May 19, 1942. G. D. ARNOLD 2,283,483

SEPARATOR

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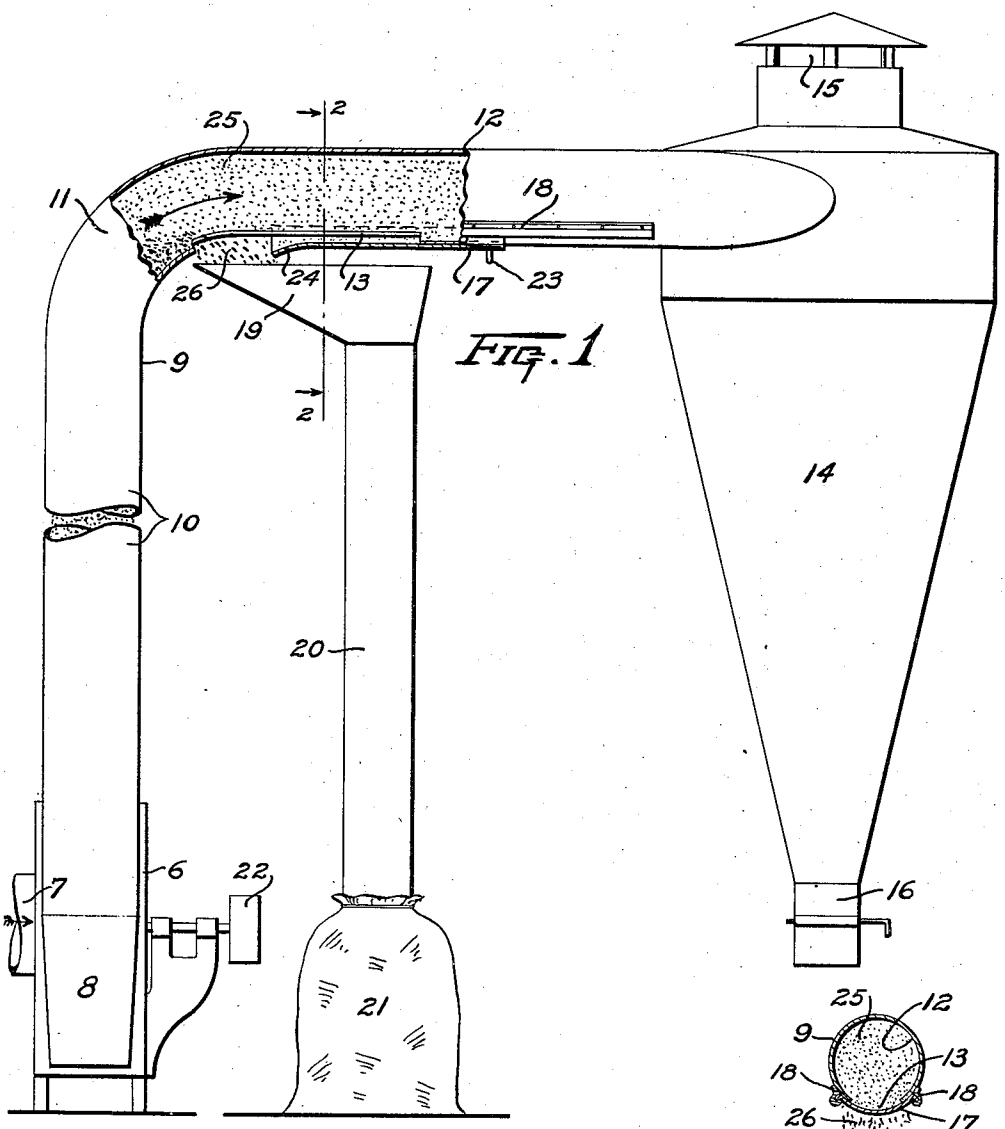


FIG. 1

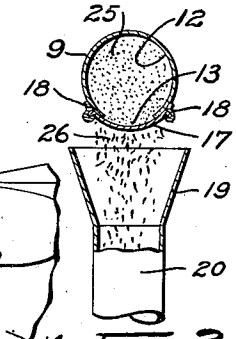


FIG. 2.

