Oct. 21, 1969 G. M. McCOURT 3,473,237

CONDENSATE DRAINAGE CONDUIT FOR STEAM-HEATED DRUM AND THE LIKE

Filed Dec. 7, 1967 2 Sheets-Sheet 1

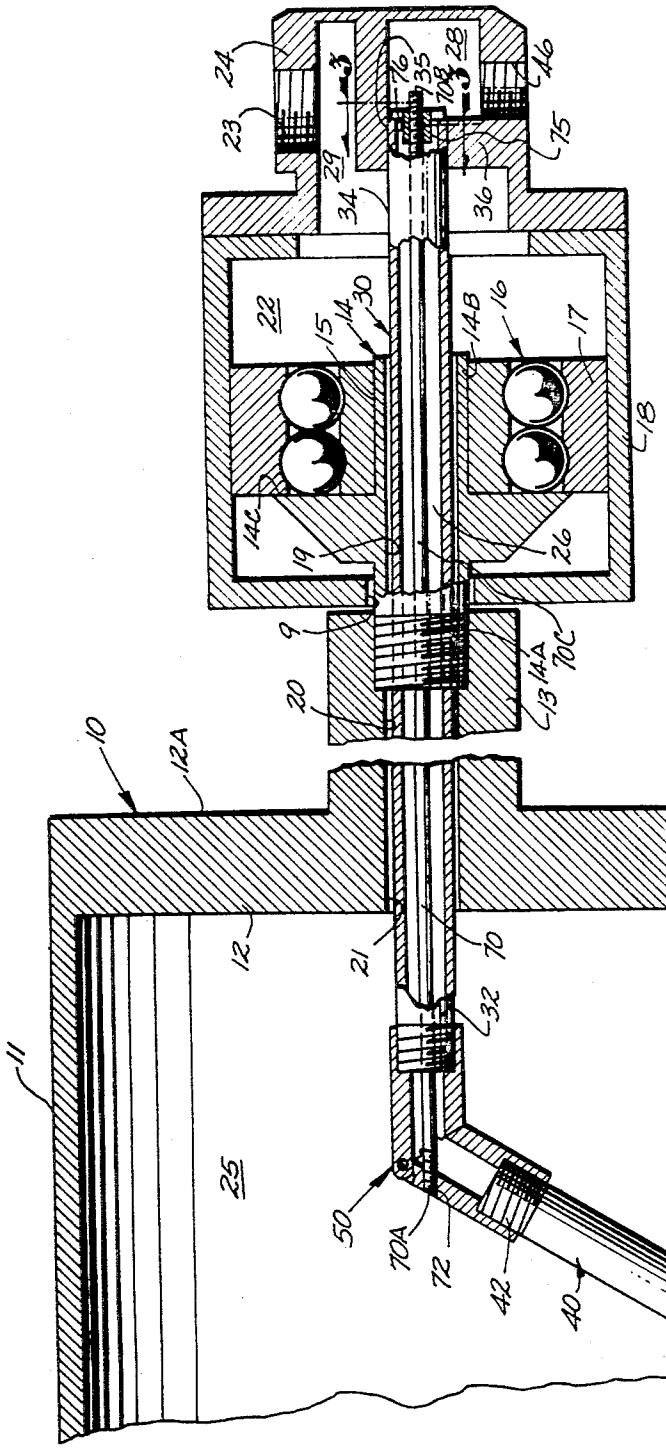

Fig. 1

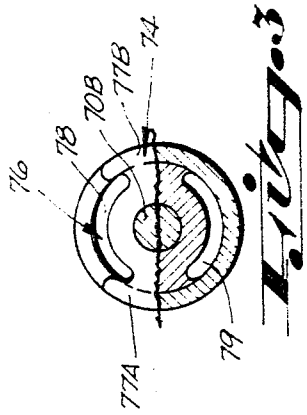

Fig. 3

INVENTOR.
Gerald M. McCourt
BY Wood, Herron & Evans
ATTORNEY'S

Oct. 21, 1969 G. M. McCOURT 3,473,237

CONDENSATE DRAINAGE CONDUIT FOR STEAM-HEATED DRUM AND THE LIKE

Filed Dec. 7, 1967 2 Sheets-Sheet 2

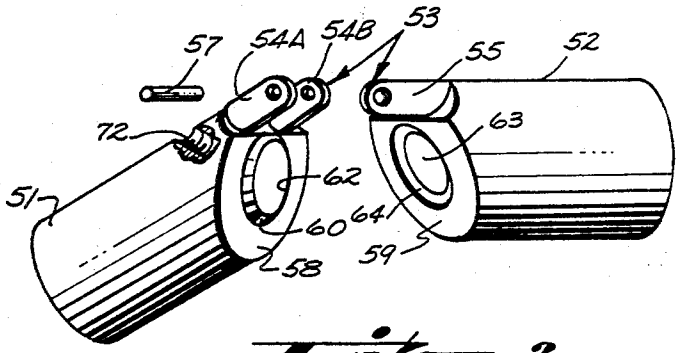

Fig. 2

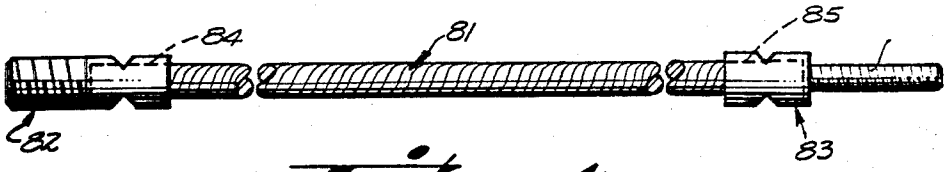

Fig. 4

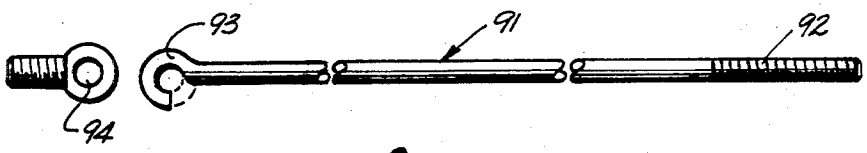

Fig. 5

INVENTOR.
Gerald M. McCourt
BY Hood, Herron & Evans
ATTORNEYS

United States Patent Office 3,473,237
Patented Oct. 21, 1969

3,473,237

CONDENSATE DRAINAGE CONDUIT FOR STEAM-HEATED DRUM AND THE LIKE

Gerald M. McCourt, 1240 Le Roy Place,
Cincinnati, Ohio 45230

Filed Dec. 7, 1967, Ser. No. 688,906
Int. Cl. F26b *11/04*; F28f *5/02*; F28d *11/02*
U.S. Cl. 34—125 9 Claims

ABSTRACT OF THE DISCLOSURE

A stationary condensate drainage conduit is disclosed for permitting condensate, which collects in the bottom of a rotating steam-heated drying drum, to be siphoned while the drum is rotating, and transmitted to a suitable condensate receptacle located external of the drum. The condensate drainage conduit includes a first or intake tube positionable entirely within the rotatng drum, and a second or discharge tube partially insertable within the drum through a bore located concentric with the drum axis. The tubes are flexibly connected to permit them to be selectively positioned between an operative position wherein the tubes are angled to permit the intake tube to have its free end adjacent the lowermost portion of the drum wall to siphon condensate collecting thereat, and an inoperative position wherein the tubes are coaxial to permit them to be freely inserted and withdrawn from the drum via the axial bore. A lock bar is positioned within the discharge tube, and has one end connected to the intake tube and the other end connectable to the unconnected end of the discharge tube. The lock bar serves the dual function of locking the tubes in the operative position, thereby preventing undue wear at the point of connection, and of providing means for retrieving the intake tube without drum disassembly should the flexible connection fail in use and the intake tube become disconnected from the discharge tube.

This invention relates to condensate drainage conduits, and more particularly to stationary condensate drainage conduits for collecting condensate from a rotating steam-heated drum.

