United States Patent

Ekama

[15] **3,701,496**

[45] **Oct. 31, 1972**

[54] **PNEUMATIC TUBE SYSTEM Y-TUBE DIVERTER CONSTRUCTION**

[72] Inventor: **Pieter J. Ekama**, Malvern, Ohio

[73] Assignee: **Diebold, Incorporated**, Canton, Ohio

[22] Filed: **Feb. 16, 1971**

[21] Appl. No.: **115,181**

[52] **U.S. Cl.** **243/29**, 243/38, 137/612

[51] **Int. Cl.**.....**B65g 51/24**

[58] **Field of Search**.....243/1, 5, 29–31, 243/38; 137/611, 612

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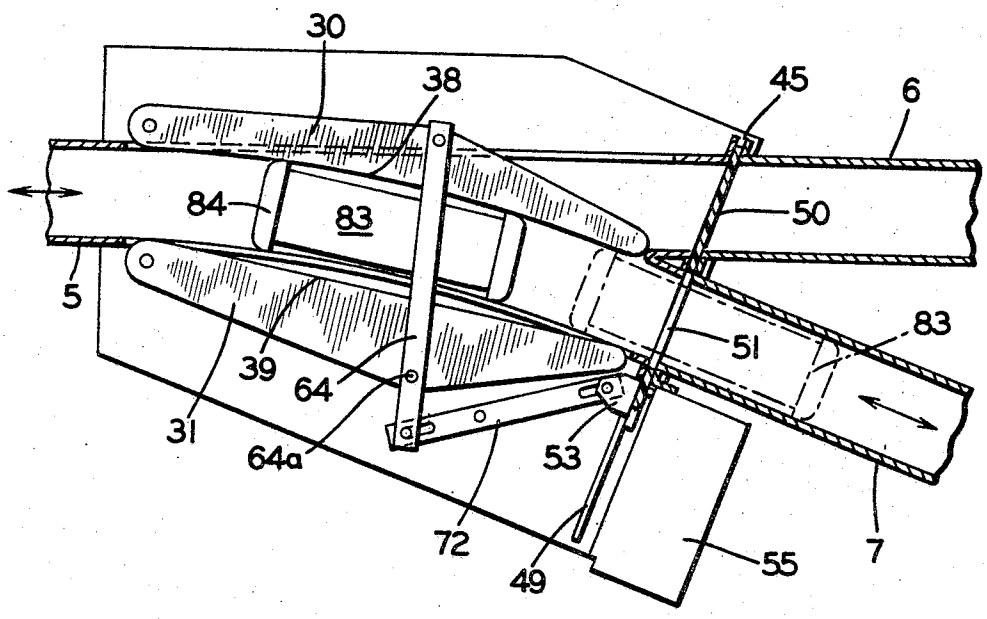
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Primary Examiner—Evon C. Blunk
Assistant Examiner—Merle F. Maffei
Attorney—Frease & Bishop

[57] **ABSTRACT**

A Y-tube diverter construction for multiple station pneumatic tube systems. A Y-tube section having a main and two branch legs is mounted within an air-tight housing and is provided with a pair of slots throughout the tube section main and branch legs. A pair of guide members alternately extend through the slots and provide connecting portions between the main leg and one of the branch legs. A slide plate alternately diverts the air flow between the main leg and a selected branch leg, which, in cooperation with the guide members, enables a carrier to travel in either direction through the main diverter leg and a selected branch leg.

