May 31, 1927. 1,630,780

T. D. BUDD ET AL

DUST COLLECTING SYSTEM FOR GRAIN ELEVATOR GARNERS

Filed Jan. 15, 1925 4 Sheets-Sheet 1

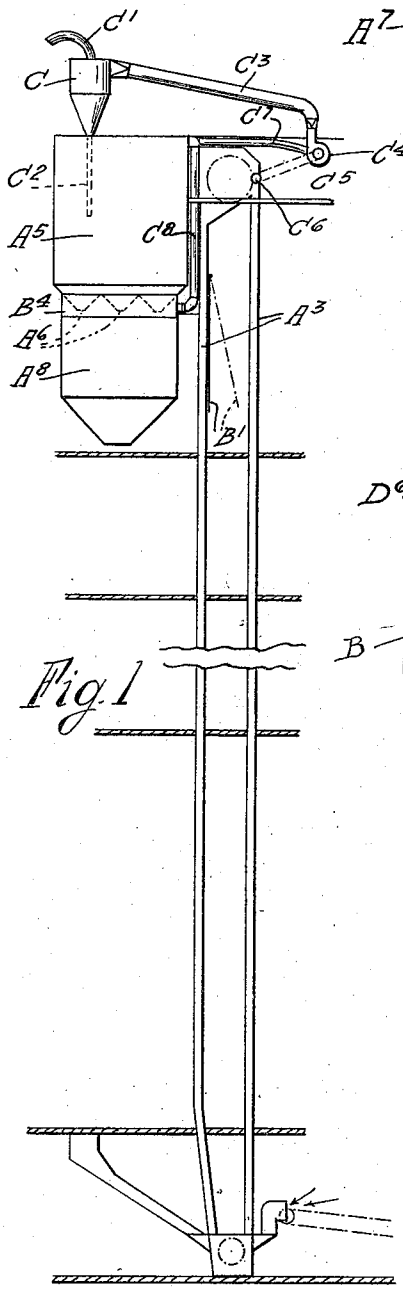


Fig. 1

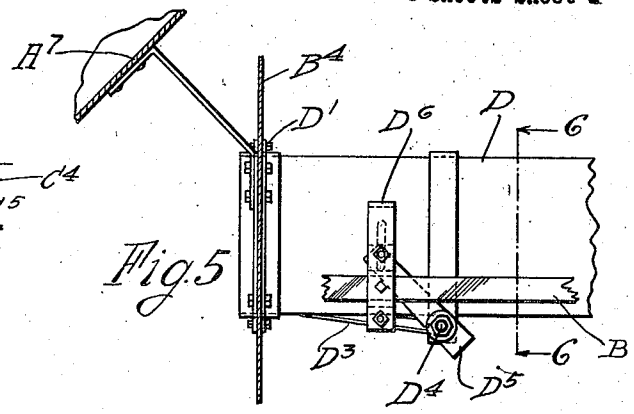


Fig. 5

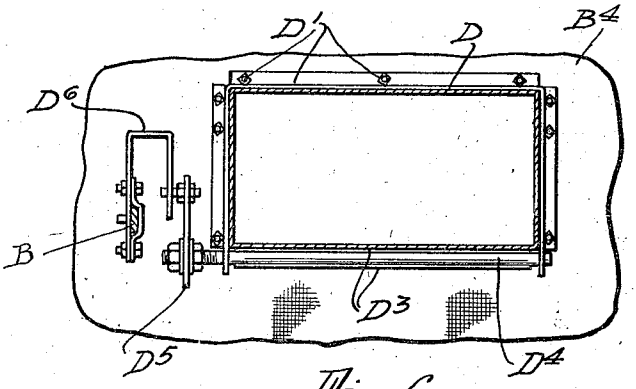