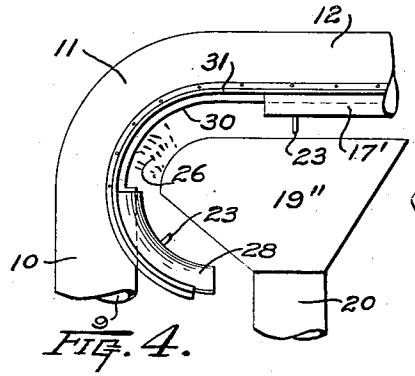


FIG. 4.

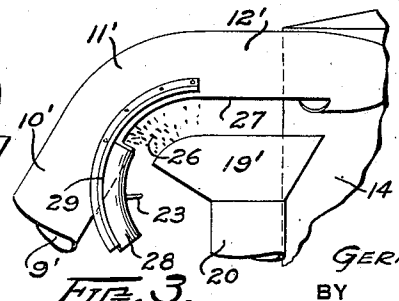


FIG. 3.

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2 Claims. (Cl. 209—143)

My present invention relates in general to improvements in the art of separating relatively bulky and heavy material from lighter and finer particles, and relates more specifically to improvements in the construction and operation of gravity separators or separating systems.

Generally defined, an object of this invention is to provide an improved gravity type of dry separator which is simple and compact in construction, and which is also readily manipulable and highly efficient in use.

When dehydrating vegetation such as alfalfa hay artifically in order to convert the same into meal, the freshly cut alfalfa is ordinarily chopped into relatively small pieces and is drawn by a suction fan through a revolving drum dryer together with hot gases of combustion, and the fan delivers the dried and disintegrated mixture to a cyclone separator in which the meal or the like is separated from the drying gases. Some attempts have been made in systems of this type, to separate foreign material such as stones, iron and steel particles, weed stems and the like, from the wholesome alfalfa meal or the like directly at the discharge end of the dryer drum and before effecting final separation of the dried material from the gases, but many of the foreign particles including oversize stems and other inflammable pieces escape this initial separation and tend to accumulate near the elbows and in the horizontal piping connecting the exhaust fan and one or more separators. Under certain conditions of operation, the hot gases of combustion admitted to the dryer, are not cooled sufficiently to prevent ignition of these accumulated stems and other debris, and serious fires therefore result. The accumulation at such places may also become so great that it will cause choking of the conduits in the dryer system, and any avoidance or elimination of the difficulty should preferably be accomplished automatically as these systems function continuously and are adapted to treat huge volumes of product.

It is a more specific object of my present invention to provide simple and effective means for positively preventing accumulation of stems and other debris in the horizontal ducts of such dryer systems, at or beyond the elbows for conducting the granular material to such ducts.

Another specific object of the present invention is to provide a new and useful separator for continuously and automatically removing oversize and otherwise objectionable particles from relatively fine meal, flowing in a continuous stream through a dryer system or the like.

A further specific object of the invention is to provide an improved automatic gravity separator for removing relatively heavy particles from lighter meal or the like, which is conveniently adjustable to vary its operation.

Still another specific object of my invention is to provide an improved separating system which can be readily applied to an ordinary air duct or conveying pipe, at relatively low cost; and which can also be made inactive when its use is not desired.

These and other specific objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the features constituting my present improvement, and of the mode of constructing and of utilizing several embodiments of the invention, may be had by referring to the drawing accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the several views.