14 Claims, 31 Drawing Figures



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SHEET 1 OF 8

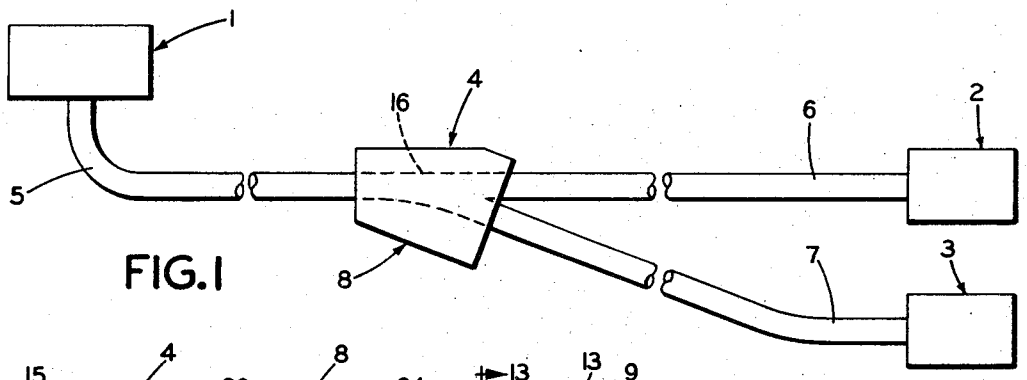


FIG.1

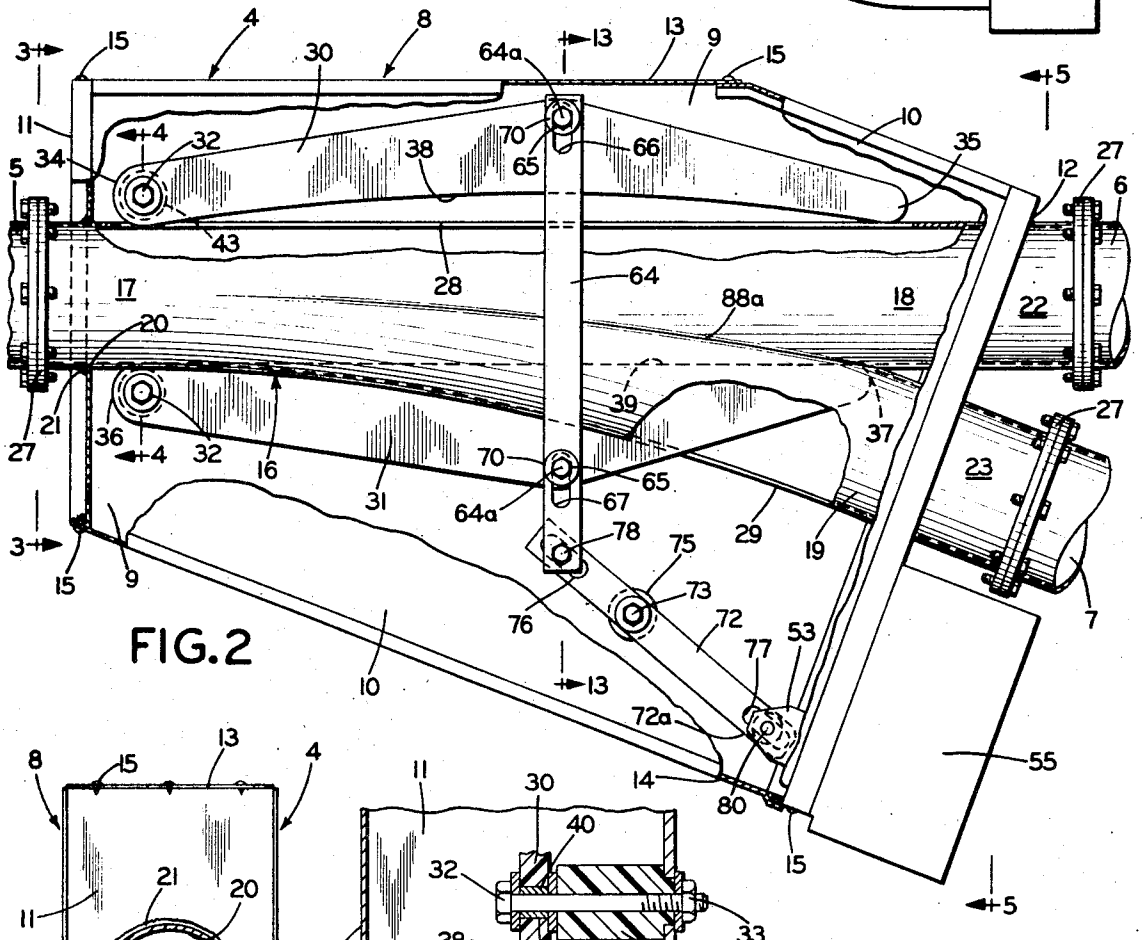


FIG.2

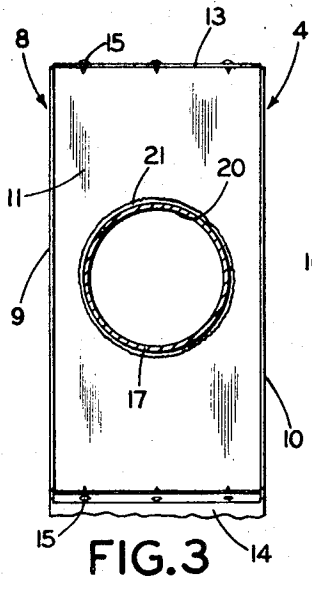


FIG.3

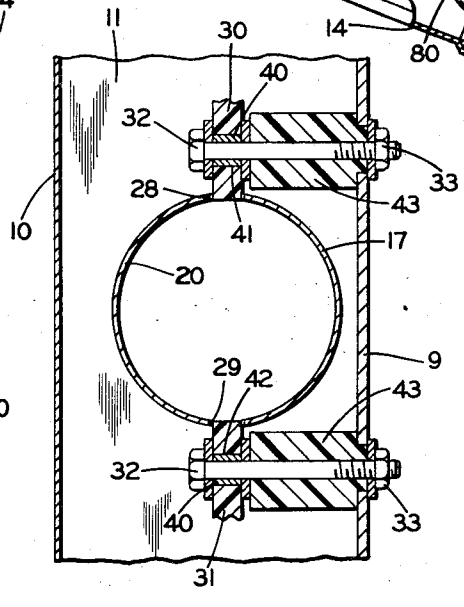


FIG.4

INVENTOR
PIETER J. EKAMA

BY
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ATTORNEYS

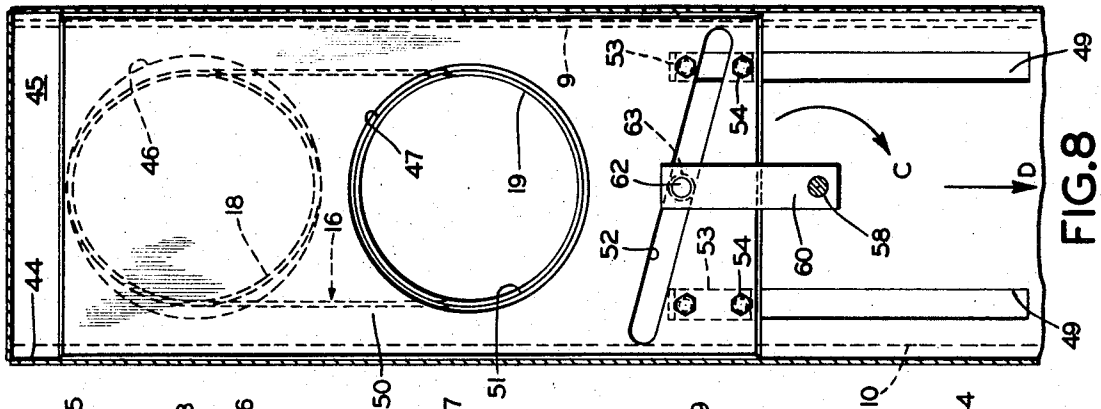


FIG.8

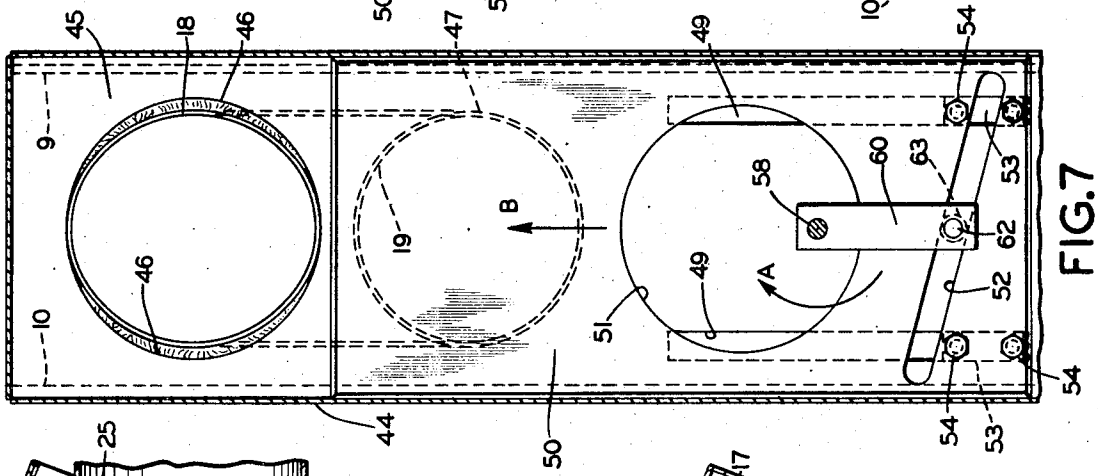


FIG.7

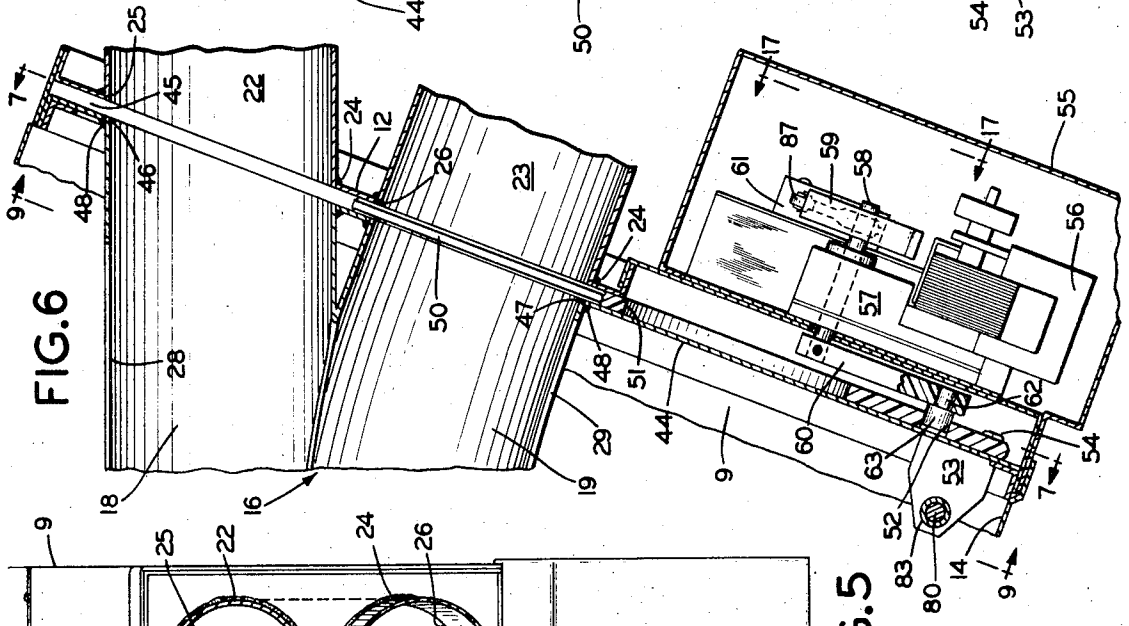


FIG.6

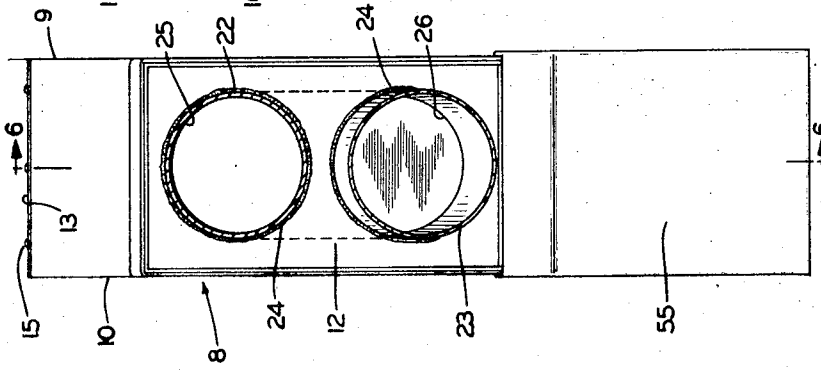


FIG.5

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PIETER J. EKAMA
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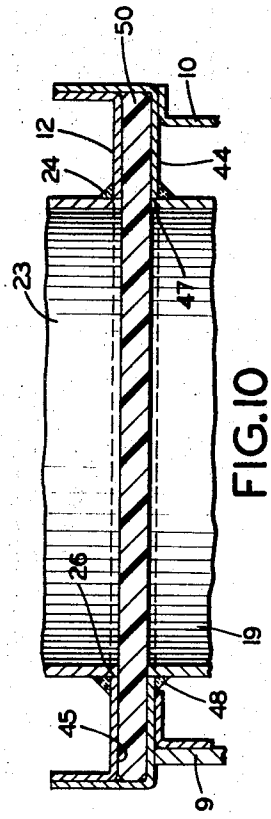