Fig. 6

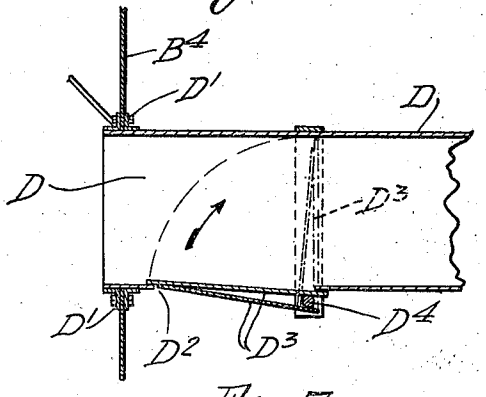


Fig. 7

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DUST COLLECTING SYSTEM FOR GRAIN ELEVATOR GARNERS

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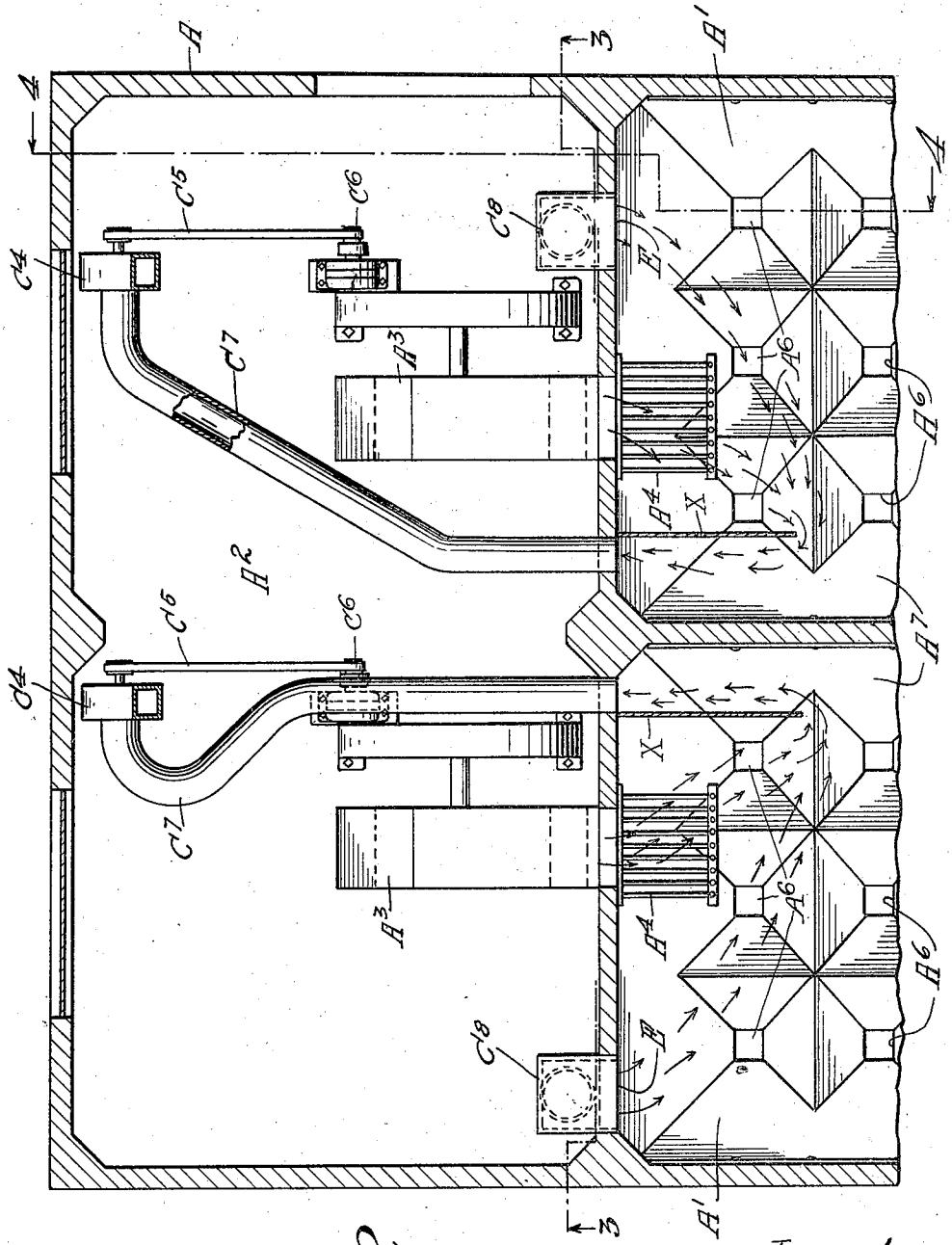


