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G. BERNERT

PNEUMATIC GRAIN CONVEYER

Filed Aug. 19, 1920

Fig-1.

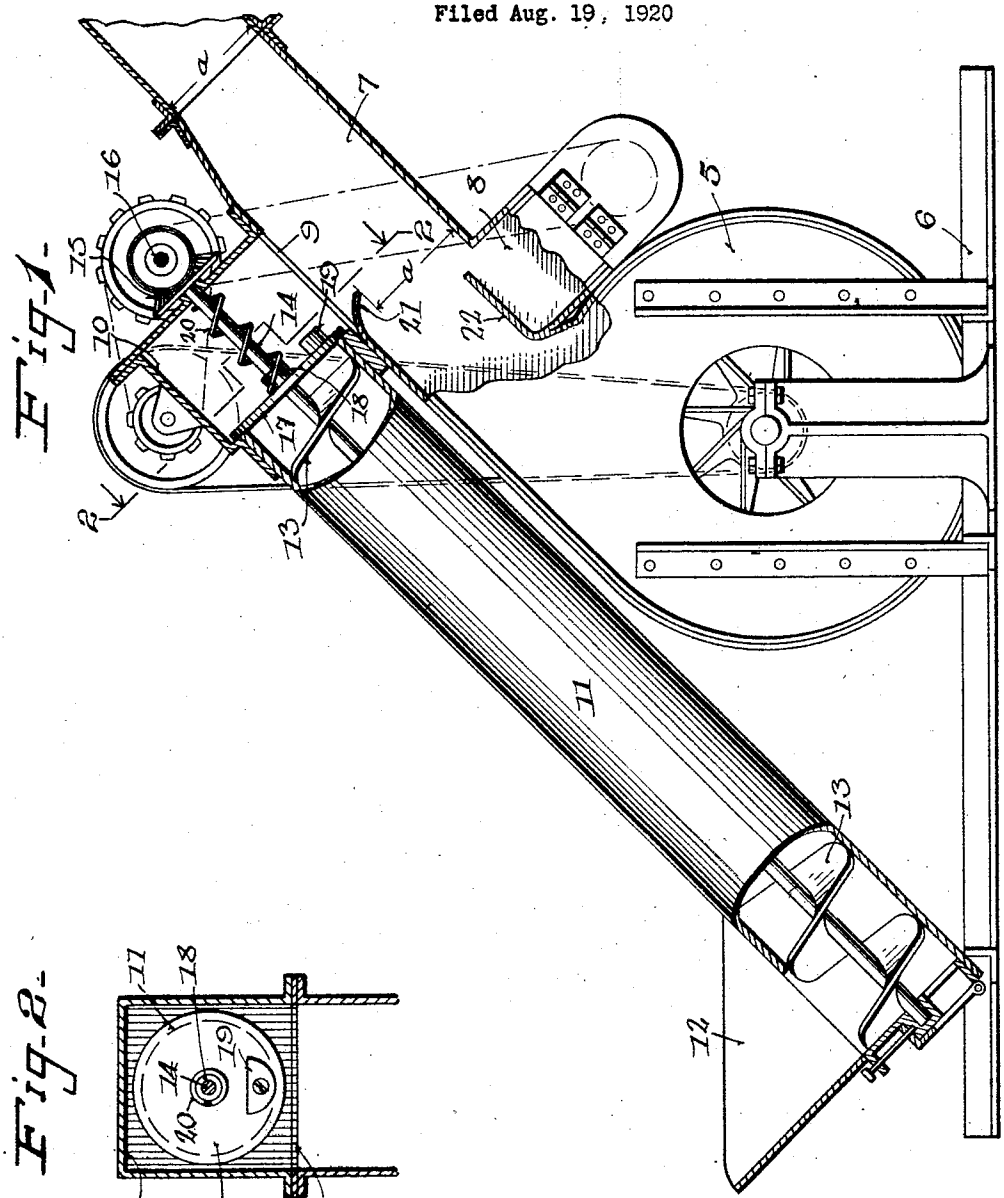


Fig-2.

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UNITED STATES PATENT OFFICE.

GEORGE BERNERT, OF MILWAUKEE, WISCONSIN.

PNEUMATIC GRAIN CONVEYER.

Application filed August 19, 1920. Serial No. 404,590.