FIG.10

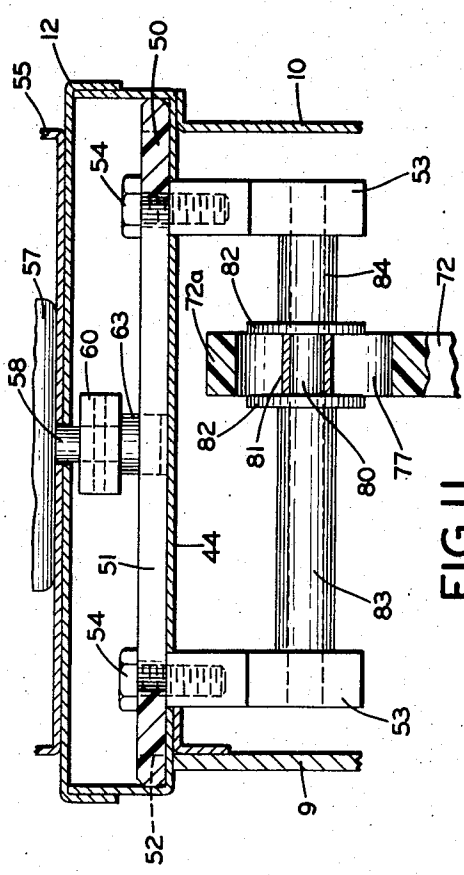


FIG.11

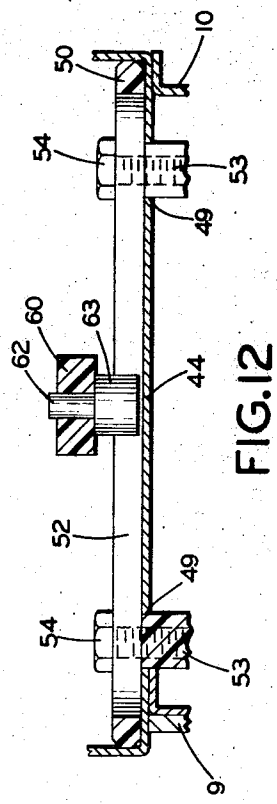


FIG.12

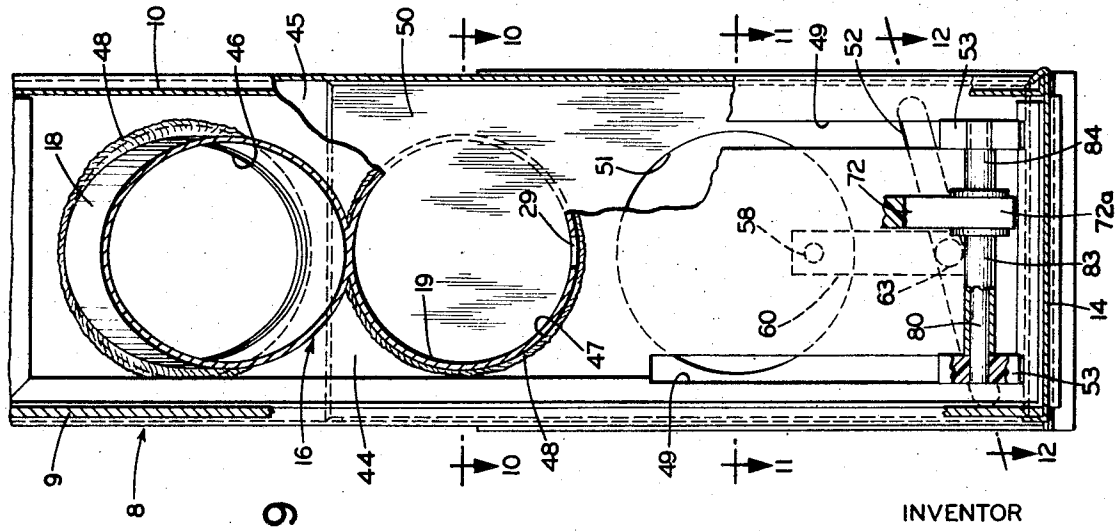


FIG.9

INVENTOR
PIETER J. EKAMA

BY
Frease & Bishop
ATTORNEYS

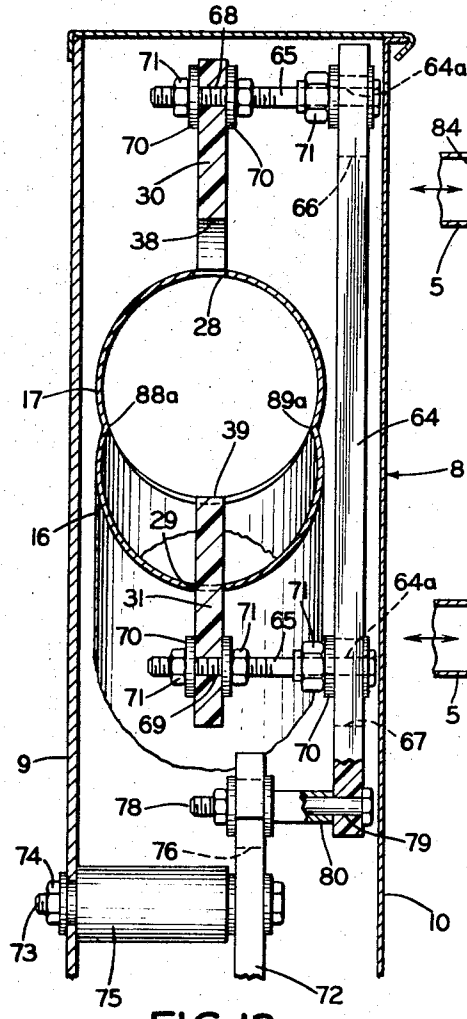


FIG.13

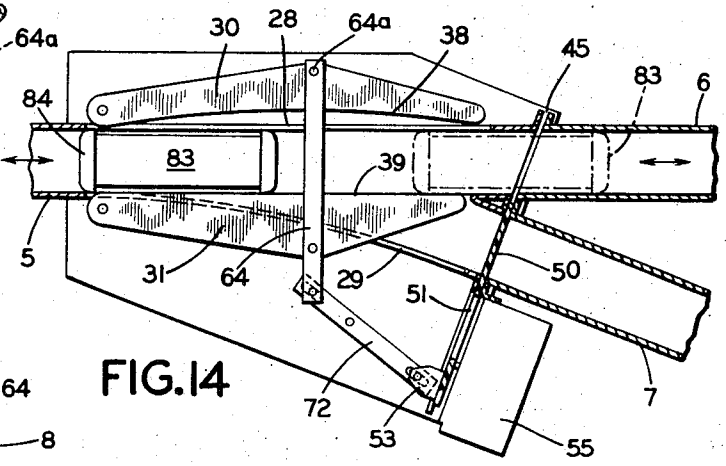


FIG.14

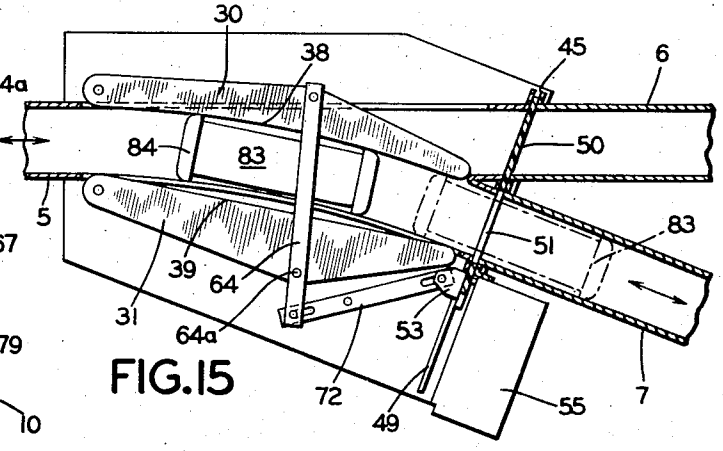


FIG.15

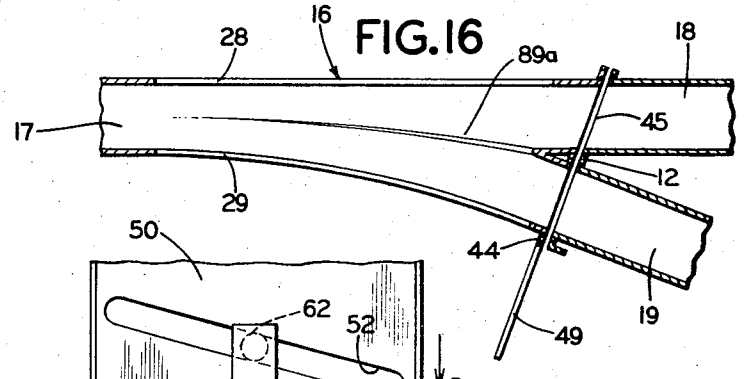
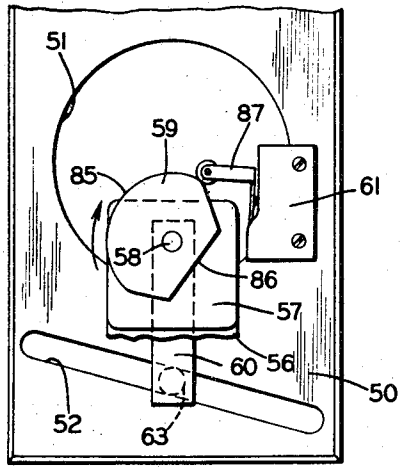