Fig. 2

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DUST COLLECTING SYSTEM FOR GRAIN ELEVATOR GARNERS

Filed Jan. 15, 1925 4 Sheets-Sheet 3

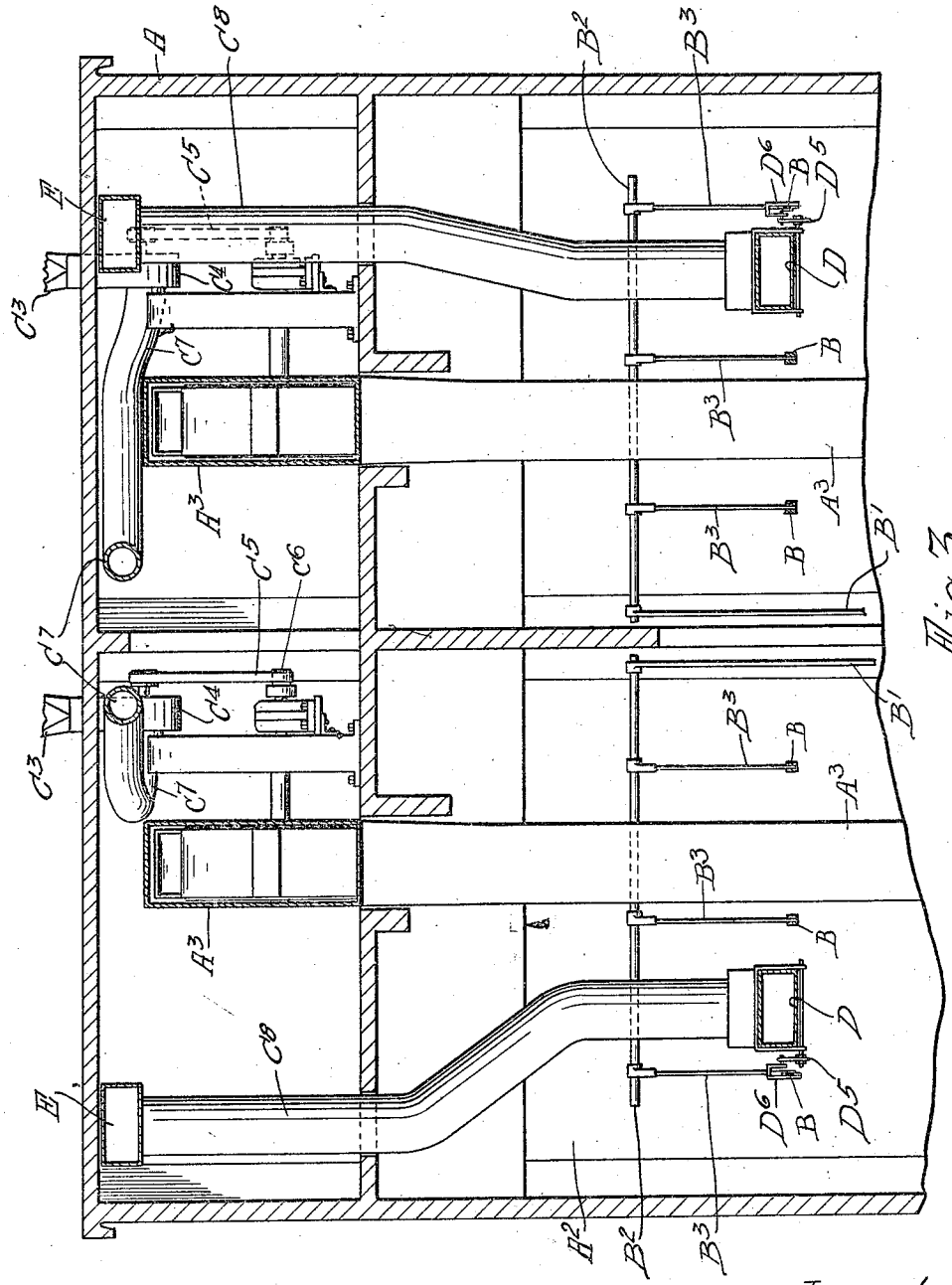


Fig. 3

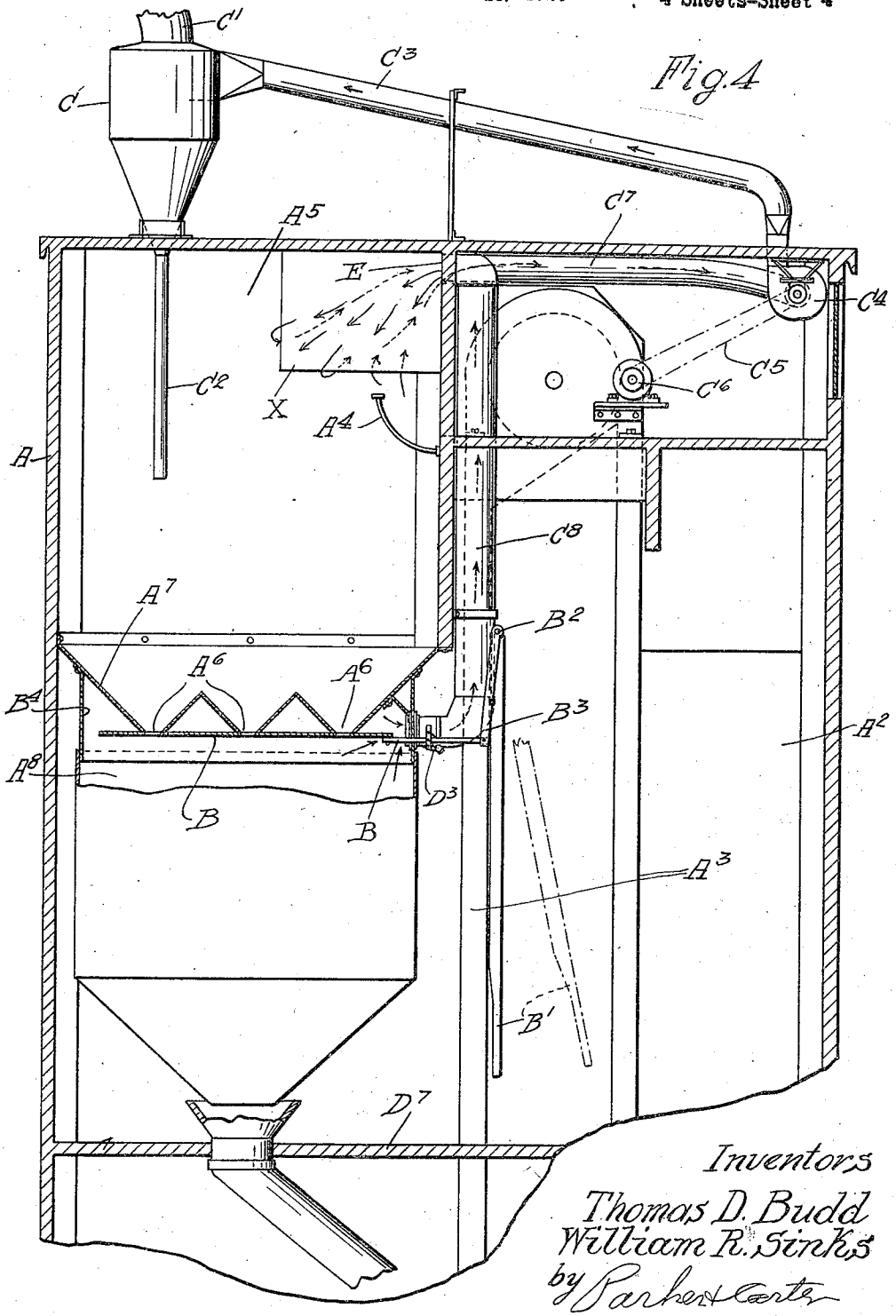
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DUST COLLECTING SYSTEM FOR GRAIN ELEVATOR GARNERS

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Fig. 4



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UNITED STATES PATENT OFFICE.