Fig. 1 is a somewhat diagrammatic elevation of the delivery end of a typical hay drying system, having a portion thereof broken away to show parts of my improved separator;

Fig. 2 is a transverse vertical section through the assemblage of Fig. 1, the section having been taken along the line 2—2;

Fig. 3 is a fragmentary diagram of a similar dehydrating system, showing a modified type of my improved separator; and

Fig. 4 is another fragmentary diagram of a dryer system, showing still another type of improved separator.

While I have shown and described the improvement as being especially applicable to hay dehydrating apparatus and systems, it is not my desire or intent to thereby unnecessarily restrict the scope or utility of the invention.

Referring specifically to Figs. 1 and 2, the improved hay dehydrating system shown therein, comprises in general, a rotary blower or suction fan 6 having an axial inlet 7 communicating with the discharge end of a rotary dryer or the like, and having a tangential peripheral outlet 8; a conducting conduit or pipe 9 having a portion 10 extending upwardly from the fan outlet 8, a bend or elbow 11 communicating with the upper end of the portion 10, and a horizontal portion 12 communicating with the elbow outlet and provided with a lower elongated opening 13 located adjacent to the elbow 11; a cyclone separator 14 communicating peripherally and tangentially with the discharge end of the horizontal pipe

portion 12 and having an upper air or gas discharge opening 15 and a lower material delivery spout 16; an elongated horizontally movable slide 17 coacting with spaced guides 18 on the pipe portion 12, and being movable along said portion beneath the opening 13 to control the effective area of the latter; and a hopper 19 fixedly disposed directly beneath the opening 13 and communicating with a material discharge pipe 20 to the lower end of which a bag 21 or other receptacle may be applied.

The fan 6 and gas separator 14 are of well known construction, and the conducting pipe 9 may be of any suitable diameter while the portions 10, 12 thereof may be of considerable length. The fan 6 may be driven by power applied to a pulley 22, and the adjustable closure slide 17 may be provided with a manipulating handle 23 at one end and has its opposite end 24 curved as shown in Fig. 1 in order to snugly engage the adjacent surface of the elbow 11 when the slide is completely closed. The material ordinarily withdrawn from the dryer drum and delivered to the pipe 9 by the fan 6, comprises a mixture of relatively warm air or other gas, and comminuted substance such as hay consisting of relatively fine meal 25 and entrained larger particles 26 such as stems, together with fabric string, pieces of cloth, weed particles, small stones, or pieces of metal. This foreign material enters the dryer with the bulk hay, and many of the debris particles are capable of ignition and burning.

During normal operation of the drying system illustrated in Figs. 1 and 2, the fan 6 is operating and is withdrawing the treated mixture of gas and solid particles from the drying zone by suction, and the fan is constantly delivering the stream of mixture at moderate velocity through the pipe 9 to the cyclone separator 14 wherein the gas is separated from the solid particles or meal 25, the former being discharged to the ambient atmosphere through the opening 15 while the meal is collected in the spout 16 for periodic discharge. When the upwardly advancing mixture reaches the pipe bend or elbow 11, its direction of travel is suddenly changed, and the larger and heavier particles 26 upon losing velocity due to the change in direction in traveling through the elbow, fall by gravity toward and through the uncovered portion of the opening 13 and drop by gravity into the hopper 19 from whence they gravitate into the receptacle or bag 21 through the pipe 20. The finer particles or meal 25 will be carried forwardly through the pipe portion 12 into the air separator 14; and by varying the effective area of the opening 13 with the aid of the closure slide 17, the nature and characteristics of the separated mass of debris may be varied throughout a considerable range. The improved separating system obviously functions automatically whenever the fan 6 is operating, and positively prevents accumulation of debris in the pipe portion 12 beyond the elbow 11.