FIG.16

FIG.17



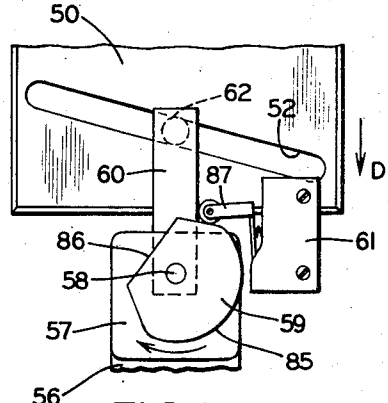


FIG.18

INVENTOR
PIETER J. EKAMA

BY
Frease & Bishop
ATTORNEYS

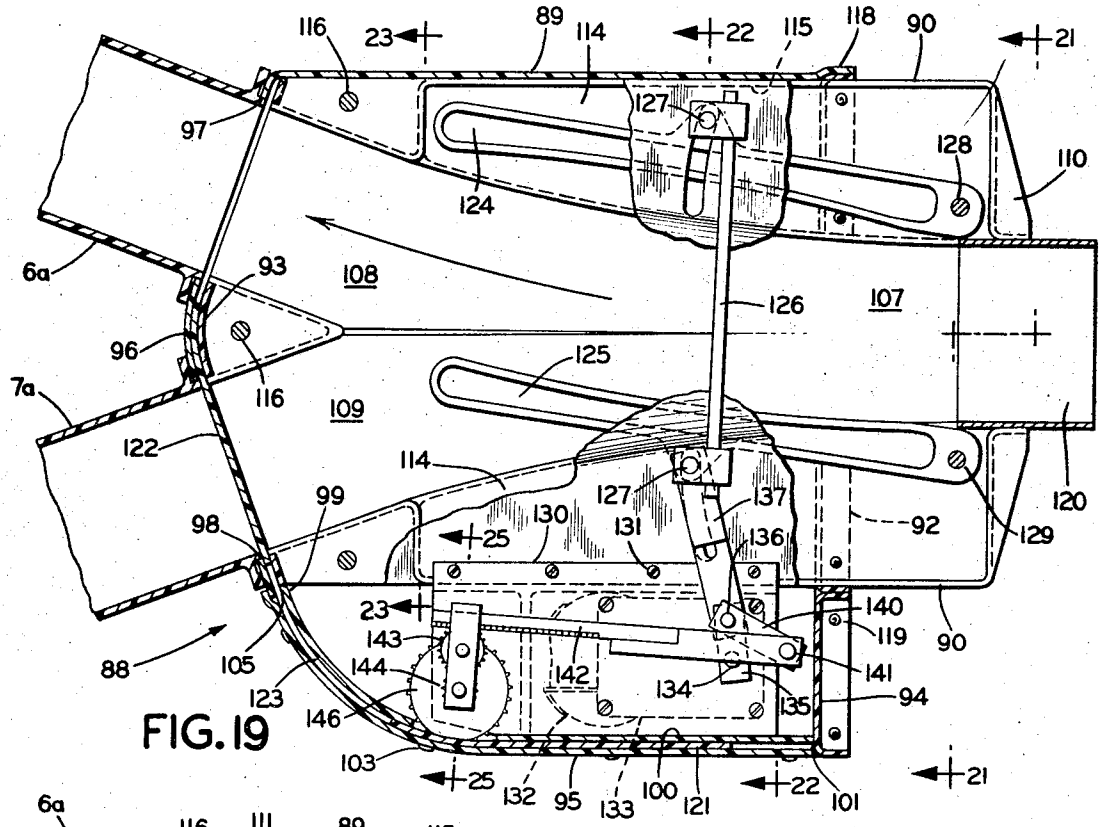


FIG. 19

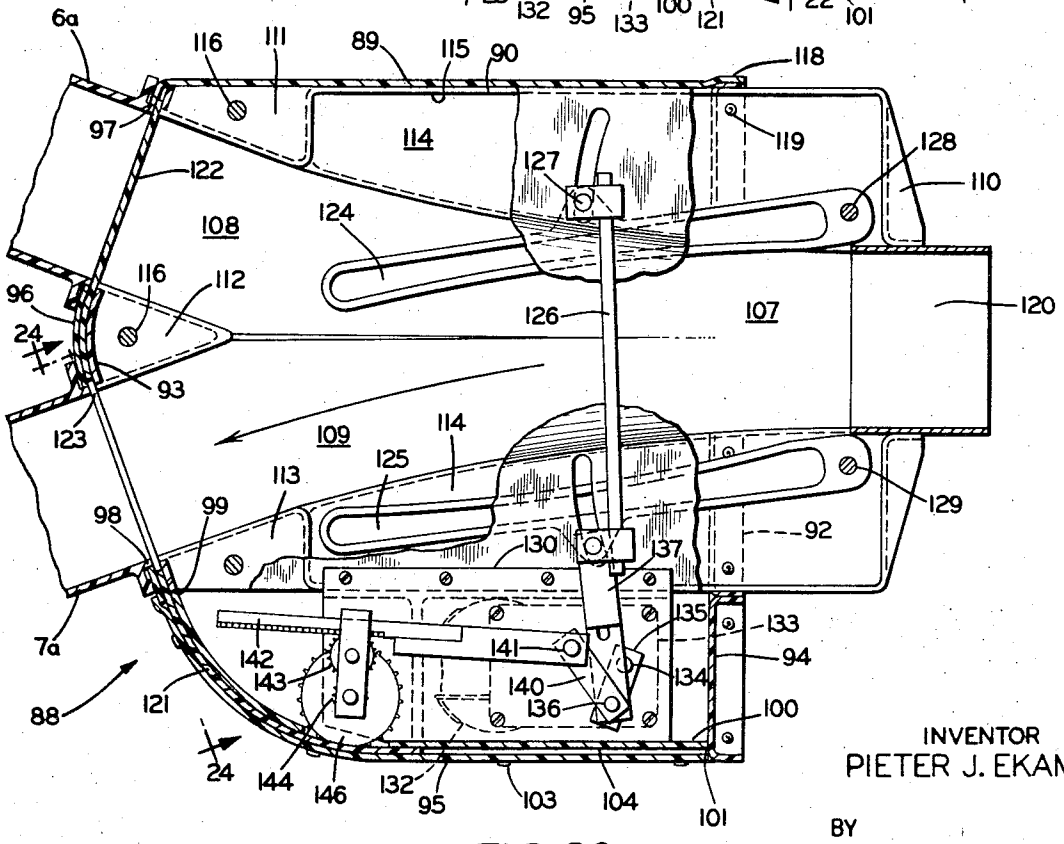


FIG. 20

INVENTOR
PIETER J. EKAMA

BY
Frease & Bishop
ATTORNEYS

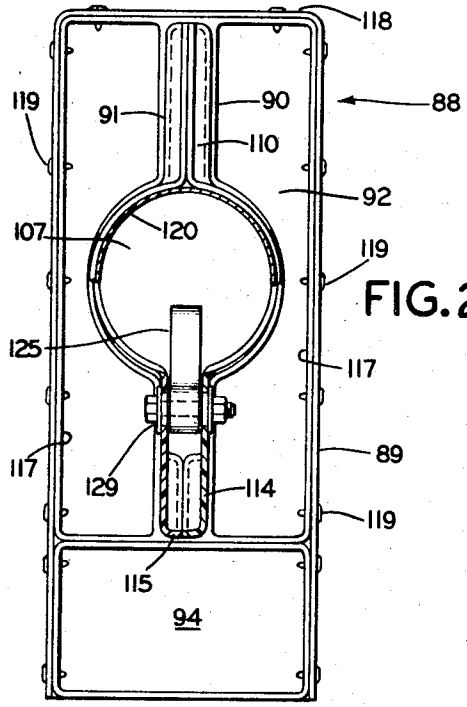


FIG. 21

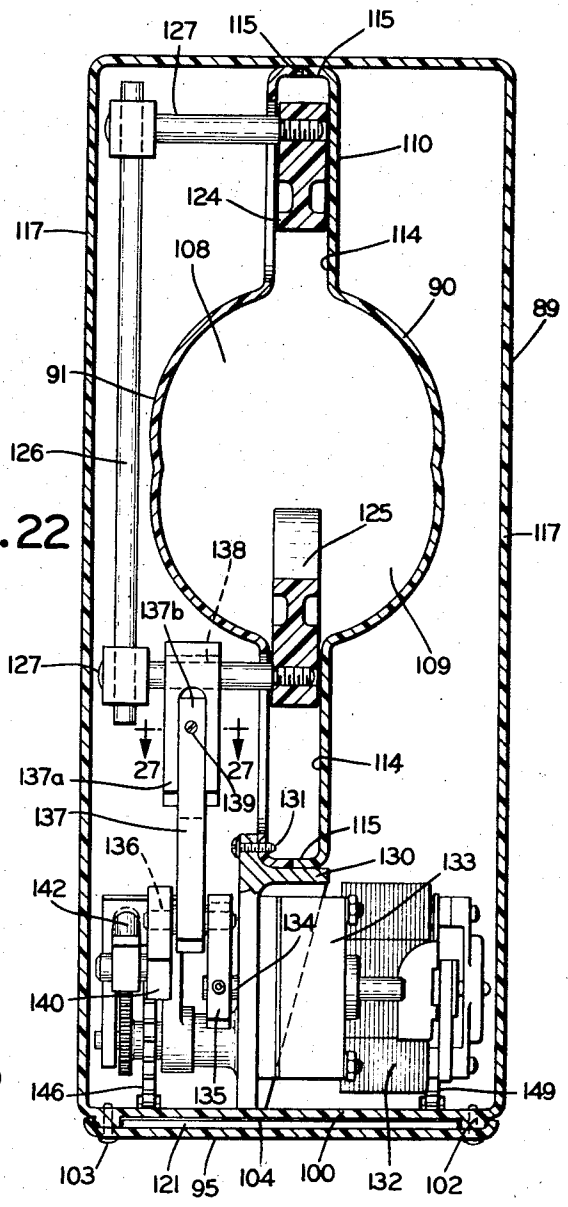


FIG. 22

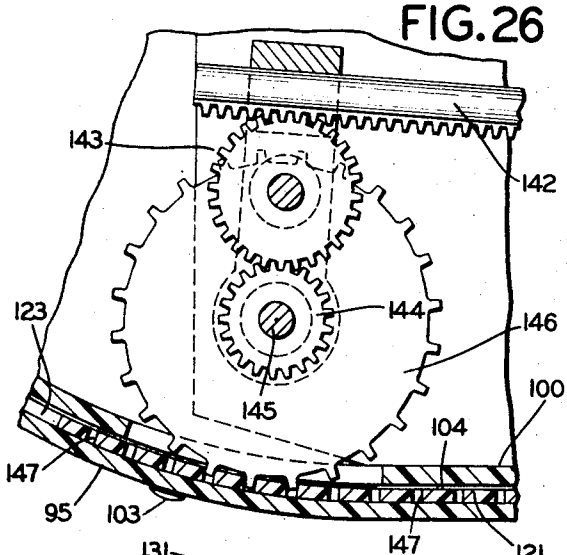


FIG. 26

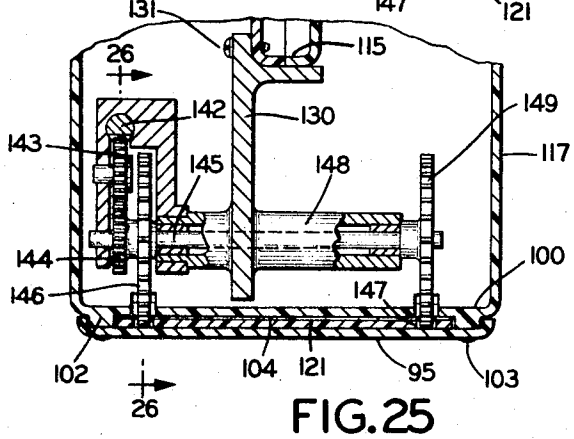


FIG. 25

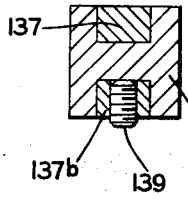


FIG. 27

INVENTOR
PIETER J. EKAMA

BY
Frease & Bishop
ATTORNEYS

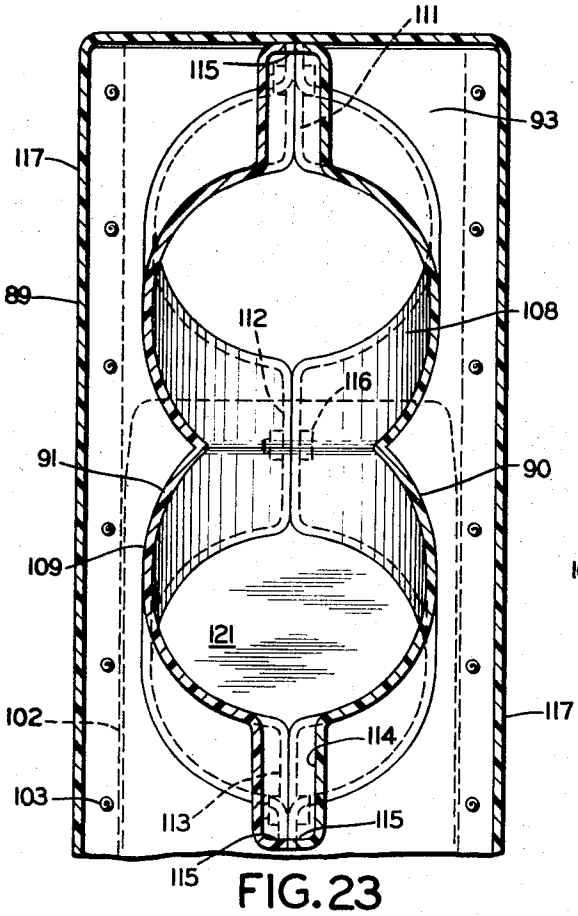


FIG. 23

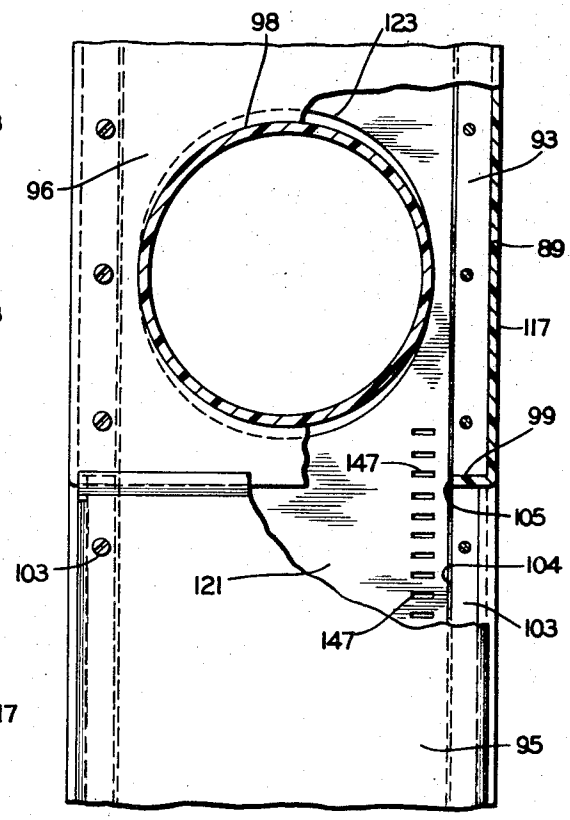


FIG. 24

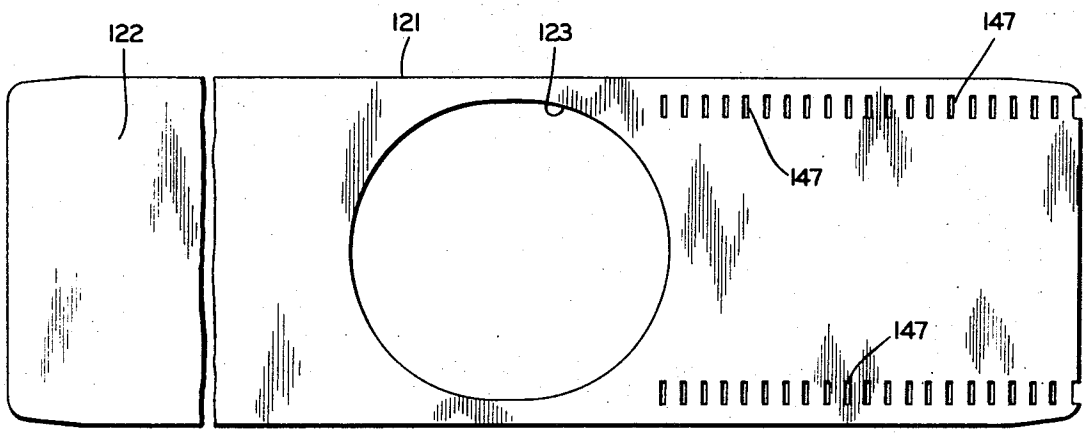


FIG. 28

INVENTOR
PIETER J. EKAMA

BY
Frease & Bishop
ATTORNEYS

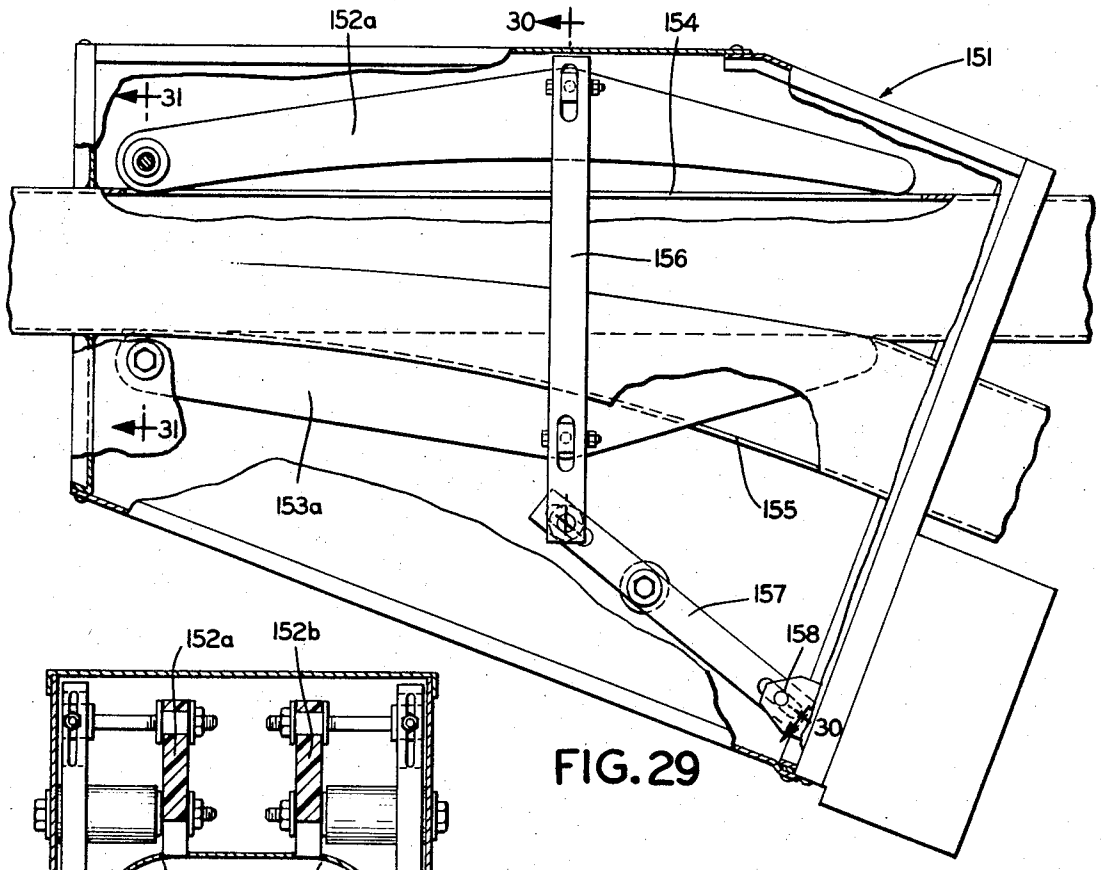


FIG. 29

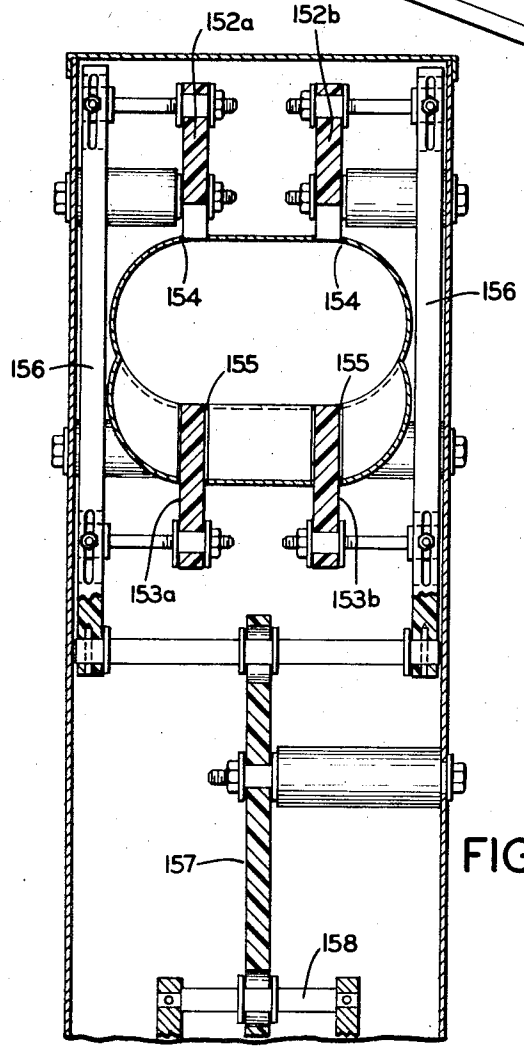


FIG. 30

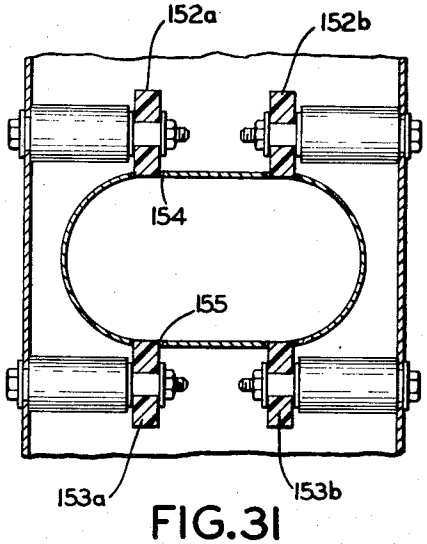


FIG. 31

INVENTOR
PIETER J. EKAMA
BY
Frease & Bishop
ATTORNEYS

PNEUMATIC TUBE SYSTEM Y-TUBE DIVERTER CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to pneumatic tube systems and particularly to Y-tube diverter constructions for such systems. More particularly the invention relates to a Y-tube diverter construction which may be placed at various locations in a single pneumatic tube, multiple station system for diverting a moving carrier between either of two branch legs of the Y-section and the main leg, regardless of the direction of carrier travel. The Y-tube diverter may be installed in a variety of positions to cooperate with the particular direction in which the connected pneumatic tubes extend, and may be controlled by a variety of electrical control systems.

2. Description of the Prior Art