To all whom it may concern:

Be it known that I, GEORGE BERNERT, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Pneumatic Grain Conveyers; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to new and useful improvements in conveying apparatus for granular materials, and more particularly of the general type shown in my co-pending application for patent, filed February 9, 1920, Serial #357,450, and comprising an upwardly inclined pneumatic conveyer trunk portion having an opening in its top communicating with the upper end of the casing of a spiral feeding conveyer.

The feeder casings of conveying apparatus of this type have heretofore been provided with hinged valves urged to closing position by spring or gravity action exerted adjacent the pivot of the valve, and inasmuch as it is desirable in the general construction to drive the shaft of the spiral conveyer from its upper end, said shaft is usually extended through a slot in the pivoted valve permitting a leakage of air through the feeding conveyer casing. This leakage flow of air is desirable when it is wished to procure a cleaning action in the feed operation by the provision of a cleaner vent as stated in my said co-pending application, but in certain instances it is neither necessary nor desirable to effect this cleaning action and in this event it becomes advantageous to prevent any retrograde flow of air in the conveyer trunk for the main conveying function.

It is therefore primarily the object of my invention to provide a valve structure in the present type of conveying apparatus which will effect a complete closure of the feeder casing against the admission of air, yet which is freely yieldable to permit the proper passage of grain from the feeder casing into the conveyer trunk.

It is further my object to accomplish this result by the provision of an arrangement whereby the valve is urged to its closing position by the gravity action incidental to its own weight, and whereby the resistance of the valve to opening movement is consequently substantially uniform throughout the entire path of travel of the valve, in contra-distinction to any feeding arrangement including a sliding valve member and wherein the closing action of the valve member would be procured by a spring bearing thereagainst, the spring action increasing in opening movement of the valve to such degree as to interfere with the opening movement if the spring possesses initially sufficient strength to properly hold a valve in its closing position.

It is further my object to provide a conveying apparatus of the present general character wherein a minimum back pressure action of air is exerted on the feeding means, thus reducing the amount of power necessary to procure the feeding action of the grain into the conveying column.

With the above and other objects and advantages in view, my invention resides more particularly in the novel combination, formation and arrangement of parts hereinafter described and pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a side elevation of a pneumatic grain conveying apparatus embodying my invention and having portions of the feeder casing and air trunk broken away to more clearly disclose the invention.

Figure 2 is a detailed sectional view on the line 2—2 of Figure 1.

Referring now more particularly to the accompanying drawings, 5 designates the usual blower fan casing which is mounted on a suitable base 6 and has a pneumatic conveying trunk 7 extending obliquely upwardly therefrom, the lower portion of said trunk being provided with the usual collector pocket 8 for surplus grain tending to drop down into the fan casing, and while I have shown conventionally a belt drive extending to the collector pocket for actuating mechanical means for clearing grain therefrom, it will be appreciated that the accumulated grain may be cleared from the collector pocket in any desired manner.

This conveyer trunk is, in the present instance, square in cross-section and is provided in its top, at a point above the collector pocket 8, with an inlet opening 9 over which is disposed a square boxing 10 which forms the upper end portion of the feeder casing, the major portion of said casing being formed by a cylindrical section 11 which is inclined upwardly from a feeding hopper 12. A spiral conveyer blade 13 is extended through the cylindrical casing portion 11

terminating just short of the box 10, and the shaft 14 of the conveyer blade is extended through the box 10 for drive gear connection 15 with a countershaft 16 which is suitably supplied with power. The cylindrical casing portion 11 enters the lower wall of the box portion 10 of the casing and a shoulder is consequently formed within the casing which forms a valve seat. A disk valve 17, slightly larger in diameter than the diameter of the cylinder 11, is provided for engagement on this seat, said valve being carried by a collar 18 slidable on the upper end portion of the conveyer shaft 14.

It is particularly noted that the inclination of the feeder conveyer casing and consequently of the shaft 14 is such that the valve 17 will move downwardly to closing position by the gravity action of its own weight, and this weight may, if necessary, be increased by the securement of a weight block 19 to the upper face of the valve. I may, in certain instances, employ a very light spring 20, coiled on the shaft 14 above the valve for the purpose of starting the gravity impelled closing movement of the valve in the event that a slight sticking of the valve would be encountered, it being appreciated that a very slight impetus may be effective to start positive movement of a member by gravity. This spring, however, would be eliminated in the majority of cases and is not to be considered a medium for closing the valve, for if the spring were made of sufficient strength to exert any positive closing action adjacent the closing position of the valve, said spring would possess such tension upon opening movement of the valve as to materially retard such opening movement and impose excessive power requirements upon the feed conveyer action. For this reason, a spring pressed valve, such as shown in Patent #1,002,556, granted to myself and Jacob Bernert, Sept. 5, 1911, is not operative since a spring is relied upon to close the valve and closing pressure of the spring would cause binding action of the valve in addition to the excessive tension.