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DUST-COLLECTING SYSTEM FOR GRAIN-ELEVATOR GARNERS.

Application filed January 15, 1925. Serial No. 2,500.

Our invention relates to improvements in ventilating dust collecting and dust prevention system for grain elevators and the like and has for one object to provide means for circulating the dust laden air to and through the garner scale and elevator leg and for withdrawing dust therefrom and returning it in the garner. The need for this arises from the fact that in grain elevator work it is necessary to maintain a high degree of accuracy with regard to the weight of the grain and if the circulating air is allowed to escape carrying with it dust that has been weighed with the grain, the weight of the grain being handled will change and inaccuracy in the handling, measuring and recording of the grain will result.

Our invention is therefore adapted to decrease the liability of dust explosions and fire hazards and for ventilating, collecting the dust and preventing the spread of dust in grain elevators and the like, and has for one object to provide means for positively circulating the dust laden air to and through the garner, and provides a positive suction on the garner, the scale and the elevator leg for withdrawing dust therefrom and returning it to the grain in the garner from which it was taken, and at the same time affords a positive system of ventilation for the several floors of the elevator, including the basement. Furthermore, this escaped dust circulates and accumulates throughout the various floors of the elevator, including the basement, thus creating a fire and explosion hazard, and when and as it accumulates it has to be removed from the elevator by labor and disposed of, as the rules governing the handling of grain in elevators do not permit of the dust being returned to the grain after its identity has been lost.

Our invention is shown in connection with that part of the grain handling system located at the top of the house and illustrates the garner and associated parts. Other objects will appear from time to time throughout the specification and claims.

Our invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a diagrammatic side elevation of leg, garner and scale;

Figure 2 is a section through the top of the house;

Figure 3 is a section along the line 3—3 of Figure 2;

Figure 4 is a section along the line 4—4 of Figure 2;

Figure 5 is a detail of the control valve;

Figure 6 is a section along the line 6—6 of Figure 5;

Figure 7 is a section through the valve.

Like parts are indicated by like characters throughout the specification and drawings.

A, A are the walls of the grain elevator house. This house contains bin sections A^1 A^1 and a working section A^2. In the working sections are legs of elevators A^3 adapted to raise the grain and discharge it through screens A^4 into the garner A^5 whence the grain may be discharged through openings A^6 in the hopper bottoms A^7 to a scale hopper A^8.

The flow of the grain through these hoppers is controlled by the garner slide B, the movement of which is controlled by garner levers B^1 on control shafts B^2 which rotate the shafts, the arms B^3 and thus the garner slides. B^4 is a canvas curtain or apron depending downwardly from the hopper bottoms A^7 toward the scale hopper A^8.

C is a dust collector having an air outlet C^1 for the discharge of clean air into the outer atmosphere and a discharge spout C^2 adapted to discharge dust into the garner. C^3 is a conduit for dust laden air leading from the centrifugal fan C^4 and discharging into the rotary or centrifugal dust collector. This fan is driven by a belt C^5 from the pulley C^6 at the top of each of the legs, there being one leg for each garner and one dust collector fan and conduit for each leg so that when the leg stops running, the displacement of air by the fan will also stop. C^7 is a conduit leading from the top of the garner A^5 to the fan C^4 and C^8 is a suction duct leading from the top of the garner to the scale hopper inside the curtain B^4, so that air is drawn from the garner to the fan setting up a vacuum in the garner and when this takes place, air is also drawn from the scale hopper to the garner and discharged therefrom at a point remote from the connection to the fan. D^3 is a control valve at the lower end

of the conduit which controls the flow of air from the scale hopper to the garner.

The necessity for this valve is obvious because if a suction were placed on the scale hopper when weighing is taking place, the weighing action would be radically interfered with and it is desirable to have a suction then only during the time when the grain is flowing to the hopper and during the time when dust is being created.