Drums of the type in which the condensate drainage conduit of this invention finds particular utility are employed in a number of different industrial applications. For example, drying drums are used in the printing industry where they function to dry the ink applied to the paper as it leaves the printing press. Drying drums are also used in the paper making industry for drying the paper output from the paper making machine prior to its being coiled in rolls or otherwise prepared for shipment.

Typically, the drying drums of the type to which the condensate drainage conduit of this invention relates are hollow, and are heated to the operating temperature by the introduction of steam into the drum interior. In the course of heating the drying drum, condensate necessarily is formed and if not removed, collects in the bottom of the drum.

For optimum effectiveness of the drying drum, the condensate formed in the drum interior must be continuously removed. If it is not, and is allowed to accumulate, in due time the mass of condensate which develops is sufficient to appreciably decrease the drum speed as well as dynamically unbalance it, tending to produce undue vibration and bearing wear. In addition, failure to remove the accumulated condensate prevents the temperature of the drum from being elevated much above the vaporization point of the condensate. Since the condensate, which is at a temperature slightly below its vaporization point, is in contact with the rotating drum wall, the drum wall

is prevented from being elevated to a temperature much above the condensate vaporization point. Should the drum wall temperature attempt to rise above this point, heat is transmitted to the condensate from the drum, vaporizing the condensate. Thus, the condensate, if not removed, draws heat from the drum preventing the drum temperature from rising substantially above that of the condensate vaporization point.

Typically, the prior art proposals for removing condensate from a drying drum of the type described have involved the use of a pair of flexibly connected or hinged tubes. One of the tubes, termed an intake tube, is adapted to be positioned within the drum via an axial bore with its free end adjacent the drum wall where the condensate collects. The other tube, termed the discharge tube, is adapted to be partially inserted into the drum, also via the axial bore. Condensate is removed from adjacent the drum wall by the intake tube as the drum rotates, whereupon it is transmitted by the discharge tube to a suitable condensate receptacle located externally of the moving drum.

The hinge connection between the tubes permits the tubes, which are necessarily angled when operatively positioned in the drum, to be arranged coaxially for convenient insertion and withdrawal. If the tubes are not hinged, but rather are permanently angled, it is not possible, without disasembling the drum, to operatively position the tubes within the drum.

The prior art condensate conduit proposals have been the source of two distinct, but yet related, problems. The first problem involves the eventual, and often premature, disconnection of the tubes by failure of the hinge connection. This is typically the result of undue hinge wear caused by excessive relative angular movement of the tubes induced by vibration and the like, and once it occurs has the obvious effect of preventing further drainage of condensate. The other problem, induced by the first, relates to the difficulty of retrieving the intake tube once it becomes disconnected from the discharge tube, and falls to the bottom of the drum. In the past, when the hinge connection failed, it has been necessary to stop the drum, after allowing it to cool, disassemble it or remove from it an access cover permitting entry therein for tube retrieval purposes, and thereafter, the tube having been retrieved, reasemble the drum and heat it up again.

As will be apparent, the above difficulties necessitate interruption of the operation of the drying drum each time a condensate conduit hinge fails. This, in turn, causes interruption of the paper making line or printing process in which the drying drum is used, aggravating the problem.

It has been an objective of this invention to provide a flexibly-connected tube drainage conduit for removing condensate from a rotating steam-heated drying drum which is not subjected to excessive connection wear leading to premature breakage, and which if broken permits retrieval of the fallen discharge tube without the need for disassembling the drum. This objective has been accomplished in accordance with the principles of this invention by modifying the conventional flexibly-connected tube discharge conduit in a very simple, yet unobvious and extraordinarily effective manner, which reduces relative movement between the tubes, and hence connector wear, while at the same time providing means for retrieving a fallen discharge tube, should the conduit break.

