Nov. 18, 1941. G. C. MORGAN 2,262,853

ART OF COLLECTING MATERIAL FROM AIR CURRENTS

Filed April 4, 1939 2 Sheets-Sheet 1

Fig. 1

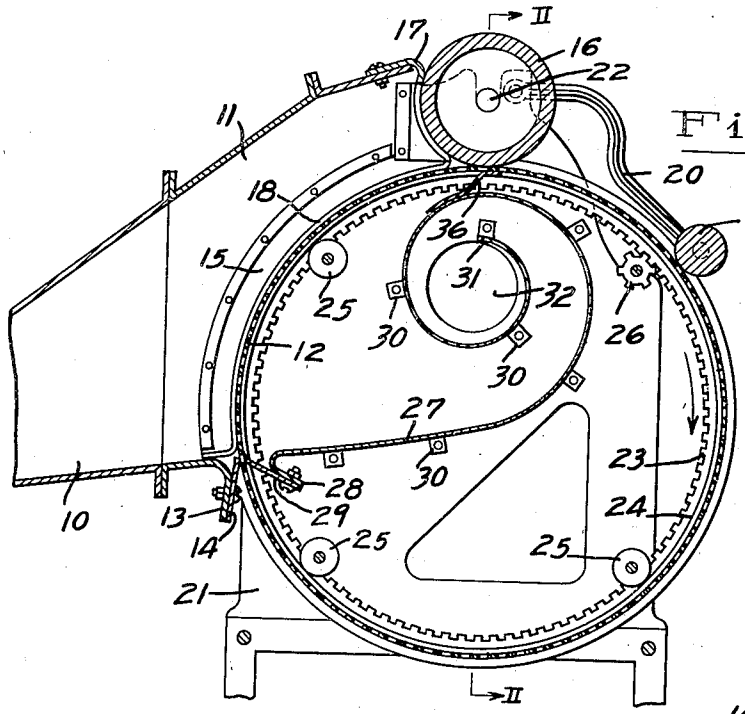
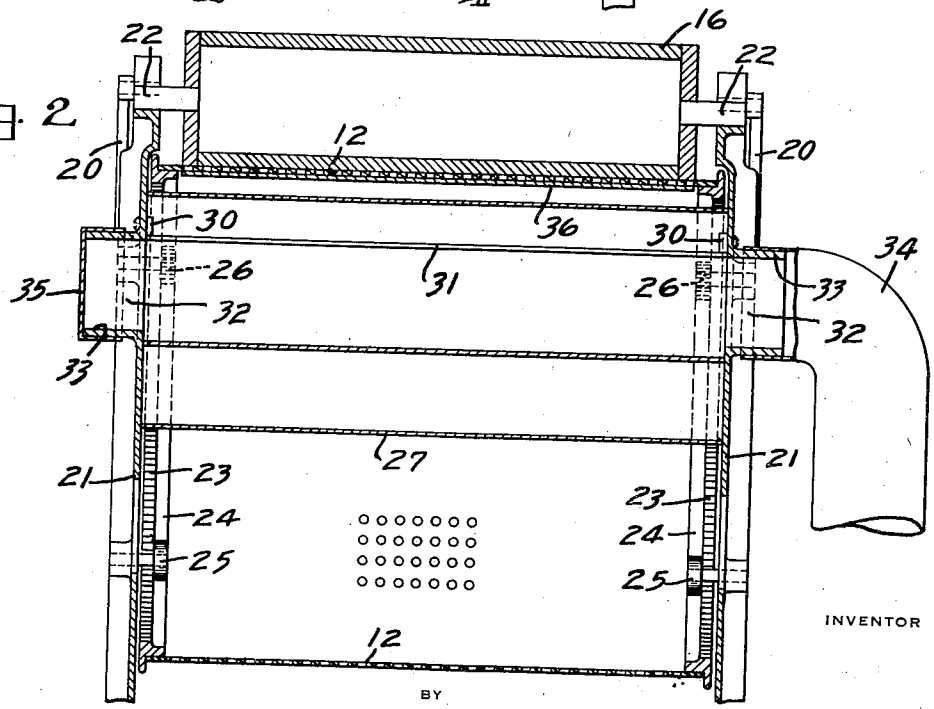


