March 9, 1943. G. C. MORGAN 2,313,256

FLUID DISTRIBUTION AND COLLECTION SYSTEM

Filed Aug. 11, 1941 2 Sheets-Sheet 1

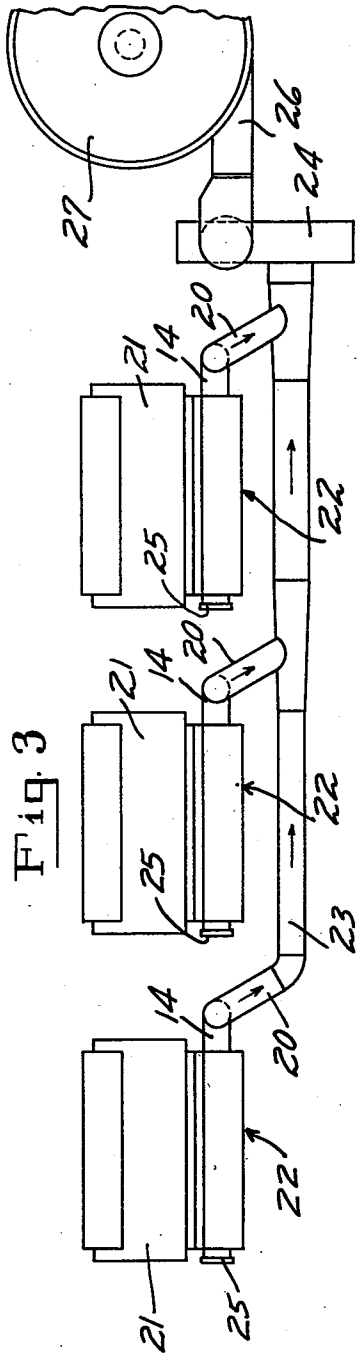

Fig. 3

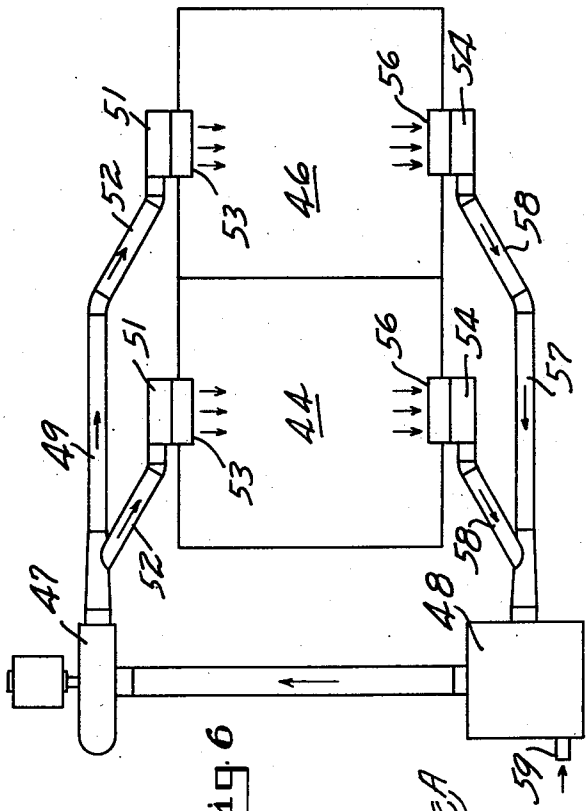

Fig. 6

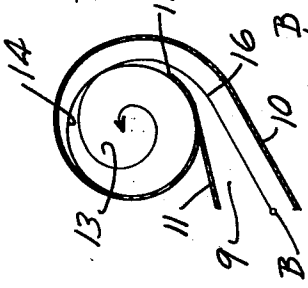

Fig. 1

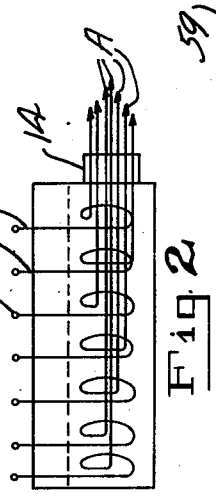

Fig. 2

INVENTOR
GEORGE C. MORGAN
BY Henry L. Jennings
ATTORNEY

March 9, 1943. G. C. MORGAN 2,313,256

FLUID DISTRIBUTION AND COLLECTION SYSTEM

Filed Aug. 11, 1941 2 Sheets-Sheet 2

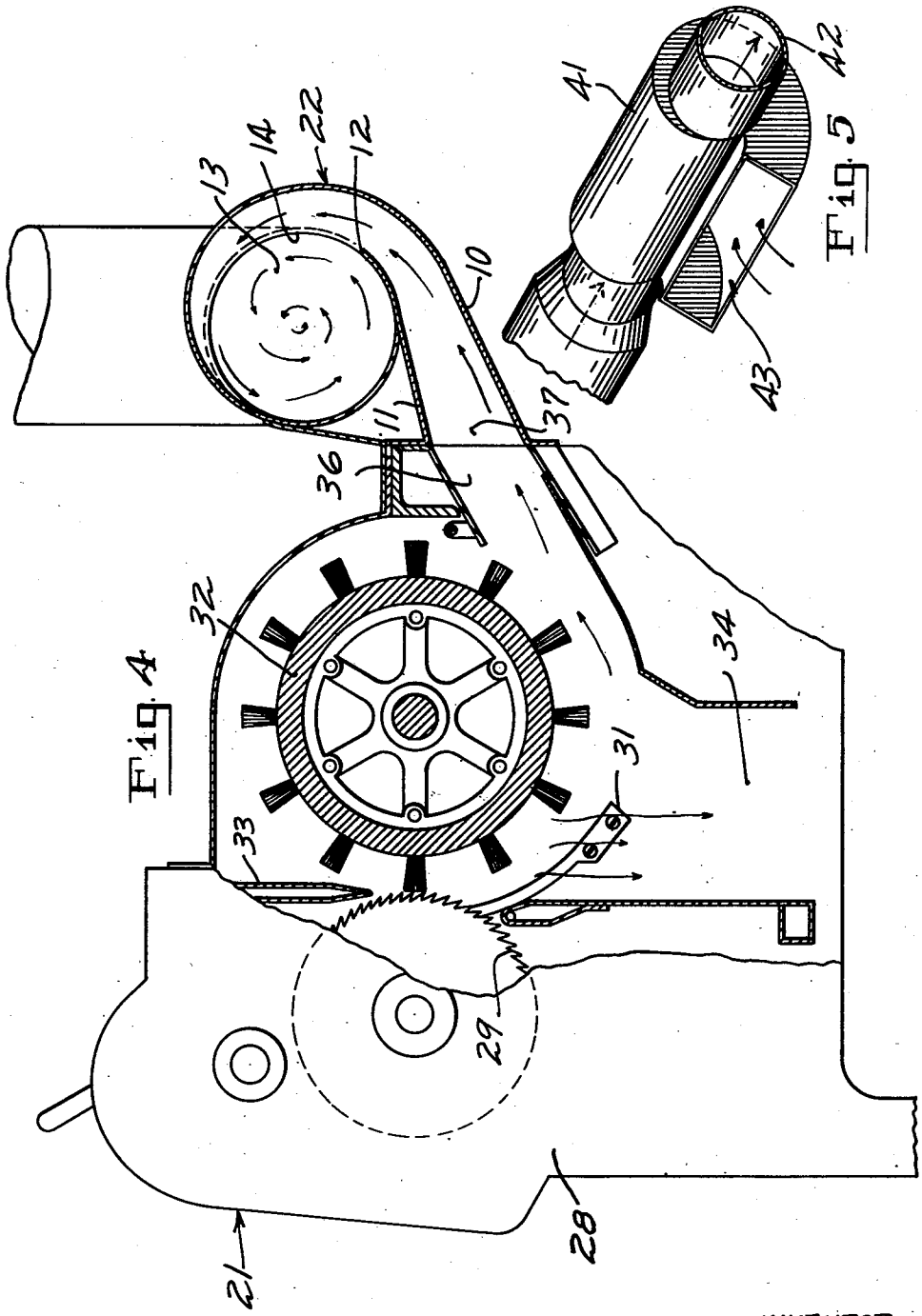

Fig. 5

Fig. 4

INVENTOR
GEORGE C. MORGAN
BY Harry L. Jennings
ATTORNEY

Patented Mar. 9, 1943

2,313,256

UNITED STATES PATENT OFFICE

2,313,256

FLUID DISTRIBUTION AND COLLECTION SYSTEM

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

Application August 11, 1941, Serial No. 406,427

5 Claims. (Cl. 19—72)

This invention relates to fluid distribution and collecting systems, and particularly to apparatus for incorporation in such systems in which there is required a change in velocity and direction of flow of a fluid, and has for its object the provision of such apparatus which shall be adapted to effect such change with a minimum disturbance to the flow of the fluid at points of change in direction and velocity.