The modification of the conventional flexibly-connected conduit contemplated by this invention includes the provision of a lock bar within the discharge tube of the conduit, which at one end is connectable to the connected end of the intake tube and at the other end is connectable to the unconnected end of the discharge tube. The lock bar functions in a dual capacity. First, it locks

the tubes, when inserted in the drum, in their angled operative condition, with the free end of the intake tube adjacent the interior drum wall. This is achieved by tensioning the lock bar and thus urging the connected ends of the tubes together, and serves to prevent excessive tube movement, and hence, connector wear which leads to premature conduit breakage. Additionally, the lock bar, should the connector eventually fail, permits the intake tube to be removed from the drum interior. This is accomplished by merely withdrawing the lock bar which at its inner end is connected to the now unconnected intake tube.

Other objectives and advantages of this invention will be more readily apparent from a detailed description of the invention taken in conjunction with the accompanying drawings in which:

FIGURE 1 is an elevational view in cross section of a preferred embodiment of the condensate drainage conduit of this invention showing the conduit inserted into the drum with the tubes locked in their angled operative position.

FIGURE 2 is a perspective view of the hinge shown in FIGURE 1.

FIGURE 3 is a cross-sectional view taken along line 3—3 of FIGURE 1.

FIGURES 4 and 5 are elevational views of alternate lock bar constructions suitable for use in practicing this invention.

A rotatably-mounted, steam-heated drum **10** with which the condensate drainage conduit of this invention finds particular utility is shown in FIGURE 1. The drum **10** includes a cylindrical shell or wall **11** the ends of which are enclosed by circular discs **12** only one of which is shown in FIGURE 1. Axially extending from the outer surface **12A** of the disc **12** is a hub **13**. To rotatably support the drum **10**, of pair of suitable bearings (not shown) are provided which engages the hub **13** projecting from disc **12** and a similar hub projecting from the other end of the drum (not shown).

Also included are a stepped diameter shaft **14** and a ball bearing **16** enclosed within a stationary housing **18**. One end **14A** of the stepped diameter shaft **14** passes through an opening **9** in the housing **18** and is threaded into the hub **13**. The other end **14B** of the shaft **14** fits within and rotates with an inner race **15** of the ball bearing **16**. Inner race **15** engages shaft shoulder **14C**. The ball bearing **16** has an outer race **17** which is secured to the interior of the stationary housing **18**. The ball bearing **16** supports the housing **18**.

To permit steam to be introduced into the interior **25** of the drum **10** for heating the wall **11** the shouldered shaft **14**, hub **13**, and disc **12** are provided with concentric bores **19**, **20**, and **21**, respectively. Steam is admitted into the interior **22** of the housing **18** via a port **23** provided in a housing end cap **24** and from there passes into the drum interior **25** via the coaxial bores **19**, **20**, and **21** of the shouldered shaft **14**, hub **13**, and disc **12**, respectively.

The condensate drainage conduit of this invention includes a first or discharge tube **30** having an intermediate portion concentrically disposed within the coaxially arranged bores **19**, **20**, and **21**, and intake and discharge ends **32** and **34**, respectively, interiorly and exteriorly disposed realtive to the drum **10**. The discharge end **34** of the discharge tube **30** is preferably threaded into a suitably disposed bore **35** formed in a wall **36** of the housing end cap **24** separating cavities **28** and **29** formed in the housing end cap. With the discharge end **34** of the tube **30** so mounted the tube is cantilevered concentrically within the bores **19**, **20**, and **21** and the drum **10**. As those skilled in the art will appreciate the external diameter of the tube **30** must be less than the internal diameter of the bores **19**, **20**, and **21** to provide an annular passage **26** for steam to pass from the interior

22 of the ball bearing housing **18** into the interior **25** of the drum **10**.

The condensate drainage conduit further includes a second or intake tube **40** positionable within the interior **25** of the drum **10**. The tube **40** has an intake end **41** and a discharge end **42**, and is flexibly connected at its discharge end to the intake end **32** of the tube **30** for movement between an operative position (shown in FIGURE 1) and an inoperative positioin. In the operative position, the intake end **41** of the tube **40** is positioned adjacent the cyclindrical wall **11** of the drum **10** so as to permit condensate **45**, which collects in the bottom of the drum **10**, to be siphoned and successively flow through tubes **40** and **30** into the cavity **28** where it is ultimately discharged into a suitable reservoir or receptacle (not shown) via a port **46** formed in the outer wall of the housing end cap **24**. In the inoperative position the tube **40** is disposed substantially coaxially with the tube **30**, permitting the connected tubes **30** and **42** to be easily inserted and withdrawn from the interior **25** of the drum **10** through the coaxial bores **19**, **20**, and **21**.

