of Fig. 5, and Fig. 7 is a detail in vertical section on the line x^7 x^7 of Fig. 3.

The various parts of the machine are supported directly or indirectly from the rectangular skeleton frame 1, shown as constructed of timber.

In this invention I employ what I term an endless "air-trunk" and which includes one or more fans and a dust-collector. In the best arrangement of this air-trunk a portion thereof is bifurcated or formed with two branches which unite at both ends in the common body of the trunk, and in each of these branches is interposed a fan.

In the drawings the numeral 2 indicates the bifurcated upper section of the air-trunk, which is constructed to afford laterally-spaced fan-cases 3.

The numeral 4 indicates a depending hopper-like section of the air-trunk which unites the bifurcated section thereof and opens at its lower end into the receiving end of a box or case 5 of the dust-collector. The delivery end of the said box or case 5 is connected to an approximately vertical section 6 of the air-trunk, the upper portion of which section 6 is turned laterally inward and expanded to afford a precipitating-hopper 7. The hopper 7 is of such width that it extends between the fan-cases 3, and at its sides and upper portion it has communication with the said fan-cases through large axial openings or eyes 8 in the sides of said fan-cases.

The parts so far described are all rigidly secured to the frame 1. Fan-heads 9 of ordinary or any suitable construction work one in each of the fan-cases 3 and are carried by a common shaft 10, extended transversely through the fan-cases and hopper 7. The fan-shaft 10 is suitably journaled in bearings 11 on the frame 1, and at one end it is provided with a pulley 12, while at its other end it is provided with a pulley 13 and a short-throw eccentric 14, for purposes which will hereinafter appear.

The lower end of the trunk-section 6 depends from its junction with the box or case 5 to form a catch-hopper 6^a, having an opening which is normally closed by a gravity-actuated hinged door 15. The so-called "precipitating-hopper" 7 is formed with a discharge-opening, which is normally closed by a gravity-held hinged door 16. Depending within the said hopper 7, from the upper wall thereof, is a deflecting-plate 17, provided at its lower edge with an adjustable hinged section 18, as best shown in Fig. 7. The hinged deflecting-section 18 is provided with a shaft that projects outward through one wall of the hopper 7 and is provided with a hand-piece 19, by means of which the said section 18 may be adjusted to vary the throat-opening or passage between the free edge of the said section 18 and the bottom of the hopper. Said hopper or enlarged chamber 7 in the air-conduit, taken together with the coöperating parts 16,

17, and 18, constitute a screenings-trap located in the air-conduit at a point intermediate the outlet and the inlet of the dust-collecting chamber 5.

The box or case 5 of the dust-collector is closed at its top and sides, but is open at its bottom, and immediately below said box is an approximately rectangular dust receptacle or box 20, having an inclined bottom and provided at its lower end, as shown, with three openings normally closed by gravity-held hinged doors 21. The said dust-receptacle is shown as supported from the base of the frame 1 by spring-legs 22, so that it is free for a slight vibrating motion. The open upper portion of the box 20 always closely engages the open bottom of the dust-collecting box 5, and, if desired, a flexible joint, such as a canvas strip, may connect the two. The interior of the dust-collecting box 5 is divided into two compartments by a pair of parallel vertically-divided partitions 23 and a transverse partition 24, extended from the top to the bottom of said box, except that longitudinal spaces are left between upper and lower sections of the partitions 23. Likewise the dust receptacle or box 20 is divided into two compartments by parallel partitions 25 and transverse partitions 26, which partitions rise from the bottom of said box and aline, respectively, with the partitions 23 and 24 of the box 5. The upper sections of the partitions 23 are provided with depending inverted-trough-like sections 23^a, which overlap the lower sections of said partitions but leave inverted-**U**-shaped passages 23^b, as best shown in Fig. 4. In the depending trough-like sections 23^a are transverse partitions 23^c, which divide the **U**-shaped channels 23^b longitudinally into short sections or passages.

The grain to be cleaned is delivered to the machine through a vertically-disposed supply-spout 27, which passes between the bifurcated sections or branches 2 of the air-trunk and delivers the grain onto the upper screen 28 of a vibrating shoe 29, which, as shown, is supported from the frame 1 by depending spring-legs 30. As shown, the shoe 29, in addition to the screen 28, has screens 31 and 32 located below said screens 28. The bottom of the shoe 29 is closed by an inclined imperforate bottom 33, which at its lower end terminates in a spout projection 34, that projects into the section 6 of the air-trunk, as best shown in Fig. 1. The screens 28 and 31 may be assumed to discharge onto the transverse inclined discharge-trough 35, carried by the shoe 29, while the sieve 32 may be assumed to discharge on top of the spout-section 34 and from thence at one side of the shoe. The exact arrangement is not important so far as the present invention is concerned. As shown, a weighted hinged valve-plate 36 is hinged to the lower end of the grain-supply spout 27, and this valve cooperates with a small shelf 37, carried by the shoe 29, to feed the grain in the proper proportions under the vibrating movement of the said shoe. To impart vibrating movements to the shoe 29, it is connected by eccentric-rods 38 to a pair of eccentrics 39, carried by a counter-shaft 40, mounted in suitable bearings in the frame 1 and provided at one end with a pulley 41. An ordinary belt (not shown) will run over the said pulley 41 and over the pulley 13 of the fan-shaft and impart motion from the said fan-shaft to the said counter-shaft 40. A pair of levers 42, fulcrumed to the dust-collecting box 5 and pivotally connected to the shoe 29 and to the dust-receiving box 20, impart vibrating motions from the former to the latter.