The control valve D^3 is adapted to control the flow of air through the conduit C^8 to and through the fan and dust collector. This valve is located in a horizontal sleeve D, one end of which penetrates the curtain B^4 being attached thereto by flanges and bolts as indicated at D^1 to make an air tight joint. The lower part of this sleeve is apertured at D^2, the valve plate D^3 being adapted to close the aperture. This valve plate is mounted on a shaft D^4 having a valve lever D^5 and a yoke connection D^6 to the garner slide. When the plate D^3 is in the dotted line position shown in Figure 7, the operator can look in through the sleeve and through the port in the curtain to the space beneath the garner to the space through which the grain flows to the scale hopper. The relation between this valve and the garner slide is such that when the garner slide shuts off the stop the valve closes the conduit and obstructs the flow of air and permits the operator to look in. When the flow of grain is taking place the garner slide is open, the valve is open, the air circulates but the operator cannot look in. The operator to manipulate the garner lever to make his inspections through the valve sleeve stands on the floor D^7 where he has control of the weighing and the operation of the garner.

The conduit C^7 also has a communication at E with the interior of the garner and thereafter with the leg A^3 which discharges thereinto. Thus the garner chamber and the leg A^3 with its conveyor are all stopped at a separate atmospheric pressure. This prevents escape of dust or dust laden air from any part of the system. As soon as the elevator in the leg starts working a suction is put on the leg and thus there is an upflow of air in the same direction as the flow of grain and an inflow of air at the inner leg of the bottom of the conveyor leg. There is a tendency for air to flow in through the joints of the inner leg and thus no dust escapes. This is in sharp contrast with the normal operation without the fan where the buckets of the conveyor tend to discharge dust laden air outwardly into the house thus preventing all of the weight of the grain from reaching the garner and being weighed and adding to the fire risk.

When the grain is discharged from the garner into the scale bin, the air displaced from the bin will normally rush out carrying dust with it. This dust ought to be weighed and is not and ought not to be distributed around the house because it adds to the fire risk. The suction space on the scale bin draws the air out through the dust system as it is displaced by the grain and the dust. The separator returns heavier particles of dust back into the grain in the garner from which it came, so that it is weighed with the parcel of grain from which it originated. The dust that is so fine as to be substantially invisible, and which will not settle out of the air, is the dust that is so highly explosive, and this is discharged through the cyclone outlet to the outside air and thus permanently removed from the grain, the grain dust and from the elevator in the one operation. There is some loss of dust through the air because as noted above the cyclone collector cannot work at one hundred percent efficiency but this dust that is lost is so fine as to be substantially invisible and it is this dust which by spreading throughout the house any way so that the dust collecting system not only keeps down the fire risk but thus returns to the grain a very appreciable part of the dust which would otherwise be lost. Thus the weighing is more accurate and there is less loss in weight with our system than without it.

The fan draws air from the garner through a relatively small opening at a point adjacent the top of the garner and well removed from the point at which the leg discharges to it. The garner is a comparatively large chamber and is very large in proportion to the cross sectional area of the duct leading to the fan. The fan puts a suction on the garner and the air rushes up through the leg or the scale or any other part of the system and discharges into the garner carrying a large quantity of dust at relatively high speed. The great increase in size at the garner provides a primary settling chamber which is especially adapted for settling because of the reduced atmospheric pressure. Then a relatively small proportion of fine dust only is drawn out through the conduit to the fan and discharged into the cyclone separator, thus making it possible to handle very large quantities of grain and get adequate separation through the cyclone separator with a comparatively small cyclone. The cyclone thus acts as a secondary or finer separator element.

The baffle plate X is interposed in the garner between the discharge from the leg and the suction outlet from the garner to cause the air to take a tortuous path in the garner and thereby improve the settling effect of the garner or primary settling chamber.

We have shown a leg feeding to the conveyor. Obviously the grain might be fed

to the conveyor by any suitable means from any suitable source.

It will be evident that while we have shown in our drawings an operative device, still many changes might be made in the size, shape and arrangement of parts without departing materially from the spirit of our invention and we wish, therefore, that our showing be taken as in a sense diagrammatic.