The flexible connection between the discharge end **42** of tube **40** and the intake end **32** of tube **30** is preferably in the form of a hinged elbow **50** shown more particularly in FIGURE 2. The hinged elbow **50** includes a lower one-half section **51** and an upper one-half section **52** which are flexibly connected via a hinge **53**. The hinge **53** includes cooperating lugs **54A** and **54B** projecting from the lower one-half elbow section **51**, and a lug **55** projecting from the upper one-half section **52**. The lugs **54** and **55** are provided with holes which receive a pin **57** for pivotally mounting or hinging the upper and lower one-half sections **51** and **52** when the lug **55** is sandwiched between the lugs **54A** and **54B** with the holes aligned.

The mating end surfaces **58** and **59** of the elbow sections **51** and **52**, respectively, are angled relative to the axes of their respective one-half sections so as to be in complete contact with each other when the tube **40** is in its operative position, thereby preventing condensate leakage at the joint formed by the elbow sections. To aid the sealing action provided by the mating faces **58** and **59**, an axially projecting lip **60** encircling the bore **62** of the lower section **51** is provided which snugly interfits, when the tubes **30** and **40** are angled, in a circular recess **64** circumscribing the bore **63** of the upper section **52**.

A lock bar **70**, which locks the tubes **30** and **40** in the operative position and additionally provides means for retrieving the intake tube **40** should it become disconnected, is provided in the condensate drainage conduit of this invention. The lock bar **70**, which is preferably fabricated of metal, has an intermediate portion **70C** which is disposed substantially concentrically within the tube **30**, a first threaded end **70A** which is threadable in a hole **72** formed in the wall of the lower elbow one-half section **51** adjacent the discharge end **42** of tube **40**, and a second threaded end **70B** which projects from the discharge end **35** of the tube **30** into the cavity **28** formed in the housing end cap **24**. The diameter of the bar **70** must be less than the internal diameter of the tube **30** to permit condensate to flow through the tube.

A fastening or tensioning device **74**, which is shown more particularly in FIGURE 3, is provided for drawing the rod **70** rightwardly, as viewed in FIGURE 1, to urge the end faces **58** and **59** of the hinge one-half sections **51** and **52**, respectively, into intimate contact thereby locking the tube **40** in the operative position shown in FIGURE 1. The fastening device **74** includes a shaft portion **75** adapted to fit within the discharge end **35** of the tube **30** forming therewith an annular passage **76** through which condensate is adapted to flow from the tube **30** into the cavity **28**. The fastening device **74** further includes a pair of oppositely disposed radially projecting portions **77A** and **77B** which are adapted to extend beyond the wall of the discharge end **35** of the tube **30**

to enable the fastening device to engage and abut the tube discharge end when the fastening device is threaded onto the end 70B of the lock rod 70 to draw the lock rod 70 rightwardly and thereby lock the tube 40 in the operative position. Spaces 78 and 79 disposed between the projections 77A and 77B provide communication between the annular passage 76, formed by the shaft 75 and the walls of the tube discharge end 35, and the cavity 28. These enable condensate to pass from the discharge end 35 of the tube 30 into the cavity 28 and thence through the port 46 to a suitably positioned condensate receptacle or container (not shown).