In a more specific aspect of my invention it is concerned with apparatus for incorporation into pneumatic collection and distribution systems wherein there is required an undisturbed regular flow of air into an apparatus or confined space with a change of direction and velocity of air leaving the apparatus or space. In its application to fluid distribution systems, such as air conditioning systems, the invention is adapted to provide a relatively high velocity flow to points of distribution with a change of direction and a lower velocity distributing flow from the apparatus. The return flow may be effected by a low velocity pickup with a high velocity return, thereby obviating discomforting drafts. This permits the employment of relatively small diameter conveying conduits in which fluid at a relatively high velocity of movement may be conveyed.

In a still more specific aspect of my invention, one object is to provide apparatus for collecting lint from a battery of gins which shall be effective to withdraw the lint from one or more gins uniformly across each gin and uniformly with respect to the several gins.

In the collection of the lint from linter gins, it has in the past been found difficult to collect the lint uniformly throughout the length of a gin. The reason for this has been the necessity of handling relatively large volumes of air and the fact that motes, dirt and trash removed with the short lint are difficult to separate therefrom due to the action of the air currents created by the gin brush. Further, the lack of uniformity in the air flow from the gin, caused an excess of such motes, dirt and trash to be carried out with the lint. Heretofore, hoods have been employed connecting the gins to the lint flue, which hoods began with a large inlet opening to match the outlet opening of the linter gin with which the hood was associated and converged to an outlet connection with the lint flue approximately one-fourth the inlet area. Such hoods permitted a portion of the air entering their central sections to pass directly therethrough, while air entering from either extremity passed through the hoods at a lower velocity. Consequently there was an uneven flow of air from the gin, and unsatisfactory moting of the gin. Furthermore, the strength of the suction on the various gins of a battery would depend on the position of each gin with respect to the suction blower, which fact further contributed to the unsatisfactory moting. For the reasons just set forth it has heretofore been almost the universal practice to provide a separate condenser for each linter gin and to take the lint therefrom in a bat. Such a system is shown in my prior Patent No. 2,237,358, issued April 8, 1941, and assigned to Continental Gin Company.

It has been proposed to remedy these difficulties with hoods comprising multiple conduits connected with multiple openings in the back of the gin, and converging to connect to a common branch line, and finally to a main trunk line. Such expedients are expensive and are still open to the objection of uneven pressures in the gins, uneven suction between separate gins, and resultant unsatisfactory moting.

These and other difficulties are overcome by means of my invention in which I provide a casing for the hood which is of a volute or spiral shape in cross section. The lint laden air enters the outer convolution of the casing and moves with a shortening radius toward the focal axis of the casing. An offtake conduit is connected to one end of the casing with its long axis coincident with the focal axis of the casing. A suction blower is connected to the offtake conduit, and, I have found, produces a uniform withdrawal of air throughout the entire length of the casing. In actual use it has been demonstated that hoods thus constructed of a length up to ten times the outlet diameter perform satisfactorily without undue loss of pressure and with uniform withdrawal of air from the linter which they are associated and with respect to each other. This limitation in length is, of course, not conclusive, but was brought about by factors such as friction which were present in the particular apparatus. In different apparatus, offering less frictional resistance to flow, the ratio of length of casing to diameter of outlet may be increased.

Apparatus embodying features of my invention is illustrated in the accompanying drawings forming a part of this application, in which

Fig. 1 is a diagrammatic sectional view of a volute casing such as may be employed with my invention, and showing the theoretical path of

angular movement of a particle passing through the casing;

Fig. 2 is a diagrammatic elevational view at right angles to Fig. 2, and showing the change in the theoretical path of movement of a particle from angular to axial movement in the volute casing;

Fig. 3 is a plan view of a lint collecting system embodying my invention;

Fig. 4 is a detail sectional view of one of the linter gins shown in Fig. 3;

Fig. 5 is a perspective view showing the manner in which one of my improved collecting and distributing units may be applied to a conveying conduit in an air conditioning system; and

Fig. 6 is a diagrammatic view of an air conditioning system employing my improved collecting and distributing units.