Fig. 2



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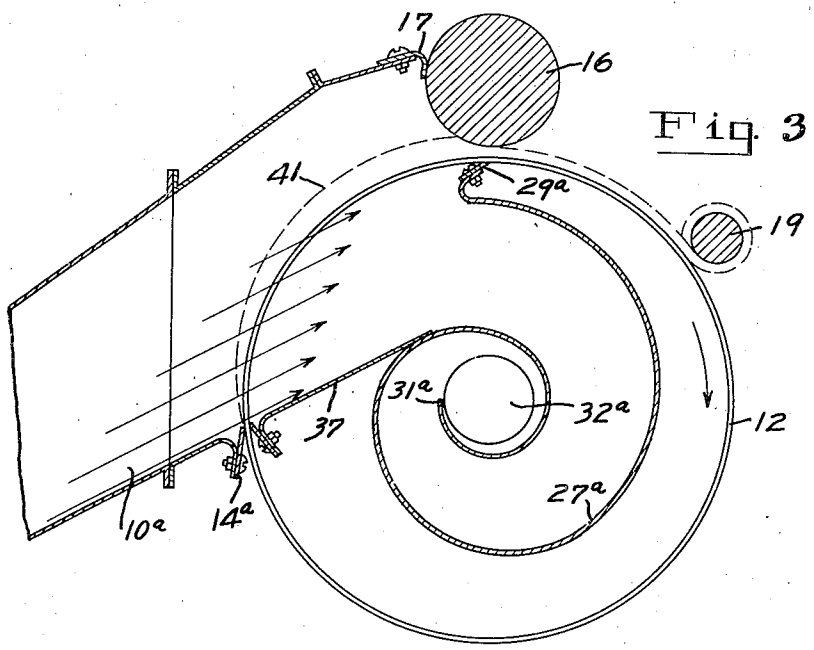


Fig. 3

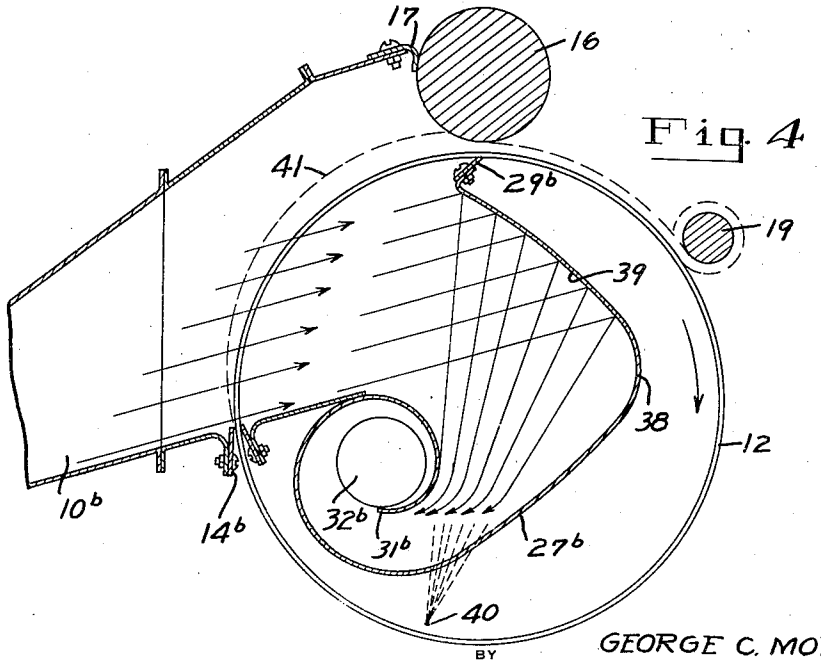


Fig. 4

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2,262,853

ART OF COLLECTING MATERIAL FROM AIR CURRENTS

George C. Morgan, Birmingham, Ala., assignor to Continental Gin Company, a corporation of Delaware

Application April 4, 1939, Serial No. 265,915

11 Claims. (Cl. 19—156)

My invention relates to the art of separating cotton, fibers or other material from a current of air or gas in which they are borne and collecting the fibers on a moving screen.