In operation, to insert the condensate drainage conduit into the interior 25 of the drum 10, it is first necessary to remove the housing end cap 24 from its operative position on the side of the housing 18, disengage the lock rod end 70B from the threaded hole 72, and coaxially align the tubes 30 and 40. With this done, the tubes 30 and 40 are inserted through bores 19, 20 and 21 into the interior 25 of the drum 10. When the tubes 30 and 40 are inserted the desired distance, the tube 30 is rotated until the tube 40 assumes the angled position depicted in FIGURE 1 whereupon the end 70A of the lock bar 70 is threaded into the hole 72 formed in the discharge end of the lower hinge member 51. The lock rod 70 is then tensioned by drawing it rightwardly as viewed in FIGURE 1. This is done by threading the fastener 74 onto the end 70B of the lock rod 70 and tightening it until the mating surfaces 58 and 59, and the lip 60 and recess 64 of the hinge members 51 and 52, respectively, are snugly engaged, providing a fluid tight joint between the bores 62 and 63. With the tube 40 locked in the operative position, the housing end cap 24 is threaded onto the discharge end 35 of the tube 30 and the end cap thereafter mounted to the housing, cantilevering the tubes 30 and 40 concentrically within the bores 19, 20, and 21 and the drum interior 25. With the condensate drainage conduit so connected, condensate is siphoned from the drum interior 25 by connecting suitable siphon means between port 46 and the condensate receptacle (not shown).

As those skilled in the art will appreciate, various modifications may be made in the preferred embodiment described in connection with FIGURES 1–3 without departing from the spirit and scope of this invention. For example, the lock bar, which is utilized to lock the intake tube 40 in its operative position as well as to permit its retrieval upon failure of the hinge 53, may be fabricated of flexible material as depicted in FIGURE 4. Referring to FIGURE 4, the alternative lock bar construction disclosed includes a flexible cable 81, the opposite ends 84 and 85 of which are connected to threaded members 82 and 83. The threaded members 82 and 83 are secured to the flexible cable ends 84 and 85 by suitable means such as by inserting the ends 84 and 85 into blind holes formed in the threaded members 82 and 83, respectively, and thereafter crimping the members 82 and 83. Threaded member 82, like its counterpart threaded end 70A of lock bar 70, is threadable in the hole 72 formed in elbow one-half section 51. Similarly, threaded member 83, like its counterpart threaded end 70B of lock bar 70, is threadable in fastener 74. The operation of the flexible cable 81 is substantially identical to the operation of the lock bar 70, and therefore, is not described in detail herein.

Shown in FIGURE 5 is another alternative construction of the lock bar of this invention. This alternative includes a rod 91 having at one end a threaded portion 92 engageable with the fastener 74, and at its other end a hook 93 engageable with an eyelet 94 threadable in the hole 72 of the hinge one-half section 51. In operation, the eyelet 94 is threaded into the hole 72 of the hinge one-half section 51. The rod 91 is then inserted into the tube 30, the hook 93 engaged with the eyelet 94, and the hook crimped to fasten the hook and eyelet. Thereafter, the tubes 30 and 40 are inserted into the drum interior 25. When the tubes 30 and 40 have been properly inserted and oriented in the drum, the fastening device 74 is threaded onto the end 92 of the lock bar 91 to tension the lock bar and lock the intake tube 40 in its operative position.

As will also be understood by those skilled in the art, the manner of tensioning the lock bar may be modified from that shown in FIGURES 1–5; namely, modified to include tensioning by means other than the fastener 74. For example, it is contemplated that the lock bars, 70, 81 and 91 may be provided with radially projecting hooks adjacent their ends 70B, 85, and 92, respectively, which engage the discharge end 34 of the discharge tube 30 to lock the intake tube 40 in its operative position. It is also contempleted that the lock bar may be fabricated of a combination of both rigid material such as bar stock and flexible material such as cable, the flexible material being connected to the intake tube 40 and the rigid material being connected to the discharge tube 30 or vice versa.

It is also contemplated that tensioning of the lock bar may be accomplished by connecting a tension spring to the ends 70B, 85, and 92 of lock bars 70, 81, and 91, respectively, which tension spring is engageable with the discharge end 34 of the discharge tube 30.