Various types of structures and mechanisms are used in pneumatic tube systems for diverting a moving carrier from a main line into branch lines at a Y-section. Deflector structures are used at many terminal stations for deflecting the carrier into the proper terminal. Such deflectors consist of curved lever arms or flap-like members which project into the Y-section or are hingedly mounted therein. These curved or flap-like members deflect the carrier when the carrier strikes such member and the carrier follows the member's curvature while the air pressure continues in the main line and is unaffected by the deflector.

Such a deflector must be located adjacent a terminal since upon entering the branch line the carrier loses much of the propelling air pressure. Likewise, these deflectors can only be used in a pneumatic system in which the carrier travels in one direction through the system.

Various Y-diverter constructions also are used in pneumatic tube systems. A diverter is similar to a deflector except that a diverter had the added feature of diverting the air flow as well as the carrier. The leg of the Y-section not traversed by the carrier moving through the diverter is sealed off. The carrier therefore is propelled through the Y-section into the branch leg by the system air pressure without substantial impact with the diverting member in changing the direction of carrier travel.

These known diverters generally include a flap-like member pivotally attached at the apex of the Y-tube section which is completely enclosed within the tube sections. The flap-like member is provided with surfaces to match the curvature of the main and branch legs.

Such known diverters have several disadvantages. Maintenance of the diverting member is extremely difficult due to its location within the Y-tube section. Also an enlarged area must be provided within the Y-tube section to enable the diverting member to pivot properly within the tube portions. This prevents the carrier from maintaining a proper seal with the tube walls when passing through the Y-tube diverter section, resulting in a loss of carrier speed, excess noise, and increased propelling costs.