My invention is more particularly concerned with improvements in the art of, and mechanism for, collecting and condensing cotton, and particularly cotton linters, from the air current in which they are discharged from the linter gin, but when I use the term lint hereinafter the same is to be regarded as inclusive of any lint or fibrous material which it may be desirable to recover from a gaseous vehicle by which it is borne.

In collecting lint, it has been the established practice for many years to conduct an air current, usually induced by the doffing brush of the gin, with the entrained lint through a gradually expanding passage into contact with the moving screen of a condenser through which the air current was free to pass but upon which the lint is adapted to be collected and pressed into a bat and from which it is subsequently stripped or recovered in any suitable manner. The duct for conducting the lint bearing air current to the condenser screen was of a gradually expanding cross sectional area so as to bring about a gradual reduction in the pressure and velocity of the air without producing objectionable eddy currents therein, so that the lint could be properly collected and formed into an even bat on the condenser. But little attention has been paid to the design of the vacuum or suction duct or chamber for collecting and carrying off the air current, with such lint and foreign matter as may have passed therewith through the condenser screen, to some suitable point of discharge or recapture of the lint.

I have conceived that it is of even greater importance to prevent the occurrence of eddy currents or disturbances in air flow adjacent to the screen on its exhaust side than on its lint collection side, as such disturbances react directly on the manner of deposit of the lint on the screen by setting up unbalanced conditions with respect to the passage of air through the screen into the suction chamber. An ideal condition for the collection of the lint will therefore exist where the air ducts are so designed and arranged that they produce an air current that flows undisturbed and with decreasing velocity to, and departs with still undisturbed flow but gradually increasing velocity from, the zone of lint separation, i. e., where the moving screen intercepts the air current. It is the chief object of my invention to attain this improved manner of lint collection, and I have conceived that the best design of exhaust duct will be of spiral or volute design adapted to produce a whirl of the outgoing air.

It will be obvious that there are no mechanical difficulties in designing the duct for delivering the lint bearing air current to the screen, as there are no limiting factors there, but the screen in its most practical form being cylindrical and of limited diameter, a definite problem is presented to so design the exhaust duct that it will produce the contemplated gradual contraction of the duct and set up the desired whirl of the air current. In this connection my invention contemplates forming within the condenser screen a volute suction chamber defined either by a spiral wall, or a wall having its surface, against which the air currents traversing the screen will impinge, so designed at all points it will deflect such currents in a common direction toward the pole of the volute chamber.

It is within the contemplation of my invention that such wall may have, throughout that portion against which the air currents first impinge, a parabolic curvature.

My invention further contemplates terminating the inner end of the wall defining the volute suction chamber in such position that it is protected from direct exposure to the condenser screen, so that the suction, which will be applied at an end of the chamber through an opening in line with the pole of the induced spiral air whirl, will not tend to short circuit air through any particular part of the active portion of the condenser screen but will exert its suction effect on said screen through the gradually expanding volute chamber to produce a substantially uniform action on the screen, whereby a balanced exhaust effect is attained eliminating short circuiting and the creation of eddy currents in the volute chamber adjacent to the screen is minimized.

My invention further contemplates taking advantage of a natural condition existing in lint condensers to concentrate the air current, passing through the condenser screen, so as to carry with it the lint and foreign matter into and through the volute chamber regardless of its position within the condenser drum, thus permitting the volute chamber to work with its suction discharge disposed in the upper, central or lower area of the condenser drum.

My invention further contemplates the elimination of any suction pipes or ducts extending

through the condenser drum and to make it possible to apply the suction connection at either end of the drum without at the same time unbalancing its effect axially of the condenser screen. This is possible because the volute suction chamber produces so even and uniform an acceleration of the air in the whirl that at the inner end of the volute chamber it will flow uniformly into, and then move outwardly along the axis of its vortex whirl through a port or ports in the condenser head or heads into the lint flue without tending to short circuit or unbalance its flow through the lint collecting screen. In other words, the accelerating velocity of the whirl will produce sufficient inertia to prevent the lateral draft at its center by means of which the air current is withdrawn, exerting a disturbing action on the balanced and equalized suction effect desired throughout the active portion of the screen.