Referring to the drawings, I show in Fig. 1 a volute casing having a tangential opening 9 defined by walls 10 and 11. The wall 10 extends in a spiral to join the wall 11 at 12, where the wall 11 stops, to provide a vortex chamber 13. The casing may be of any suitable length up to ten times the diameter, or more, of the chamber 13, and is provided on one end with an opening 14, as shown in Fig. 2, the center of which is substantially coincident with the focal axis of the vortex chamber. If we assume particles of elastic fluid, or solids in suspension in an elastic fluid, entering the casing at its tangential opening 9, its angular path of movement is shown by the arrow 16 in Fig. 1, where, it will be seen, the particle moves in a spiral path with an ever decreasing radius toward the focal axis of the vortex chamber 13. Also, if we assume a force acting on the particle, or on the fluid in the casing, along the focal axis of the casing, there will be a change from angular to axial direction of movement, as shown by the arrows 17 in Fig. 2. Selecting the particle B for the purpose of illustration, as it enters the casing, it is moving in a plane around a spiral path with a definite angular velocity, but with a zero axial velocity. This condition exists only so long as the magnitude of the force tangential to the spiral is great enough to maintain the body in its entrant plane. With a reduction in the radius of movement, the energy of the body represented by its angular motion is reduced until the force acting in an axial direction, as at A, overcomes the force acting in an angular direction and deflects the body from its initial direction of movement. It thereupon describes a helicoidal path in its change from angular to axial movement, and leaves the casing in an axial direction, as shown at A. The force thus acting in an axial direction behaves similarly to the force of gravity on the trajectory of a projectile fired from a gun. With the gun pointed horizontally, the projectile has zero downward velocity at the moment it leaves the muzzle of the gun, but attains an accelerated downward velocity throughout its travel, due to the action of the force of gravity.

If we assume now that the greater force, or pressure of fluid, in the vortex chamber 13 acts in an axial direction, the movement of the particle B would be the reverse of that just described. The area of the opening 9 of the casing being very much greater than the area of the opening 14, the velocity of fluid passing through the opening 14 is much greater than through the opening 9. For this reason, my invention is particularly adapted to incorporation in systems in which there is required a change in velocity and direction of flow of a fluid. The fluid entering the inlet 9, as shown in Figs. 1 and 2, enters the casing at a relatively low velocity and leaves it at a relatively high velocity in a direction normal to its entrant direction of movement. If it be desired to employ the invention as a distributing unit, fluid would enter the casing through the opening 14, gradually assume an angular direction of movement, and pass out of the casing through the opening 9, which has been described as the entrant opening, at a lower velocity.

Referring now to Fig. 3 of the drawings, I show the manner in which my invention may be adapted for the pneumatic collection of lint from linter gins. At 21 are shown a plurality of linter gins, each of which has connected thereto one of my improved collection units 22. The offtake 14 of each of the collection units is joined by a branch conduit 20 to a common lint flue 23 which, in order to handle the increasing volume of air, increases in diameter from the initial gin 21 of the battery until it connects to the inlet of a blower 24 which acts to create suction in an axial direction on the outlets 14. The opposite ends of the outlets 14 are each closed by means of a cover 25. The blower 24, as is well understood, draws the lint-laden air from the several gins 21. It may discharge through a conduit 26 to any suitable separator, such as the cyclone separator 27 shown in Fig. 3, where the lint and air are separated. Further processing and cleaning of the lint may then be effected in any manner known to the art.

In Fig. 4 I show a detail sectional view of one of the gins 21 which embodies a casing 28 enclosing a saw cylinder 29 and gin ribs 31. At the rear of the saw cylinder 29 is a brush 32 for removing lint from the saw cylinder, and which, in its movement, acts as a blower to create movement of a relatively large volume of air which carries the lint away from the gin. A division board 33 extending across the gin and downwards to a line immediately above the line of engagement of the brush 32 with the saw cylinder 29, prevents the air set in motion by the brush 32 from passing into the front of the gin to interfere with its operation. The heavier particles of dirt and motes are thrown off by the saw cylinder 29 and brush 32, and fall downwardly into the passage 34, where they may be removed, as is well understood. The current of air created by the brush 32 with its lint passes upwardly and outwardly of the gin through the passage 36, where it joins the inlet opening 37 to the volute casing 22 employed as a collection unit in my improved system. The upward inclination of the passage 36 and opening 37 aid in keeping the lint in suspension in the air current.