In the operation of the present structure, the valve 17 is held positively closed by gravity and the back pressure of air and effects a complete seal of the feed conveyer casing, and as grain is fed upwardly in the casing it will move the valve upwardly a distance contingent upon the rate and volume of grain interposed between the valve and its seat serving to prevent retrograde flow of air, and as the feeding of the grain is reduced, the valve will promptly move to its closing position, this opening and closing movement of the valve being thus readily secured and imposing no undue load upon the feeding mechanism.

To reduce the retarding action of back pressure air on the feeding action, I provide a deflector lip 21 inclined inwardly a short distance from the lower edge of the feed opening 9 of the air trunk, whereby the current of air flowing through the trunk is slightly deflected immediately adjacent the valve and hence produces a reduced pressure area in the open upper end portion of the feeder casing constituted by the box 10, thus preventing the exertion of back pressure on the valve and on the grain as it is fed past the valve. This deflector lip 21 reduces the cross-sectional area of the trunk at the point at which said lip is located and hence, since the conveying column of air is procured in the apparatus by the use of a blower fan, the effective current is defined by the smallest cross-sectional area of the column since the blower fan merely exerts a certain degree of head pressure over a certain area and will not be operable to further compress the air. To thus maintain the proper air velocity, the air trunk is reduced in cross-section a very short distance beyond the feed opening 9, and is continued to the distance of conveying action with this reduced cross-section. This reduced cross-section is substantially equal to the reduction of cross-section caused by the disposition of the deflector lip 21, and thus at the points marked *a* in the drawing the cross-sections are substantially equal. The fan may be thus designed for the proper air velocity at the cross-sectional areas *a*, and the excess space in the lower portion of the duct merely banks up idle air. I am aware that deflector lips have been heretofore employed in feeding material into a pneumatic duct, but the provision of such deflector lips has heretofore served to reduce the general cross-sectional area of the trunk, resulting either in the decrease of the conveying velocity or in the necessity of providing an excessive fan action to procure the required velocity, and no one has heretofore contemplated the reduction of the major portion of the trunk to correspond to the reduced cross-sectional area resulting from the provision of a deflector lip in the trunk.

To prevent grain from possibly jumping past the collector pocket 8 under adverse conditions of conveying, I provide a wall 22 which extends inwardly from the juncture of the lower side of the pocket with the duct and then is directed longitudinally in the direction of the duct over the area of the pocket, the forward edge of the wall being spaced from the edge of the lip a distance equal to the width of each of the cross-sectional areas *a* whereby to avoid choking the cross-sectional area and the major portion of the wall is also spaced an equal distance from the top of the duct. The mouth of the pocket is thus defined at the upper side thereof and extends transversely of the

lower portion of the duct to thus provide a positive trap for grain travelling downwardly at the lower portion of the duct.

I have further discovered that back pressure of air exerted in the feeder casing has an exaggerated retarding action in connection with the spiral conveyer inasmuch as said back pressure of air increases the density of the grain carried in the convolutions of the spiral conveyer and hence increases the friction action of the grain against the casing along the line of the spiral conveyer, in addition to the direct retrograde thrust of said back pressure on the column of grain and thus the provision of the deflector lip 21 and the avoidance of valve spring tension possesses particular advantages in connection with the positive feed means afforded by the spiral conveyer.

While I have shown and described a preferred embodiment of my invention, it will be appreciated that various changes and modifications of structure and arrangement may be employed without departing in any manner from the spirit of the invention. For instance, while the collector pocket wall 22 in the air duct extends over the body of the pocket and thus provides a means for shielding the pocket from direct pressure of the grain conveying current of air, it is seen that a further essential grain trapping relation is provided by the fact that the side wall of the pocket adjacent the fan extends closer to the top of the air duct than does the other side wall of the pocket to thus afford a deflecting abutment for grain sliding downwardly through the duct.