In the modified embodiment of the invention shown in Fig. 3, the upwardly extending portion 10' of the pipe 9' is inclined, and the horizontal pipe portion 12' is shortened while the elbow 11' affords a less abrupt change in the direction of travel of the mixture. The slot 27 extends along the bottom of the elbow 11' as well as the bottom of the pipe section 12', and an arcuate slide 28 which coacts with curved guides 29 on the elbow 11' is adjustable to cut off more or less of the portion of the slot 27 located at the elbow. The hopper 19' is formed to cooperate with the entire slot 27, and when the slide 28 is raised to extreme height, the slide 28 will provide a forwardly and downwardly directed chute for most effectively guiding the debris into the hopper 19'. This modification functions approximately the same as the form of the invention previously described, but the slot 27 can never be completely sealed as in Figs. 1 and 2.

In the additionally modified embodiment of the invention disclosed in Fig. 4, the pipe 9 has an upwardly extending vertical portion 10, a horizontally directed portion 12, and an elbow 11, the same as in Fig. 1, but the lower slot 30 extends along the entire bottom of the elbow 11 and also along the bottom of the pipe portion 12. An arcuate slide 28 and a rectilinear slide 17' are provided, and these slides 28, 17' are independently adjustable and coact with longer guides 31. The hopper 19'' is formed to cooperate with the entire slot 30, and the curved slide 28 may be utilized to shut off more or less of the slot 30 located at the elbow 11, while the straight slide 17' may likewise be utilized to close more or less of the slot 30 at the pipe portion 12. This modification likewise functions approximately as previously described, and the slot 30 can be completely sealed if desired.

From the foregoing detailed description it should be apparent that my present invention provides an extremely simple, compact and highly efficient separator for debris and objectionable particles, from the good meal, in a hay dehydrating system or the like. The improved separator functions automatically during operation of the dryer system to avoid accumulation of material in the mixture transporting conduit, and thus eliminates fire hazard and prevents choking of the pipes. The adjustability of the size of the discharge opening for the foreign material makes the separating system relatively flexible, since this adjustment permits variation in the velocity of flow at and beyond the elbow. The use of an arcuate slide also provides means for effectively guiding the discharged debris into the receiving hopper, and additionally prevents possible undesirable accumulation; and by providing two independently adjustable control slides, finer adjustments and control are made possible. The improved separator avoids interfering with the normal operation of the pneumatic conveying system, and is most effective in removing heavy and bulky particles from the fine material. The velocity of the conveying gas will prevent undesirable delivery of good meal through the separator slot, and the improvement is adapted for diverse uses other than that specifically referred to. The improved separator has, however, proven highly successful and especially adaptable to hay dehydrating systems, because of the fire hazard introduced in such systems during periods of light operation or when they are shut down. The improvement may be applied to systems in which the transporting piping has diverse shapes and disposition, and may be manufactured and installed at extremely moderate cost.

It should be understood that it is not desired to limit the invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

I claim:

1. In combination, a conduit having an up-

wardly extending portion and having a substantially horizontally extending portion connected by an elbow with the upper end of said upwardly extending portion, means for blowing solids including heavy and light particles into said upwardly extending conduit portion to travel upwardly therein, the bottom of said horizontally extending conduit portion extending in a substantially horizontal plane and having an opening therein which coincides at one end with a portion of the elbow and through which heavy particles of said solids may fall by gravity when their velocity is lost as they travel through the elbow while fine particles continue through the horizontal conduit portion, and means for varying the effective length of said opening at both ends.

2. In combination, a conduit having an upwardly extending portion and having a substantially horizontally extending portion connected by an elbow with the upper end of said upwardly extending portion, means for blowing solids including heavy and light particles into said upwardly extending conduit portion to travel upwardly therein, the bottom of said horizontally extending conduit portion extending in a substantially horizontal plane and having an opening therein which coincides at one end with a portion of the elbow and through which heavy particles of said solids may fall by gravity when their velocity is lost as they travel through the elbow while fine particles continue through the horizontal conduit portion, and oppositely movable slides cooperable with said opening to vary the effective length thereof, said slides being independently adjustable, and at least one slide having a curved end portion to conform to the curvature of the elbow.

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