My invention further contemplates the arrangements of parts and the principles of operation which are hereinafter more particularly described and claimed, and which are illustrated in several embodiments which exemplify the application of the principles underlying my invention.

Fig. 1 is a vertical transverse cross sectional view through a cotton condenser embodying my invention;

Fig. 2 is a vertical longitudinal sectional view taken on the line II—II of Fig. 1;

Fig. 3 is a diagrammatic view, corresponding to Fig. 1, showing a modified type of volute suction chamber; and

Fig. 4 is a similar diagrammatic view showing a suction chamber formed to present a parabolic deflector portion to the incoming air.

Similar reference numerals refer to similar parts throughout the drawings.

In the embodiment of my invention illustrated in Figs. 1 and 2, I show conventionally a duct for delivering air current, bearing the lint or other material to be collected therefrom, to the collecting apparatus. This duct comprises an intake section **10** which, in the case of a linter gin, is connected to the gin in such manner, that the doffed lint, borne in an air current induced by the doffing roller to the gin or by suction if desired, will flow therethrough into the enlarged delivery head **11** which subtends that part of the rotatable cylindrical foraminous drum **12** that is termed its active or lint collecting portion. The head **11** is coextensive in length with the drum and has along its bottom edge a downwardly deflected flange **13** to which is attached a sealing flap **14** which rubs against the outer foraminous surface of the drum **12** so as to seal the bottom joint between it and the duct. A packing strip **15**, attached in the head **11** on each side, seals the side joints along the active portion of the drum which terminates opposite a loosely mounted presser roll **16** which rides on the drum **12** and has the joint between it and the top of duct head **11** sealed by the flap **17**. Extensions **18** of the packing strips **15** seal the joints between the roller **16** and the sides of head **11**. A bat collecting roll **19** is swung by arms **20** from the end frames **21** of the condenser in which the journals **22** of the roll **16** turn in slots which permit the roll to have vertical play and to rest by gravity on the drum. The drum has end rings each provided with internal teeth **23** and with an inner circular track **24**. The tracks are engaged by drum supporting rollers **25** mounted on the end frames **21** of the condenser, and the drum is driven by pinions **26** suitably mounted in the end frames **21** and meshing the ring gear teeth **23**.

The condenser structure as thus far described is of conventional design and may be widely varied in its structural details without departure from my present invention, which is concerned chiefly with the design and arrangement of the suction chamber formed within the drum to carry off the air current which must pass through the active surface portion of the drum to leave the entrained lint or fiber deposited thereon, it being understood that the drum is constantly rotated clockwise and the lint or fiber that collects on its outer surface in bat form, passes under the roll **16**, by which it is compressed, and finally is stripped and rolled up on the collecting roll **19**.

In the embodiment of my invention shown in Fig. 1, the suction chamber is defined by a plate bent, or adapted to be bent as applied, into a spiral or volute form suitable for reception within the interior of the drum between the end frames **21**. As shown, the plate **27** defining this volute suction chamber has its lower edge **28** bent under and provided with a sealing flap **29** which engages the inner surface of the drum **12** opposite the sealing flap **14**. The plate presents its lower end in position to form a continuation of the bottom of the delivery duct **10**, **11** and its body portion may be preformed to a definite spiral shape, or it may be bent to that shape by having attaching lugs **30**, secured along its side edges, connected through bolt holes provided in the end frames **21** in position so that when all these plate lugs are bolted in place to the end frames **21** the plate itself will assume and be fixedly held in the correct spiral shape. It will be noted that the inner edge **31** of the spiral wall formed by the plate **27** terminates in spaced relation to the adjacent convolution of the spiral so as to leave ample a clearance for the air current to enter, and flow in a vortex whirl around the pole of the spiral. In each of the end frames **21** I provide an outlet connection **32**, preferably circular with a radius corresponding to the radius of the spiral at its edge **31**, and each outlet defined by an outwardly extending collar **33** integral with or secured to its respective end frame **21**. A suction pipe **34** can be connected to either or both of these collars **33**, but as only a connection at one end is necessary, I have shown the other outlet connection closed by a cap **35**. The collars are slightly tapered outwardly so that the cap and suction pipe can be readily and tightly fitted thereto and easily removed therefrom. A sealing flap **36** is attached along the plate **27** opposite the roller **16** so as to seal the joint between it and the drum surface **12** overhead. This flap **36** stops short of the ring gears **23** in the drum and substantially corresponds in length with the presser roll **16** opposite which it works so that between them they complete a sealing of the lint collection zone overhead. This flap **36** extends axially across the entire perforated portion of the drum which it engages.