We claim:

1. In a grain elevator, a garner, and means for holding therein the grain received thereby, a leg adapted to discharge grain to said garner, an air circulating and dust separating system associated with said leg and garner, comprising an air withdrawal passage in communication with said garner, means for withdrawing air therealong, means for separating dust from the air so withdrawn and means for returning said dust to the grain in said garner.

2. In a grain elevator, a garner, and means for holding therein the grain received thereby, a leg adapted to discharge grain to said garner, an air circulating and dust separating system associated with said leg and garner, comprising an air withdrawal passage in communication with said garner, means for withdrawing air therealong, means for separating dust from the air so withdrawn, means for returning said dust to the grain in said garner, and means for driving the air circulating system in unison with the leg, so that when the leg is inoperative the air circulating system is also inoperative.

3. In a grain elevator, a garner, and means for holding therein the grain received thereby, a leg adapted to discharge grain to said garner, an air circulating and dust separating system including an air withdrawal passage adapted to withdraw air from the garner at a point adjacent the discharge of grain into said gearner, means for withdrawing air therealong, means for separating dust from the air so withdrawn and means for returning said dust to the grain in said garner.

4. In a grain elevator, a garner, and means for holding therein the grain received thereby, a leg adapted to discharge grain to said garner, an air circulating and dust separating system including an air withdrawal passage adapted to withdraw air from the garner at a point adjacent the discharge of grain into said garner, means for withdrawing air therealong, means for separating dust from the air so withdrawn and means for returning said dust to the grain in said garner, means for controlling the flow of grain from the garner and means, operative in unison therewith, for controlling the flow of dust and separated air.

5. In a grain elevator, a garner having a flexible apron depending therebelow, a valve sleeve extending through the apron and making an air tight connection therewith, an air circulating system adapted to draw air through said sleeve, a port in the side of the sleeve and a valve adapted in one position to close the port and permit circulation of air through the sleeve and in another position to open the port to permit inspection of the garner and close the sleeve against air circulation.

6. In a grain elevator, a garner having a flexible apron depending therebelow, a valve sleeve extending through the apron and making an air tight connection therewith, an air circulating system adapted to draw air through said sleeve, a port in the side of the sleeve and a valve adapted in one position to close the port and permit circulation of air through the sleeve and in another position to open the port to permit inspection of the garner and close the sleeve against air circulation, a garner slide adapted to control the flow of grain from the garner and a working connection between it and the valve.

7. In a grain elevator, a garner, a garner slide adapted to control the flow of grain therefrom, an elevator leg adapted to supply grain thereto, an air circulating system including a fan and a dust separator, the intake for the system being located adjacent the discharge from the garner and means for discharging separated dust from the separator to the garner.

8. In a grain elevator, a garner, a garner slide adapted to control the flow of grain therefrom, an elevator leg adapted to supply grain thereto, an air circulating system including a fan and a dust separator, the intake for the system being located adjacent the discharge from the garner and means for discharging separated dust from the separator to the garner, a valve controlling the air circulation associated with the garner slide.

9. In a grain elevator, a garner, a garner slide, adapted to control the flow of grain therefrom, an elevator leg adapted to supply grain thereto, an air circulating system including a fan and a dust separator, the intake for the system being located adjacent the discharge from the garner and means for discharging separated dust from the separator to the garner, a driving connection between the fan and the leg whereby the fan operates only when the leg is in operation.

10. In a grain elevator, a garner, a garner slide adapted to control the flow of grain therefrom, an elevator leg adapted to supply grain thereto, an air circulating system including a fan and a dust separator, the intake for the system being located adjacent the discharge from the garner and means for discharging separated dust from the sep-

arator to the garner, a driving connection between the fan and the leg whereby the fan operates only when the leg is in operation and a valve controlling the air circulation operated in unison with the garner slide.

11. A grain handling apparatus comprising a bin, a leg leading thereto, and an elevator in the leg discharging into the bin, means operative in unison with the elevator for maintaining reduced pressure in the leg and the bin to prevent discharge of dust laden air therefrom, said means comprising a suction system communicating with the garner and the leg and an air fan driven from the same source of power as the elevator, a dust separator into which the air fan discharges adapted to discharge the separated air at a point removed from the bin and to return the recovered dust to the bin.