We will now return to the construction of the grain-supply spout 27 and will describe its important relation to the air-trunk and other coöperating elements. Below the horizontally-extended upper section of the air-trunk the spout 27 is formed with a hopper-like lateral extension 43, which communicates from end to end with an overlying transverse portion of the air-trunk. The section 43 is preferably formed with dividing-partitions 44, as best shown in Fig. 3. At its rear side the spout 27 opens at 45 directly into the upper hopper-like section 4 of the air-trunk. It will be noted that the extension 43 and the opening 45 will permit a portion of the air forced through the air-trunk to pass transversely through the grain-supply spout 27, and hence will afford what is herein designated as the "main passage of the air-trunk." The space between the side walls of the main supply-spout 27 and the side walls of the conduits or trunk-sections 2 afford by-passes for coöperation with said main passage under the controller-valves to determine the quantity of air which will be forced either through the main passage or the by-passages at will. To vary the amount of air which will pass through the air-trunk by-passes and through the said main passage thereof, cut-off valves or gates are provided, and these are preferably arranged as shown in the drawings, wherein said valves are in the forms of curved plates 46, mounted to slide so as to open or close, more or less, the branches 2 of the air-trunk just beyond the transverse portion thereof which leads to the main passage just noted—to wit, directly to the lateral extension 43 of the grain-spout 27. These valves 46 are adjusted by means of a transverse rod 47, mounted in the sides of the air-trunk section 2 and having screw-threaded engagement with said valves, one of the threads being a right and the other a left. The rod 47 projects at one end and is provided with a hand-piece 48, by means of which it may be turned.

The flow of the grain through the feed-spout 27 is regulated by a pair of choke-plates 49 50, the former of which is subject to an adjusting-screw 51 and the latter of which is

continuously vibrated, being provided with a projecting shaft 52, mounted in suitable bearings on the air-trunk and provided at one end with an arm 53, connected by an eccentric-rod 54 to the eccentric 14, carried by the fan-shaft and already noted. As shown in the drawings, the hopper 7 discharges into a transverse trough 55, carried by the shoe 29, and the dust-box 20 discharges into a transverse trough 56, supported by the frame 1.

Operation: The uncleaned grain as it falls through the supply-spout 27 is, as already clearly described, precipitated through the blast of air which is directed through the said spout by the so-called "main passage of the air-trunk." This blast of air carries off dust and light foreign material and delivers the same to the dust-collector. The air laden with dust and with other materials noted, which are carried off from the grain in the spout 27, is delivered into the receiving-compartment of the dust-box 5 and in escaping therefrom into the other compartment of said box is caused to take a winding course through the inverted U-shaped channels 23^b, as indicated by the arrows marked on Fig. 4. Under the above action of forcing the air through the said channels 23^b the lower sections of the partitions 23 and the depending walls of the inverted troughs 23^a act as deflecting-plates, which cause the precipitation of all the heavier particles carried by the air, and these falling are caught by the dust-receiving box 20, from whence when they accummulate sufficiently to open the hinged doors 21 they will be discharged onto the transversely-inclined trough 56 and from thence into any suitable receptacle. (Not shown.) The purified air will pass from the dust-collector through the trunk-section 6 and precipitating-hopper 7 back to the fans. The feed-spout 27 directs the purified grain freed from the light dust, chaff, oats, and other foreign materials onto the feed device at the head of the shoe 29 and from thence onto the upper screen 28 of said shoe. The upper screens of the said shoe, as already stated, serve to carry off the various foreign materials which may not have been removed therefrom by the primary action of the air-blast, while the pure grain is directed by the spout 34 at the foot of the shoe 29 into the air-trunk section 6, wherein the strong upward current of air carries the screenings (light, impure grain) upward toward the fans and into the so-called "precipitating-hopper" 7. The pure grain freed from screenings drops into the catch-hopper 6^a of the trunk-section 6, from whence it escapes whenever it is accummulated sufficiently to press open the gravity-held door 15. The screenings in passing through the precipitating-hopper 7 are caused to take an abrupt turn around the lower edge of the hinged section 18 of the deflecting-partition 17 and are thereby precipitated into the bottom of the hopper. The pure air is then again taken up by the fans and caused to again travel through the endless air-trunk and perform over again the several functions just described.