Modern pneumatic tube systems normally only have a single tube used for both sending and receiving carriers. This greatly reduces the material cost and space required for the installation of the system. A reversible blower is connected to the tube system and provides either a vacuum or positive pressure for moving the carrier. Known Y-tube diverters are incapable of satisfactory operation when connected in a single tube system, since such diverters only permit passage of a carrier in one direction through the Y-section.

Thus, a need exists for a Y-tube diverter construction for use in a single tube pneumatic system which may be maintained easily, which is quiet in operation, and which permits a carrier to travel and be propelled in either direction through the Y-tube diverter section. No known prior Y-tube diverter construction provides an answer to these problems or provides the indicated operating features.

SUMMARY OF THE INVENTION

Objectives of the invention include providing a pneumatic tube system Y-tube diverter construction which can be placed at various locations in a single tube pneumatic system; providing a Y-tube diverter which permits a carrier to travel in both directions in the main diverter tube leg and in both directions in the branch legs; providing a Y-tube diverter which is relatively noiseless during passage of a carrier therethrough; providing a Y-tube diverter which enables a carrier to maintain a sufficient seal with the tube walls at all times; providing a Y-tube diverter which can be maintained or serviced easily and in which the various components are accessible for maintenance; providing a Y-tube diverter which can be connected in various positions extending in required directions in a pneumatic tube system; providing a Y-tube diverter which can be controlled by various electrical control systems; providing a Y-tube diverter which may be easily modified and used as a deflector, and which will deflect a carrier traveling in either direction through the Y-section; and providing a Y-tube diverter of simple construction which achieves the stated objects in a simple, effective and inexpensive manner, and which solves problems and satisfies needs existing in the art.

These and other objectives and advantages may be obtained by the pneumatic system Y-tube diverter construction, the general nature of which may be stated as including a substantially airtight housing having first and second end walls; a Y-tube section located within said housing and having a main leg and two branch legs, said main leg communicating with an opening formed in said first end wall and said branch legs communicating with a pair of openings formed in said second end wall; a pair of diametrically opposed longitudinal slots formed in the main tube leg, each of which extends continuously from the main leg along one of said branch legs; guide means including a pair of guide members each pivotally mounted within the housing, each guide member being generally aligned for movement through one of said tube slots; means slidably mounted within the housing for selectively sealing each of the branch legs; means connected to said guide means for selectively projecting said guide members through their respective tube slots, whereby said guide means form connecting guide portions selectively between the branch legs and the main leg; control means operatively connected to said slide means and to said guide means for coordinated movement of said slide and guide means; each of said guide means being

generally triangular in shape and having two ends, a vertex, and a base extending between said ends, said base having a shape complementary to the shape of the opposite branch leg; said slide means being movable between extended and retracted positions and having a plate formed with an opening which aligns with one of said branch legs when said slide means is in extended position; said plate being formed with a generally diagonal slot; and said control means having a member engaged in said diagonal slot for moving said plate.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention — illustrative of the best mode in which applicant has contemplated applying the principles — are set forth in the following description and shown in the drawings, and are particularly and distinctly pointed out and set forth in the appended claims.

FIG. 1 is a diagrammatic view of a pneumatic tube system in which one type of improved Y-tube diverter may be used;

FIG. 2 is an elevational view of the Y-tube diverter with portions broken away and in section;

FIG. 3 is a fragmentary end elevation looking in the direction of the arrows 3—3, FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view taken on the line 4—4, FIG. 2;

FIG. 5 is an end elevation looking in the direction of the arrows 5—5, FIG. 2;

FIG. 6 is an enlarged fragmentary sectional view taken on the line 6—6, FIG. 5;

FIG. 7 is a sectional view taken on the line 7—7, FIG. 6;

FIG. 8 is a view similar to FIG. 7, but with the slide gate shown in fully extended position;

FIG. 9 is a sectional view with portions broken away taken on the line 9—9, FIG. 6;

FIG. 10 is an enlarged fragmentary sectional view taken on the line 10—10, FIG. 9;

FIG. 11 is an enlarged fragmentary sectional view with portions broken away taken on the line 11—11, FIG. 9;

FIG. 12 is an enlarged fragmentary sectional view taken on the line 12—12, FIG. 9;

FIG. 13 is an enlarged fragmentary sectional view taken on the line 13—13, FIG. 2;

FIG. 14 is a diagrammatic view of the Y-diverter showing a carrier being diverted between one Y-branch leg and the main leg of a pneumatic tube Y-section;

FIG. 15 is a diagrammatic view similar to FIG. 14 showing a carrier being diverted between the other Y-branch leg and the main leg of a pneumatic tube Y-section;

FIG. 16 is a diagrammatic view of the Y-tube section in section;

FIG. 17 is a diagrammatic elevational view looking in the direction of the arrows 17—17, FIG. 6;

FIG. 18 is a view similar to FIG. 17, but with the control cam rotated 180° and the slide plate in extended position;

FIG. 19 is a sectional view similar to FIGS. 2 and 14 of a modified construction;

FIG. 20 is a view similar to FIG. 19 with the guides in alternate position;

FIG. 21 is a section on line 21—21, FIG. 19;

FIG. 22 is a section on line 22—22, FIG. 19;

FIG. 23 is a section on line 23—23, FIG. 19;

FIG. 24 is a section on line 24—24, FIG. 20;

FIG. 25 is a section on line 25—25, FIG. 19;

FIG. 26 is a section on line 26—26, FIG. 25;

FIG. 27 is a section on line 27—27, FIG. 22;

FIG. 28 is a fragmentary view of the slide valve for the diverter of FIG. 19;

FIG. 29 is a view similar to FIG. 19 of another modified construction;

FIG. 30 is a section on line 30—30, FIG. 29; and

FIG. 31 is a section on line 31—31, FIG. 29.

Similar numerals refer to similar parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

A typical multiple station single-tube pneumatic tube system is illustrated diagrammatically in FIG. 1 and includes a central station indicated at 1 connected with substations 2 and 3 through the improved Y-tube diverter 4. A single main pneumatic tube 5 is connected to station 1 and communicates with branch tubes 6 and 7 which are connected to stations 2 and 3, respectively at diverter 4.

Diverter 4 (FIG. 2) includes a substantially airtight housing 8 having side walls 9 and 10, end walls 11 and 12, and top and bottom walls 13 and 14. Bottom wall 14 and a portion of top wall 13 preferably are attached to housing 8 by means of screws 15 in order that such walls or a portion thereof can be removed easily for maintenance of the diverter components assembled within housing 8.

A Y-tube section 16 having a main leg 17 and two branch legs 18 and 19 is mounted within housing 8. Main leg 17 extends through an opening 20 formed in end wall 11 and is secured therein by welds 21 (FIG. 3). Two short tube sections 22 and 23 are secured by welds 24 within openings 25 and 26 formed in end wall 12 (FIG. 5), and are aligned with branch legs 18 and 19, respectively.

Flanges 27 may be provided at the outer ends of main leg 17 and tube sections 22 and 23 for connection to main tube 5 and branch tubes 6 and 7, respectively.

A pair of diametrically opposed slots 28 and 29 are formed in main leg 17 and extend continuously along main leg 17 and into branch legs 18 and 19, respectively. A pair of guide members 30 and 31 are aligned longitudinally with slots 28 and 29, respectively, and alternately are projected through their respective slots to positions for deflecting a carrier into or out of the opposite branch leg.

Guides 30 and 31 are pivotally mounted within housing 8 on bolts 32 which are secured to side wall 9 by nuts 33. Guides 30 and 31 are generally triangular in shape having rounded ends 34 and 35, and 36 and 37, respectively, and are joined together by base edges 38 and 39.

Edges 38 and 39 have surface contours generally similar to the merging contours of the opposite branch legs 19 and 18. The guide members provide continuously smooth tube inner surfaces when projecting through their respective slots along which a carrier is guided without abrupt deflection or substantial impact. Thus, edge 38 is concavely curved to match the curvature of the merging edge of branch tube 19, and edge

39 is straight to match the shape of straight branch leg 18.

Bushings 40 (FIG. 4) preferably are mounted within holes 41 and 42 formed in ends 34 and 36 of guides 30 and 31 through which bolts 32 extend. A spacer 43 is mounted on each bolt 32 so that guides 30 and 31 are properly spaced from side wall 9 and are aligned with slots 28 and 29.

An inner end wall 44 is mounted within housing 8 parallel to and spaced from end wall 12 forming a slide chamber 45 therebetween (FIGS. 6, 7, 8 and 9). Wall 44 is formed with openings 46 and 47 aligned with end wall openings 25 and 26. Branch legs 18 and 19, respectively, are inserted and secured as by welds 48 within wall openings 46 and 47.

A rectangular plate 50 is slidably mounted within chamber 45 for selectively sealing branch tubes 6 and 7. Plate 50 is formed with a circular opening 51 and a generally diagonal slot 52 adjacent one end thereof. A pair of slide blocks 53 is attached to plate 50 by bolts 54 and extend through a pair of slots 49 formed in inner wall 44 and into housing 8.

When plate 50 is in the retracted position shown in FIGS. 6, 7 and 9 the end of plate 50 extends just below (FIG. 7) wall tube openings 25 and 46 effectively blocking the flow of air in either direction through tube 7 and diverting the entire flow of air through tube 6. Plate 50 is moved upward in chamber 45 (by means described later) to an extended position as shown in FIG. 8 to block the flow of air through tube 6 and divert it through tube 7. When in the extended position of FIG. 8 opening 51 aligns with openings 26 and 47 enabling passage of a carrier and the flow of air between tube 7 and tube 5.

A second housing 55 is mounted on the outside of housing 8 on end wall 12. Control and operating means for guides 30 and 31, and slide plate 50 are mounted in housing 55. The control and operating means preferably include a motor 56 connected to a gear box 57. A shaft 58 is connected to and extends through gear box 57 with one end connected to a cam 59 and the opposite end connected to a crank arm 60. Cam 59 operatively engages a limit switch 61 for controlling the operation of slide plate 50. A pin 62 is connected to the other end of crank 60 and is provided with a cylindrical knob 63 which is located within slot 52 of plate 50 for slidably moving plate 50 within chamber 45 as crank arm 60 is rotated by motor 56.