The method of operating and collecting lint from the air current is briefly as follows. The lint bearing air current flowing through the gradually expanding delivery duct **10—11** is gradually decelerated as it approaches the lint collecting zone defined by the arcuate path of the active drum portion so that it impinges on the drum under low pressure and velocity and free of disturbing eddy currents. The drum thus acts to collect the lint thereon from the air current while it is at its lowest velocity and a suc-

tion effect from the exhaust chamber within the drum is required to draw the air current through the screen, leaving the fiber and lint deposited on the moving surface of the drum. To prevent the occurrence of too high air velocities, or unbalanced air flow, through the active portion of the screen, the exhaust chamber has the design of a duct that will induce an air current which has its lowest velocity adjacent to the screen and which has practically an equalized flow lengthwise of the active surface area of the screen. As the air current is drawn away by suction from the screen, however, it is forced to traverse a volute path of gradually decreasing area, which results in a gradual acceleration of the rate of flow of the air current until it enters at relatively high velocity into a central whirl about the pole of the spiral chamber, throughout which the suction effect from the port **32** acts uniformly to withdraw air along the pole of the spiral chamber. The velocity of the whirl is calculated to counteract any tendency of this axial withdrawal at its center exerting any appreciable unbalancing effect of the suction as applied to the active portion of the drum, but velocity of the air current in the volute suction chamber is sufficient to carry off with it such lint and foreign matter as may pass through the drum and deliver same into the vortex whirl and thence into the suction pipe.

By disposing the edge **31** in position where it is shielded by a convolution of the suction chamber from direct exposure to the active surface of the drum, I avoid any tendency of the suction to create short circuits and I cause the suction force, applied along the pole of the whirl, to become uniformly distributed across the enlarged exhaust chamber before it is effective against the drum. As shown in Fig. 1, the suction outlet **32** is disposed in the upper portion of the drum and the air currents are of such character as to overcome the action of gravity on any entrained foreign matter and lift same to the exit level and discharge same into the suction pipe.

In Fig. 3 I show a modification of the design of the volute suction chamber which is here formed by the plate **27***a* which has its outer end disposed uppermost and terminating opposite the roller **16**. A sealing flap **29***a* is mounted on said plate in position to engage the inner perforated surface of the drum. The inner edge **31***a* of the suction chamber is disposed so as to produce a vortex whirl of the outgoing air current approximately in the center of the condenser drum where the suction outlet connections **32***a* are provided in the manner already described. A deflector **37** is attached to a convolution of the plate **27***a* and disposed in a tangent plane thereto and in line with the bottom of the delivery duct **10***a* which has a sealing flap **14***a* for the purposes already described. In this arrangement the direction of the whirl is the reverse of that described in Fig. 1, but the operation of the apparatus is otherwise the same with the exception that it is only necessary to lift any matter entrained with the air current to the upper level of the inner whirl. The dotted line **41** in this Fig. 3, and also in Fig. 4, indicates the manner of accumulation of the fiber on the active portion of the drum into bat form before reaching the presser roll **16** which presses the bat down into condensed form suitable to be wound on the bat roll **19**. The arrows in this view, by their relative length, indicate the volume of air which flows through the active surface of the drum into the exhaust chamber, this volume decreasing gradually upwardly of said active surface responsive to the accumulation of the bat thereon. The greatest volume is thus shown to flow up along the deflector **37** so that it will sweep up with it into the vortex whirl any foreign matter that comes in contact with said deflector.