By the adjustment of the valves 46 the openings through the prongs or bifurcations 2 of the air-trunk may be varied at will, so that any desired proportionate amount of the entire flow of air may be directed through the main passage of the air-trunk by-passes thereof, or, in other words, any desired amount of air may be made to pass through the grain dropped down through the grain-supply spout 27. This feature is of great importance, since grain under different conditions will require more or less air—that is, a stronger or lighter blast of air to properly clean the same. Again, this by-passage in the air-trunk is important, for the reason that a larger amount of air is usually required to separate the screenings and impure grain from the pure grain in the air-trunk than is required to remove the light dust, chaff, and broken straw in the supply-spout. It will thus be seen that the grain is relieved from light dust before it is subjected to the screening device, and by said screening device is further cleaned and then a second time passed through the endless air-trunk and subjected to the entire blast of the endless air-belt, and that this strong blast serves to take up the screenings and deposit the same in the screenings-trap, leaving the purified air to return to the fan and commence its work over and over again.

It is evident that all the air which is passed through the grain before the grain reaches the screen is again passed through the grain after the grain leaves the screen, and also that the air which passes through the so-called "by-pass" is caused to pass through the grain after the grain passes from the screen. By this arrangement a given amount of separation may be effected with a minimum amount of air, and hence the machine is reduced to a minimum in size, and the power required to drive this machine is also reduced to a minimum.

It will be understood that the machine described is capable of modification within the scope of my invention as herein set forth and claimed. It will also be understood that the machine is capable of general use for cleaning or separating material composed of relatively light and relatively heavy or coarse particle.

In the machine illustrated two fans are shown, but it will be understood that a single fan of the proper capacity might be made to do the work and could be located in any other suitable position. Many other changes in the details of the construction might be made without departing from the spirit of the invention.

The leading feature of novelty in this machine is the construction affording an endless air-trunk, through which the fan circulates a continuous belt of air, and a duct-collecting chamber, in combination with means for pass-

ing the grain through said belt of air at least twice at points intermediate the inlet and the outlet of said dust-collecting chamber. By this construction the dust and light foreign material are first removed from the grain and then the screenings are removed at the subsequent passage of the stock through the air-belt. Otherwise stated, the dust and the screenings are separately removed at different stages of the action, which enables me to secure both the good grain and the screenings entirely free from dust. Still otherwise stated, dust and screenings cannot be removed and separated from each other under a single action by an air-belt. So far as I know this is broadly new. No instance is shown in the prior art, so far as I am aware, wherein a continuous belt of air is kept in circulation through an endless air-trunk and wherein there is combined, with the fan and trunk-sections, a sieve-shoe and dust-collecting chamber coöperating to secure the results above stated.

By actual practice I have demonstrated the efficiency of this machine for the purpose intended. My design herein disclosed affords a machine which is cheap to make and gives large capacity at low cost. Moreover, this machine gives much better separation for any given capacity per unit of time as compared with any "open-blast" machine. As compared with any "continuous-air-belt" machine disclosed in the prior art, so far as known to me, my machine affords the complete separation of the dust, the screenings, and the good grain, whereas all others in the prior art deliver the screenings and the dust together unseparated from each other.

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

1. The combination with an endless air-trunk, including a fan and a dust-collector, of a screen located entirely outside of said air-trunk, and means for delivering the grain to said screen, first through the endless air-belt in said air-trunk, at a point between the outlet of said fan and the inlet of said dust-collector, and from said screen, a second time through the air-belt in said air-trunk, at a point between the outlet of said dust-collector and the inlet of said fan, whereby the grain is relieved from light dust before it is passed to said screen, and by said screen is further cleaned, and then again subjected to the said endless belt of air, substantially as described.

2. The combination with an endless air-trunk, including a fan and a dust-collector, a screen located entirely outside of said air-trunk, and means for delivering the grain to said screen, first through the endless belt of air in said air-trunk, at a point between the outlet of said fan and the inlet of said dust-collector, and from said screen, through the entire blast of said air-belt, at a point between the outlet of said dust-collector and the inlet of said fan, said air-trunk having a valve-equipped by-pass for directing part of the air through the grain and a part of the air around the grain, or the whole thereof through the grain, at the point where first passed through the air-belt, substantially as described.

3. The combination with an endless air-trunk, including a fan, a dust-collector, and a screenings-trap, of a screen located entirely outside of said air-trunk, and means for delivering the grain to said screen, first through the endless belt of air in said air-trunk, at a point between the outlet of said fan and the inlet of said dust-collector, and from said screen, a second time through the air-belt in said air-trunk, at a point between the outlet of said dust-collector and the inlet of said screenings-trap, whereby the grain is relieved from light dust before it is delivered to said screen, and by said screen is further cleaned, and delivered back into the purified air of the same endless air-belt, and is thereby relieved from screenings, the screenings being deposited in said screenings-trap, substantially as described.

4. The combination with an endless air-trunk, including a fan, a dust-collector, and a screenings-trap, of a screen located entirely outside of said air-trunk, means for delivering the grain to said screen, first through the endless air-belt in said air-trunk, at a point between the outlet of said fan and the inlet of said dust-collector, and from said screen, a second time through said air-trunk, and through the entire blast of said air-belt, at a point between the outlet of said dust-collector and the inlet of said screenings-trap, and a valve-equipped by-pass in said air-trunk for directing the whole or any desired part of the blast through the grain, at the point where first fed through said air-belt, substantially as described.

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

EMIL R. DRAVER.

Witnesses:
JOSEPH MARCHANT,
F. W. MARCHANT.