A rigid connecting member 64 extends between and is pivotally connected at 64*a* to guides 30 and 31 (FIG. 2 and 13). Pivot bolts 65 extend through enlarged openings 66 and 67 formed in member 64 and through holes 68 and 69 formed at the vertex areas of guides 30 and 31, respectively. Washers 70 may surround bolts 65 adjacent guides 30 and 31, and beneath member 64. Nuts 71 clamp bolts 65 to member 64 and properly position member 64 between end wall 10 and Y-tube section 16.

Enlarged openings 66 and 67 permit adjustments of the location of members 30 and 31 with respect to the Y-tube legs 17, 18 and 19 to be made before member 64 is clamped by nuts 71. Thus, guides 30 and 31 during movement pivot on bolts 65 with respect to member 64 but bolts 65 do not slide in openings 66 and 67 except for adjustment.

An operating rod 72 is pivotally connected on pivot bolt 73 to housing side wall 9 (FIGS. 2 and 13). Nut 74 and spacer 75 mount pivot bolt in position. Rod 72 is pivotally connected to member 64 by pivot bolt 78 which extend through a hole 79 formed in the end of member 64 and through a slot 76 formed in rod 72. A spacer 80 is journalled on bolt 78 to properly align rod 72 with respect to member 64.

The other end 72*a* of rod 72 is operatively connected to a shaft 80 on slide plate 50. Shaft 80 is connected to and extends between the spaced slide blocks 53 (FIGS. 9 and 11) at the lower corners of plate 50. Rod end 72*a* has a slot 77 through which a bushing 81 on shaft 80 extends, and bushing 81 is maintained in proper position on shaft 80 between washers 82 and spacers 83 and 84 and blocks 53.

When plate 50 is in retracted position (FIGS. 7 and 14) rod 72 holds member 64 in an up position (FIGS. 2 and 14) in which guide 30 is removed from within slot 28 and guide 31 is projected through slot 29. Guide edges 9 provides a straight, smooth surface extending between main leg 17 and straight branch leg 18 and blocking branch leg 19. Thus guide 31 guides a carrier 83 (FIG. 14) traveling in either direction between stations 1 and 2 along tubes 5 and 6 through diverter 4. Plate 50 in retracted position also blocks air flow through branch tube 7.

Since there is no air flow through branch leg 19 due to the sealing of tube 7 by plate 50 all of the air flow is along tubes 5 and 6. The air flow through diverter 4 in either direction moves carrier 83 easily and rapidly through diverter 4, and guide edge 39 of guide 31 provides the contact with carrier seal rings 84 to direct the carrier from one to the other of tube 5 or 6.

Ridges 88*a* and 89*a* (FIGS. 2, 13 and 16) formed in Y-section 16 at the intersection of merging branch legs 18 and 19, in conjunction with guides 30 and 31 provide sufficient contact around the circumference of carrier sealing rings 84 to conduct a carrier 83 through diverter 4. Thus, carrier 83 upon moving through diverter 4 is in continuous contact with tube walls and a guide member, eliminating wobble of the carrier which may cause loss of power and noisy operation.

The switching of diverter 4 for passage of a carrier 83 between stations 1 and 3 along tubes 5 and 7 is achieved through various usual control systems which energize motor 56. When energized, motor 56 rotates shaft 58 at desired speed through gear box 57. Shaft 58 rotates crank arm 60 in the direction of arrow A, FIG. 7 and as arm 60 moves, knob 63 engaged in slot 52 causes plate 50 to slide in the direction of arrow B to extended position shown in FIGS. 8 and 15.

Meanwhile slide blocks 53 on plate 50 also move in the direction of arrow B, and through shaft 80, connected with lever rod 72, pivots rod 72 about pivot bolt 73, thereby moving member 64 from the position of FIG. 14 to that of FIG. 15, disengaging guide 31 from within slot 29 and projecting guide 30 through slot 28 to the position shown in FIG. 15.

Meanwhile cam 59 on motor shaft 58 provided with high surface 85 and a low surface 86, 180° apart, rotates through 180° from retracted position (FIGS. 14 and 17) to extended position (FIGS. 15 and 18), and de-energizes switch 61 through contact of roller arm 87 of switch 61 on cam 59.

Upon completion of 180° movement of crank arm **60** and cam **59**, motor **56** is de-energized by switch **61**, and plate **50** is located in fully extended position (FIGS. **8** and **15**). In this position plate **50** blocks the air flow through tube **6** and through plate opening **51** diverts it through tube **7** in either direction between stations **1** and **3** and through diverter **4**. Edge **38** of guide **30** provides the contact with carrier seal rings **84** to direct the carrier **83** between tubes **7** and **5** within diverter **4**. Since edge **38** has the same curvature as that of the diverter between leg **17** and **19** there is no abrupt bend or any void area within Y-tube **16** to impede carrier **83** and cause noise. Likewise, since the air flow is entirely through tubes **5** and **7**, the guide **30** merely guides carrier **83** through the Y-tube and does not abruptly change its direction of travel as is done by prior pneumatic tube deflectors.

The elimination of deflectors or valve elements movable from one position to another wholly within the Y-tube section, and the complementary contour matching of the guides **30** and **31** and portions of the Y-tube section to form connecting portions between the main leg and branch legs, establish conditions which permit the carrier to travel in either direction through diverter **4**.

The operation of the mechanism to switch guides **30** and **31** and plate **50** from the position of FIGS. **15** and **18** back to the position of FIGS. **14** and **17** is similar to that described for switching from FIGS. **14** and **17** to FIGS. **15** and **18**. Motor **56** rotates shaft **58** again in a clockwise direction (arrow C, FIGS. **8** and **18**) moving knob **63** along slot **52** and displacing plate **50** in the direction of arrow D from extended to retracted position. Rod **72** pivots on pivot bolt **73** and moves member **64** upward removing guide **30** from slot **28** and Y-tube section **16** and projecting guide **31** through slot **29** into Y-tube section **16**.

Diverter **4** thus may be placed at any desired location in a pneumatic tube system and will accept carrier movement in either direction through any of its legs or branches, since the operation of the guide member is not controlled by or dependent upon movement of the carrier. Likewise, the velocity of the carrier after passage through diverter **4** is not affected, since the same air flow, pressure or vacuum acts upon the carrier before and after moving through diverter **4**. Any number of diverters may be used in a single pneumatic tube system since only those tube sections through which a carrier is directed to travel between selected stations are open for carrier movement air flow. Thus, the air pressure or vacuum required for system operation is not substantially affected by the number of branch legs and stations present in a multiple station system.

Diverter **4** may be connected in a pneumatic tube system in any position without affecting the operation of guides **30** and **31** or plate **50**. That is, housing **8** may be located with side walls **9** and **10** extending horizontally or vertically or with end walls **11** and **12** located at the top or bottom or at either end of the installed assembly. The positive connection between these components and their power operation enables such flexibility of installation. Thus, diverter **4** may be turned to any position from that shown in FIG. **2** and connected with tubes **5**, **6** and **7** regardless of their direction or position in a particular installation.

The positive interconnection between guides **30** and **31**, and slide plate **50** insures the correct positioning of these members with respect to each other for proper operation. Likewise, the enlarged openings **66** and **67** in member **64** permit field adjustments to be made of the position of guides **30** and **31** to insure smoothness of operation.

Side walls **9** and **10** may be made of transparent plexiglass or plastic material to enable the internal mechanism to be observed during operation to facilitate proper maintenance. Likewise, housing Y-tube section **16**, guides **30** and **31**, and the various connecting and operating members may be molded of plastic, and assembled to provide an inexpensive and readily assembled mechanism. If housing **8** is molded of plastic, the top and bottom walls **13** and **14** should be removable to permit access into housing **8** for adjustment and maintenance.

Also, the separation of the drive means in second housing **55** separate from an outside main housing **8**, from the interior of housing **8** and its contained components permit ease of servicing of the drive means. Furthermore, the improved construction combines a single drive or power pack for operation of both guides **30** and **31** and valve plate **50**.

Second Embodiment

The diverter construction illustrated in FIGS. **1 – 18** and described above may be termed one in which the Y-tube means has a straight branch leg and a curved branch leg. Such construction sometimes is called a straight-legged diverter. Also, the construction illustrated in FIGS. **1 – 18** has been described as including metal frame members for the housing and tubes with plexiglass members for one or more of the housing walls. In some installations it may be desired to use a symmetrical Y-diverter, that is, one having symmetrically curved Y-branch legs, rather than one straight branch leg and one curved branch leg. Also, the major portion of the diverter unit, including housing walls and tube sections, may be formed of molded plastic material. Such a modified form of construction is illustrated in FIGS. **19 – 28**.

A symmetrical Y-tube diverter is indicated generally at **88**. Diverter **88** may include a number of members molded from plastic material, such as glass reinforced plastic, including an outer housing member **89**, matching right and left inner tube leg forming members **90** and **91**, an end wall member **92**, an end wall insert **93**, a housing access closure wall **94**, and a slide cover member **95**.

Outer housing member **89** is open at its right-hand end (FIG. **19**), and is generally rectangular in cross section looking in the direction of FIG. **22**. The left-hand end wall of housing **89** (FIG. **19**) comprises a warped surface wall **96** having an opening **97** for coupling with a branch pneumatic tube **6a** and another opening **98** for coupling with a branch pneumatic tube **7***a*. Wall **96** below opening **98** is formed with a shoulder **99** and then curves downwardly to the right terminating in a bottom wall **100**. The portion of bottom wall **100** extending between its open end **101** and shoulder **99** has spaced ribs **102** (FIGS. **22** and **25**) projecting outwardly and downwardly therefrom. Slide cover **95** may be secured to ribs **102** by screws **103**.

Thus, a slide channel **104** is formed between cover **95** and housing wall **100** extending from the open end

101 to shoulder 99. Shoulder 99 is formed with a slot 105 similar in cross section to channel 104. The end wall insert 93 has a warped surface similar in contour to that of wall 96, and also has openings therein matching the openings 97 and 98. Member 93 is mounted on members 90 and 91 spaced from wall 96 to form a continuation of slide channel 104 between members 93 and 96 extending from shoulder 99 upward to the top of member 89.

Members 90 and 91 are matching members and each has generally half-round tubular walls forming matching diverter main leg portions 107 and branch leg portions 108 and 109 terminating in assembly flanges 110, 111, 112 and 113. Recessed wall portions 114 terminating in abutting flanges 115 form slot compartments communicating with the interior of the diverter legs 107, 108 and 109.

Matching members 90 and 91 may be connected together by bolts 116 which clamp abutted flange portions 111, 112 and 113 together. Assembled members 90 and 91 have end wall inserts 93 assembled thereto and this assembly is slipped inside of outer housing member 89.