In the modification shown in Fig. 4, the suction chamber is defined by a plate **27***b* so mounted as to form a volute chamber below the center of the drum, the inner end edge **31***b* of the plate defining an entrance opening to the vortex space which is shielded by the opposite convolution of the spiral wall **27***b* from direct exposure to the active drum surface. Instead of continuing as a spiral, however, the plate **27***b* is bent upwardly and away from the active drum surface at a slope to a point **38** where it is reversely curved and then is bent upwardly and forwardly so as to define a parabolic deflector portion **39** terminating in an upper flange that carries a sealing flap **29***b* opposite the presser roll **16**.

The arrows in this view indicate the direction of flow of air currents through the active drum surface and the effect of their impinging against the parabolic surface **39**. The focus **40** of the parabolic deflector **39** is so positioned that all air currents impinging thereon will be deflected downwardly in a common direction into the volute portion of the suction chamber along the lines indicated by the arrows. The curvature of the arrows indicates the deflection of the air currents due to the suction action exerted on the down flowing converging air currents so as to draw them into the vortex whirl.

In all of the designs shown, the volute suction chamber will avoid the creation of disturbed air currents adjacent to the zone of separation, i. e., the active portion of the drum, and in all cases the suction effect at the center, or along the pole of the volute suction chamber, is so distributed that practically uniform suction is applied lengthwise of the active drum surface, thus avoiding the tendency to by-pass air directly into the suction pipe **34**.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof.

What I claim is:

1. An improvement in the art of separating lint and the like from a pressure induced air current bearing it, which comprises decelerating said current as it approaches the zone of lint separation, mechanically collecting and removing the collected lint from said decelerated air current, and conducting the air current away by forced draft from said separation zone in a whirl in which its flow is gradually and uniformly accelerated until discharged along the pole of the whirl.

2. A condenser for lint cotton and the like, comprising an intake and a substantially volute exhaust duct, which duct gradually increases in size as they approach a lint collection zone defined by and between their opposed larger ends, an air discharge in line with the pole of the volute exhaust duct, a traveling condenser screen movable across said lint collection zone between and in sealed engagement with said ducts, and means to remove lint from said screen.

3. A condenser according to claim 2, in which the exhaust duct has an end suction connection in line with the pole of the spiral air whirl it creates.

4. A condenser for lint cotton and the like, comprising a traveling lint collecting screen, a duct to deliver an air current bearing lint to the active portion of said screen, and a volute suction duct to conduct the air therefrom having a contracting area as it approaches its lateral exhaust outlet.

5. A condenser for lint cotton and the like, comprising a traveling lint collecting screen, a duct to deliver an air current bearing lint to the active portion of said screen, and a suction duct to conduct away said air currents having an enlarging approach to the active portion of said screen on the opposite side thereof from said delivery duct and defined by end walls and a spirally curved side defining a curved contracting outlet passage in which the air flowing through said screen is deflected to form a whirl, and means to apply suction axially to the air in said whirl.

6. A condenser according to claim 5, in which said wall forms a parabolic deflector.

7. A condenser according to claim 5, in which said wall is in the form of a parabolic deflector forming the outer end of a volute having the suction connection at its center.

8. A condenser for lint cotton, comprising a rotating screen lint collecting drum, means to deliver a lint bearing air current to the active outer surface portion of said drum, means to define a volute suction chamber within said drum, means to direct all air passing through said active drum surface into said volute chamber, and suction means to withdraw said air along the pole of the volute.

9. A condenser according to claim 8, in which the suction chamber is defined in part by a spiral wall having one end in sealing relation to one side of the active drum surface and having means connecting an intermediate portion in sealing relation to the opposite side of said active drum surface.

10. A condenser according to claim 8, in which the suction chamber is defined by end walls and an interposed spiral wall having one end in sealing relation to one edge of the active drum surface and having an intermediate connection in sealing relation to the outer end of said active drum surface, and an opening is formed in each end wall for the suction connection.

11. In an apparatus for the treatment of lint bearing air currents, a chamber having a transverse inlet for the air current to be treated, an air outlet, transverse wall means defining said chamber as a converging passage extending from said air inlet to a point in line with said air outlet, and means to force said air into a whirl, about an axis in line with said outlet, with sufficient velocity flow to transfer the air motion while in the whirl from rotary motion about the pole of the whirl into motion along said pole to the point of outflow.

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