12. In a grain handling apparatus, a garner bin, a weighing hopper adapted to receive grain from the bin, valves adapted to control the flow of grain from the bin to the hopper and means adapted to withdraw air from the hopper at a rate greater than the rate of displacement of air by the inflow of grain from the bin.

13. In a grain handling apparatus, a garner bin, a weighing hopper adapted to receive grain from the bin, valves adapted to control the flow of grain from the bin to the hopper and means adapted to withdraw air from the hopper at a rate greater than the rate of displacement of air by the inflow of grain from the bin, and means associated with the control valves for opening the air withdrawal system to equalize pressures when the flow of grain is interrupted.

14. In a grain elevator, an elevating leg, a garner into which it discharges and a scale hopper into which the garner discharges, a valve to control the flow of grain from garner to hopper, a suction system communicating with the garner, leg and hopper and an air pump associated therewith, driven in unison with the conveyor to withdraw dust laden air from the system.

15. In a grain elevator, an elevating leg, a garner into which it discharges and a scale hopper into which the garner discharges, a valve to control the flow of grain from garner to hopper, a suction system communicating with the garner, leg and hopper and an air pump associated therewith, driven in unison with the conveyor to withdraw dust laden air from the system, a dust separator to receive the dust laden air and to return the dust to the garner.

16. In a grain elevator, an elevating leg, a garner into which it discharges and a scale hopper into which the garner discharges, a valve to control the flow of grain from garner to hopper, a suction system communicating with the garner, leg and hopper and an air pump associated therewith, driven in unison with the conveyor to withdraw dust laden air from the system, means associated with the grain and control valves for automatically connecting the hopper with the suction system when the grain valves are open.

17. In a grain elevator, means for handling, conveying and distributing grain, pneumatic means for withdrawing dust from the grain at a plurality of points during its travel through the elevator, means for separating the fine highly explosive dust from the balance of the dust withdrawn, and means for returning the heavy dust to the same body of grain and for discharging the fine explosive dust from the elevator at a point removed from the balance of the dust and grain.

18. In a grain handling apparatus, a garner bin, a weighing hopper adapted to receive grain from the bin, valves adapted to control the flow of grain from the bin to the hopper and means adapted to withdraw air from the hopper at a rate greater than the rate of displacement of air by the inflow of grain from the bin, and means associated with the control valves for opening the air withdrawal system to provide a positive and visible means to equalize pressures when the flow of grain is interrupted.

19. In a grain elevator system including a plurality of grain floors and an elevator leg, means for inducing an air current upwardly through the leg and an inflow of air to the leg at every opening therein, means for treating the air current thus induced and separating the dust therefrom.

20. In a grain elevator system including a plurality of grain floors and an elevator leg, means for inducing an air current upwardly through the leg and an inflow of air to the leg at every opening therein, means for treating the air current thus induced and separating the dust therefrom and means for returning the heavy dust particles back to the same body of grain from which they originated and for discharging the fine explosive dust particles at a point removed from the grain handling system outside of the elevator.

21. In a grain elevator, a grain handling conveyor, a relatively extended chamber into which such conveyor discharges, a housing for the conveyor communicating with the chamber, a suction member communicating with the chamber at a point removed from the point at which the conveyor discharges thereto and a secondary dust separator adapted to separate dust from the air withdrawn from the first or primary settling chamber.

22. In a grain elevator, a grain handling conveyor, a relatively extended chamber into which such conveyor discharges, a housing for the conveyor communicating with the

chamber, a suction member communicating with the chamber at a point removed from the point at which the conveyor discharges thereto and a secondary dust separator adapted to separate dust from the air withdrawn from the first or primary settling chamber, a baffle plate disposed within the primary settling chamber and interposed between the suction outlet and the grain inlet.

Signed at Chicago, Illinois, this 31st day of December 1924.

THOMAS D. BUDD.
WILLIAM R. SINKS.