Having described the invention, what is claimed is:

1. A condensate drainage conduit for a rotatably mounted drum comprising:
   - a first tube disposable axially relative to said rotating drum and having an intake end and a discharge end for communicating interiorly and exteriorly of said drum, respectively;
   - a second tube positionable within said drum and having an intake end and a discharge end, said second tube having its discharge end flexibly connected to said first tube intake end for second tube movement between an operative position, wherein said tubes are angled with said second tube intake end disposed adjacent the drum wall for siphoning condensate for transmission through said tubes exteriorly of said drum, and an inoperative position wherein said tubes are substantially coaxial for enabling said tubes to be inserted and withdrawn from said drum; and
   - a lock rod positioned within said first tube and having one end connectable to said second tube adjacent said second tube discharge end and another end engageable with said first tube for selectively locking said second tube in said operative position for preventing pivotal movement between said tubes and facilitating retrieval of said second tube should said tubes become disconnected.

2. The condensate drainage conduit of claim 1 wherein said flexibly connected tubes are hinged.

3. The condensate drainage conduit of claim 1 wherein said one end of said lock rod is threadable in a hole formed in the wall of said second tube adjacent its discharge end.

4. The condensate drainage conduit of claim 3 wherein said flexibly connected tubes are hinged.

5. The condensate drainage conduit of claim 4 further including a fastener into which said other end of said lock rod is threadably connectable, said fastener being dimensioned and configured to non-blockingly engage the discharge end of said first tube thereby permitting said fastener to draw said lock rod axially to lock said second tube in said operative position without blocking the flow of condensate.

6. In a rotatable drum condensate drainage conduit having a first tube disposable axially relative to said rotating drum and having an intake end and a discharge end for communicating interiorly and exteriorly of said drum, respectively, and a second tube positionable within said drum and having an intake end and a discharge end, said second tube having its discharge end flexibly connected to said first tube intake end for second tube movement between an operative position, wherein said tubes are angled with said second tube intake end disposed adjacent the

drum wall for siphoning condensate for transmission through said tubes exteriorly of said drum, and an inoperative position wherein said tubes are substantially coaxial for enabling said tubes to be inserted and withdrawn from said drum, the improvement comprising:

a rod positioned within said first tube and having one end connectable to said second tube, and

tension means connected to the other end of said rod for tensioning said rod and thereby locking said second tube in said operative position for preventing pivotal movement between said tubes and facilitating retrieval of said second tube should said tubes become disconnected.

7. The improvement of claim **6** wherein said tension means is a fastener into which said other end of said rod is threadably connectable, said fastener being dimensioned and configured to non-blockingly engage the discharge end of said first tube thereby permitting said fastener to draw said lock rod axially to lock said second tube in said operative position without blocking the flow of condensate.

8. A condensate drainage conduit for a rotatably mounted drum comprising:

a first tube disposable axially relative to said rotating drum and having an intake end and a discharge end for communicating interiorly and exteriorly of said drum, respectively;

a second tube positionable within said drum and having an intake end and a discharge end, said second tube having its discharge end flexibly connected to said first tube intake end for second tube movement between an operative position, wherein said tubes are

angled with said second tube intake end disposed adjacent the drum wall for siphoning condensate for transmission through said tubes exteriorly of said drum, and an inoperative position wherein said tubes are substantially coaxial for enabling said tubes to be inserted and withdrawn from said drum; and

selectively operable lock means positioned within said tubes interconnecting said tubes for selectively locking said first tube in said operative position for preventing pivotal movement between said tubes and facilitating retrival of said second tube should said tubes become disconnected.

9. The condensate drainage conduit of claim **8** wherein said lock means includes a rod positioned within said first tube and having one end connectable to said second tube, and tension means connected to the other end of said rod for tensioning said rod and thereby locking said second tube in said operative position for preventing pivotal movement between said tubes.

References Cited

UNITED STATES PATENTS

1,953,525	4/1934	Young	34—125
2,460,059	1/1949	Bruker	165—89 X
2,875,527	3/1959	Doane	34—124
2,978,815	4/1961	Hieronymus	34—125

ROBERT A. O'LEARY, Primary Examiner

T. W. STREULE, Assistant Examiner

U.S. Cl. X.R.

165—89