What is claimed is:

1. A pneumatic conveyer apparatus including an air duct, an upwardly extended feeder conveyer casing communicating at its upper end portion with said duct, a valve seat in the upper end portion of the feeder conveyer casing, a valve slidably mounted in the upper end portion of said casing and movable to engage by gravity against said seat, and means for conveying material upwardly in said casing to open said valve and feed said material therepast into the duct.

2. A pneumatic conveyer apparatus including an air duct, an upwardly extended feeder conveyer casing communicating at its upper end portion with said duct, a spiral conveyer in the casing, a shaft for said spiral conveyer extended in the top portion of the casing, and a valve disk slidably mounted on said shaft and movable thereon to closing position against the seat by the gravity action of the weight of said valve incidental to the inclination of the said shaft.

3. A pneumatic conveyer apparatus including an air duct provided with an opening in its top, a box disposed in said opening, an upwardly extended cylindrical casing communicating with said box, the portion of said box adjacent said casing forming a valve seat, a spiral conveyer in said casing, a shaft for said spiral conveyer extended in the box, and a valve disk slidably mounted on said shaft and movable thereon to closing position against the seat by the gravity action of the weight of said valve incidental to the inclination of the said shaft.

4. A pneumatic conveyer apparatus including an air duct provided with a feed opening in its top, a blower fan communicating with said duct for procuring a pressure current of air therein, a feeder conveyer casing communicating with said feed opening of the duct, a conveyer in said casing for forcing grain therethrough, and a deflector lip in the duct at the side of its feed opening adjacent the blower fan for deflecting back pressure current of air from the said conveyer, the cross-sectional area of the major portion of said duct corresponding to the reduced cross-sectional area resulting from the provision of said deflector lip.

5. A pneumatic conveyer apparatus including an air duct provided with a feed opening in its top, a blower fan communicating with said duct for procuring a pressure current of air therein, a feeder conveyer casing communicating with said feed opening of the duct, a conveyer in said casing for forcing grain therethrough, a deflector lip in the duct at the side of its feed opening adjacent the blower fan for deflecting back pressure current of air from the said conveyer, the cross-sectional area of said duct at said lip being less than the cross-sectional area of the duct at any point between the lip and the fan, and the cross-sectional area of the duct being reduced beyond and adjacent the feed opening to correspond to the reduction of cross-section by said lip whereby to maintain the effective pressure current conditions determined by the cross-sectional area of the duct at the lip.

6. A pneumatic conveyer apparatus including an air duct provided with a feed opening in its top, a blower fan communicating with said duct for procuring a pressure current of air therein, a feeder conveyer casing communicating with said feed opening of the duct, a conveyer in said casing for forcing grain therethrough, a deflector lip in the duct at the side of its feed opening adjacent the blower fan for deflecting back pressure current of air from the said conveyer, the cross-sectional area of said duct at said lip being less than the cross-sectional area of the duct at any point between the lip and the fan, and the cross-sectional area of the duct being reduced beyond and adjacent the feed opening to cor-

respond to the reduction of cross-section by said lip whereby to maintain the effective pressure current conditions determined by the cross-sectional area of the duct at the lip, and a collector pocket disposed below the feed opening of the duct, the mouth of said pocket extending transversely of the lower portion of the duct and occupying the transverse space defined by the increased area of the said portion of the duct.

7. A pneumatic conveyor apparatus including an air duct provided with a feed opening in its top, a blower fan communicating with the lower end of said duct for procuring a pressure current of air therein, means for feeding grain through said feed opening, and a collector pocket communicating with the lower portion of the duct below the feed opening, the wall of the collector pocket adjacent the fan extending closer to the top of the duct than the other wall of the pocket whereby to define a grain deflecting abutment within the duct.

8. A pneumatic conveyer apparatus including an air duct provided with a feed opening in its top, a blower fan communicating with the lower end of said duct for procuring a pressure current of air therein, means for feeding grain through said feed opening, the area of the duct being increased adjacent the feed opening, a collector pocket communicating with the lower portion of the duct below the feed opening, the wall of the collector pocket adjacent the fan extending closed to the top of the duct than the other wall of the pocket whereby to define a grain deflecting abutment within the duct, and a deflector lip in the duct at the side of its feed opening adjacent the blower fan.

In testimony that I claim the foregoing I have hereunto set my hand at Milwaukee, in the county of Milwaukee and State of Wisconsin.

GEORGE BERNERT.