The suction created by the blower 24 acting through the lint flue 23 is preferably just sufficient to overcome the frictional losses in energy of the lint-laden air passing through the casing. The action of the brush 32, being uniform across the saw cylinder 29, the movement of lint-laden air into the casing 22 is uniform across the gin and consequently, the motes and heavier particles are thrown off uniformly across the gin. I am thus enabled to collect the lint pneumatically from a battary of gins, as shown in Fig. 3, and separate it from the air in a single separator 27. With my invention, there is no necessity of employing a separate condenser for each gin where the lint is collected in a bat, as shown in my prior patent aforesaid.

In Fig. 5, I show a modification of my invention adapted for incorporation in an air conditioning system. In accordance with this modification, a spiral casing 41, such as heretofore described, is formed about the conveying conduit 42 of an air conditioning system, it being assumed that there is suction in the conduit 42 tending to draw air into the inlet opening 43 of the casing 41. When so employed, as has heretofore been explained, air enters the casing through a relatively wide inlet opening at a relatively low velocity and is carried away by the conduit 42 at a relatively high velocity. It will be seen that by this means, conveying conduits of relatively small diameter may be employed for larger volumes of air than have heretofore been throught practical, and that in collecting the vitiated air from the space served, it enters the apparatus at a relatively low velocity.

A further application of my invention to an air conditioning unit is shown in the diagrammatic view, Fig. 6. In Fig. 6, I show enclosed spaces 44 and 46, representing rooms to be served by the air conditioning apparatus. A circulating blower 47 draws air from a conditioning unit 48 and discharges it through a distributing conduit 49. Connected to the distributing conduit 49 are distributing units 51, each comprising a spiral casing as heretofore described. The conveying conduit 49 is connected to each of the units 51 through an axial connection 52 where the air enters and is discharged through the relatively large area tangential opening 53 into the spaces 44 and 46. Air from the spaces 44 and 46 is collected through similar units 54 having tangential inlets 56 opening into the air spaces 44 and 46, and connected to be collection flue 57 by means of branch conduits 58, which latter are joined to the axial openings of the spiral casing 54, as heretofore described. The collection flue 57 discharges into the conditioning unit 48, to be withdrawn therefrom by the fan 47. Makeup air may be introduced through a conduit 59 in a manner well understood.

From the previous detailed description, it will be seen that the circulation of air through the spaces 44 and 46 may be accomplished at a relatitvely low velocity without drafts, and that the air may be conveyed to these spaces to be served in relatively small conduits where it may be maintained at higher velocities and higher pressures than has been practical with the means of distribution heretofore employed.

From the foregoing it will be apparent that I have devised an improved fluid distribution and collection system embodying a unit which is adapted to change the velocity and direction of flow of the fluid without disturbance of its uniformity of flow at points of change in direction and velocity.

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, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a pneumatic lint collecting system, a plurality of gins, a volute lint collecting casing to receive the lint-laden air from each gin, said casing having a tangential opening extending across and connected to the rear of the gin, an offtake conduit connected to one end of each volute casing and having its long axis coincident with the focal axis of the volute casing, a common lint flue to which the several offtake conduits are connected, means to effect a flow of the lint bearing air from the offtake conduits into the lint flue, and a common means for separating the lint and air from all the gins.

2. In a pneumatic lint collecting system, a gin, a volute casing extending across the rear of the gin to receive the lint therefrom and having its focal axis lying horizontally at the rear of the gin, an offtake conduit connected to the casing at one end thereof, the long axis of the conduit coinciding with the focal axis of the casing, and means to effect a flow of lint bearing air from the casing into the offtake conduit.

3. In a pneumatic lint collecting system, a gin, a volute casing extending across the rear of the gin to receive the lint therefrom and having its wall of greater radius extending rearwardly from the gin in a spiral to form the vortex chamber of said casing, an offtake conduit connected to the casing at one end and having its long axis coinciding with the focal axis of the casing, and suction means connected to the offtake conduit.

4. In a pneumatic lint collecting system, a gin, a volute casing extending across the rear of the gin to receive the lint therefrom and having its wall of greater radius extending rearwardly from the gin a spiral to form the vortex chamber of said casing, an offtake conduit connected to the casing at one end and having its long axis coinciding with the focal axis of the casing, a closure for the other end of the offtake conduit, and suction means connected to the offtake conduit.

5. In a pneumatic lint collecting system, a gin, a volute casing extending across the rear of the gin to receive the lint therefrom and having its wall of greater radius extending rearwardly and upwardly from the gin and curving spirally to form a vortex chamber in the casing, an offtake conduit connected to the casing and having its long axis coinciding with the focal axis of the casing, and suction means connected to the end of the offtake conduit.

GEORGE C. MORGAN.