After members 90 and 91 have been assembled within housing member 89 the right-hand end of the assembly may be closed by end wall 92 and closure wall 94 (FIG. 21). Members 92 and 94 preferably have outer flanges 117 which telescope within the end flange 118 of member 89 and the flanges 117 and 118 may be connected together, and sealed if necessary by an adhesive, by screws 119.

A connector tube 120 is inserted in the assembly (FIG. 19) communicating with the main leg 107 of the Y-diverter and also with the main tube of the pneumatic tube system, such as member 5 of FIG. 1. Tube 120 may be coupled in any suitable manner with the system tube.

A flexible slide plate or valve member 121 (FIG. 28) is slidably mounted in the slide channel 104 and slot 105. Slide valve 121 is illustrated in retracted position in FIG. 19 wherein the end portion 122 closes the lower branch leg 109 of the diverter assembly. FIG. 20 shows the slide valve 121 in extended position wherein an opening 123 in member 121 registers with the branch leg 109, and the end portion 122 of member 121 closes branch leg 108 of the diverter assembly.

Slide valve 121 of FIG. 28 functions and operates in the same manner as slide valve member 50 of the construction shown in FIGS. 1 – 18. However, slide valve 121 is flexible so that it can travel through the warped channel 104 and close the branch legs 108 and 109 of the diverter in positions approximately at right angles to the axes of the branch leg openings.

The diverter 88 is equipped with guide members 124 and 125 which are coupled together by a connector bar 126. Bar 126 is pivotally connected by pin 127 with each guide member 124 and 125 intermediate the ends of the latter. Guide members 124 and 125 are pivotally mounted at 128 and 129 to diverter tube forming members 90 and 91. Guide members 124 and 125 thus are movably mounted within the slot compartments formed by recesses 114 in the molded walls of members 90 and 91 (FIGS. 19, 20 and 22), so that one or the other of members 124 and 125 may be projected into and out of the Y-diverter leg portions 107, 108 and 109.

A mounting member 130 extends between bottom wall 100 of housing 89 and the recess wall portions 114 and flanges 115 (FIGS. 22 and 25), and may be connected thereto by screws 131. Drive motor 132 and gear reduction unit 133 are mounted on member 130. A drive shaft 134 extends from gear reduction unit 133 and is fixed to one end of lever 135. The other end of lever 135 is pivotally connected by shaft 136 with one end of adjustable link 137, the other end of which is pivotally connected at 138 with the pin 127 extending from guide member 125. Link 137 (FIG. 27) has an outer section 137*a* slidably connected to the yoke 137*b*, the adjusted link being clamped by setscrew 139.

The left-hand end (FIG. 22) of shaft 136 is fixed to one end of a lever arm 140, the other end of which is pivotally connected at 141 to a rack member 142. The teeth of rack member 142 engage rack gear 143 (FIG. 26) which meshes with pinion 144 mounted on shaft 145 and driving sprocket 146. The teeth of sprocket 146 engage in spaced drive slots or tracks 147 formed in flexible slide member 121 for moving slide member 121 through slide channel 104.

Shaft 145 is preferably journalled in a hub 148 carried by mounting member 130 and has a second sprocket 149 mounted on its other end whose teeth are engaged with another series of spaced drive slots or tracks 147 also formed in the slide valve 121 (FIG. 25).

The diverter 88 thus has a single drive means, comprising the motor 132, reduction gear unit 133 and elements driven thereby which moves the guide bars 124 and 125, and, cooperatively at the same time and in a coordinated manner, moves the slide valve 121 as the motor is actuated by its control switches in the same manner as described above in connection with the diverter 4 of FIGS. 1 – 18.

Third Embodiment

The improved diverter construction is illustrated in FIGS. 1 – 28 in connection with two diverter units 4 and 88 which are connected with round pneumatic system tubes adapted to receive and transport round carriers.

Some pneumatic tube systems, however, involve the use of large carrier units having one or more rectangular doors and having a generally oval shape in cross section such as shown and described in U.S. Pat. No. 3,237,884. Such carriers move through pneumatic tubes which are oval in cross section. The diverter construction of either form of the invention described above can be modified to provide a Y-diverter which has main and branch legs that are oval-shaped in cross section, as illustrated in FIGS. 29, 30 and 31 at 151.

Proper guidance of the carrier through the oval Y-tube diverter 151 is best accomplished by providing spaced guide members 152*a* and 152*b* pivotally mounted at one side of the Y-section and guide members 153*a* and 153*b* pivotally mounted at the other side of the diverter unit and movable into and out of the diverter through slots 154 and 155 respectively.

The movement of the guide members 152*a*, 152*b*, 153*a* and 153*b* may be coordinated by connector bars 156 which are pivotally connected with an operating lever mechanism 157 moved by drive means connected with shaft 158. The drive means may be connected to a motor and motor drive unit similar to the drive means illustrated in connection with the diverters 4 or 88.

IN GENERAL

In each of the embodiments of the invention illustrated in the drawings and described above, guide members are projected into and out of the interior of the Y-tube means to direct a carrier therethrough from a main leg to one branch leg or the other, or vice versa. The guide member movement is coordinated with movement of valve means which blocks communication through the branch leg of the diverter through which the carrier does not pass.

Accordingly, the improved diverter construction provides for diverted carrier movement to or from either of two branch legs and a main leg of a Y-tube section regardless of the direction of carrier travel in a quiet and effective manner; enables a single tube pneumatic tube system to have numerous branch lines and terminal stations without substantially affecting the air flow requirements for operation of the system; enables a carrier to be diverted between a branch leg and a main leg at a Y-section smoothly and easily propelled by air flow in a pneumatic system; enables the diverter to be placed at various locations within a pneumatic tube system and mounted at any angle or position for connection with the pneumatic system tubes; and provides such a construction which is effective, safe, inexpensive, and efficient in assembly, operation and use, and which achieves all the enumerated objectives, provides for eliminating difficulties encountered with prior devices, and solves problems and obtains new results in the art.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are intended to be broadly construed.

Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details of the construction shown or described.

Having now described the features, discoveries and principles of the invention, the manner in which the improved Y-tube diverter is constructed, assembled and operated, the characteristics of the new construction, and the advantageous, new and useful results obtained; the new and useful structures, devices, elements, arrangements, parts, and combinations are set forth in the appended claims.

I claim:

1. Y-tube diverter construction for a pneumatic tube system having main and branch tubes including, a substantially airtight housing having first and second end wall means; Y-tube means mounted within the housing; the Y-tube means having a main leg and two branch legs; said branch legs intersecting each other and merging with the main leg, and ridge means formed at the location of branch leg intersection; means extending through the first end wall means connecting said main leg with a pneumatic tube system main tube; opening means formed in the second end wall means providing communication between said branch legs and pneumatic tube system branch tubes; longitudinal slot means formed in said main leg on diametrically opposite sides thereof; the slot means on one side of the main leg extending continuously from the main leg into one of said branch legs, and the slot means on the other side of the main leg extending continuously from the main leg into the other of said branch legs; guide means including guide members at opposite sides of said main leg each pivotally mounted at one end within the housing and exteriorly of said Y-tube means and movable through said slot means into and out of said Y-tube means; said guide members each being formed with a carrier engaging surface matching the shape of the merging contour of the opposite wall of the Y-tube means main and branch legs; valve means movable between extended and retracted positions for selectively sealing one or the other of said branch legs against air flow through such leg and the system branch tube communicating therewith; bar means interconnecting the guide members for alternate movement of one or the other through said slot means into said Y-tube means; said ridge means and guide member carrier engaging surfaces providing substantially continuous engagement with wall portions of a carrier moving through the diverter to direct a carrier during movement in either direction through the Y-tube means between the main leg and one or the other of the branch legs; and drive means operatively connected to said valve means and guide means for cooperatively moving said valve and guide means.

2. Diverter construction as defined in claim 1 in which the ridge means and guide means have smooth surfaces providing substantially continuous engagement with wall portions of a carrier moving through the diverter.

3. Diverter construction as defined in claim 1 in which the main and branch legs are tubular; in which the tubular branch legs merge with the main branch leg and intersect with each other; in which the intersection between the branch legs forms ridge means; and in which the guide means, ridge means and tubular Y-tube means legs provide a sufficient seal with a carrier passing therethrough to maintain at all times pneumatic tube propulsion of the carrier.

4. Diverter construction as defined in claim 1 in which the pivotal mounting of the guide members maintains the guide members in alignment with the slot means for movement therethrough.

5. Diverter construction as defined in claim 1 in which the opposite guide members are adjustably connected together for coordinated movement alternately one or the other into said Y-tube means.

6. Diverter construction as defined in claim 1 in which the valve means includes a slidable member, and in which the slidable member in each of extended and retracted positions maintains one branch leg of the Y-tube means open and the other closed.

7. Diverter construction as defined in claim 1 in which channel means is formed in the housing; in which the valve means includes a slide member movable in said channel means; in which said channel means intersects both branch legs of the Y-tube means; and in which the slide member has an imperforate wall portion blocking one branch leg in extended position and the other branch leg in retracted position of the valve means.

8. Diverter construction as defined in claim 7 in which the slide member has an opening adjacent its in-

perforate wall portion which is aligned with one of the branch legs when the other branch leg is blocked by the imperforate slide portion.

9. Diverter construction as defined in claim 7 in which the slide member is formed with drive opening means; and in which the drive means includes projection means engaged in said drive-opening means for moving the slide member between extended and retracted positions.

10. Diverter construction as defined in claim 16 in which the drive opening means in said slide member comprises a diagonal slot formed in the slide member.

11. Diverter construction as defined in claim 1 in which the drive means includes motor and gear reduction means operatively connected with said valve and guide means outside the Y-tube means.

12. Diverter construction as defined in claim 1 in which supplemental housing means is provided connected to and communicating with the housing; and in which the drive means includes motor and gear reduction unit means mounted in the supplemental housing having connection with the valve and guide means within the housing.

13. Diverter construction as defined in claim 1 in which the drive means includes a drive motor, in which switch means is operatively connected with the drive motor, and in which the switch means controls operation of the drive motor.

14. Diverter construction as defined in claim 1 in which the Y-tube means has one straight and one curved branch leg; and in which one guide member has a straight guiding edge and the other guide member has a curved guiding edge corresponding in contour with the contour of the opposite merging main and branch legs.

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