United States Patent [19]

Kunz et al.

[11] **3,826,539**

[45] **July 30, 1974**

[54] **METHOD AND APPARATUS FOR DIRECTIONAL SWITCHING OF PNEUMATIC MATERIAL TRANSPORT PIPING**

[75] Inventors: **Robert Irwin Kunz**, Verona; **John Gibb Oram**, Gibsonia; **Eberhard G. Schempp**, Pittsburgh, all of Pa.

[73] Assignee: **Pennsylvania Engineering Corporation**, Pittsburgh, Pa.

[22] Filed: **Oct. 10, 1972**

[21] Appl. No.: **295,862**

[52] **U.S. Cl.** **302/27**, 137/625.47, 266/35, 285/31, 302/28, 302/64

[51] **Int. Cl.** **B65g 53/36**, B65g 53/56

[58] **Field of Search** 137/625.43, 625.46, 625.47; 285/31, 32, 184; 302/11–13, 27, 28, 64, 14–16

[56] **References Cited**

UNITED STATES PATENTS

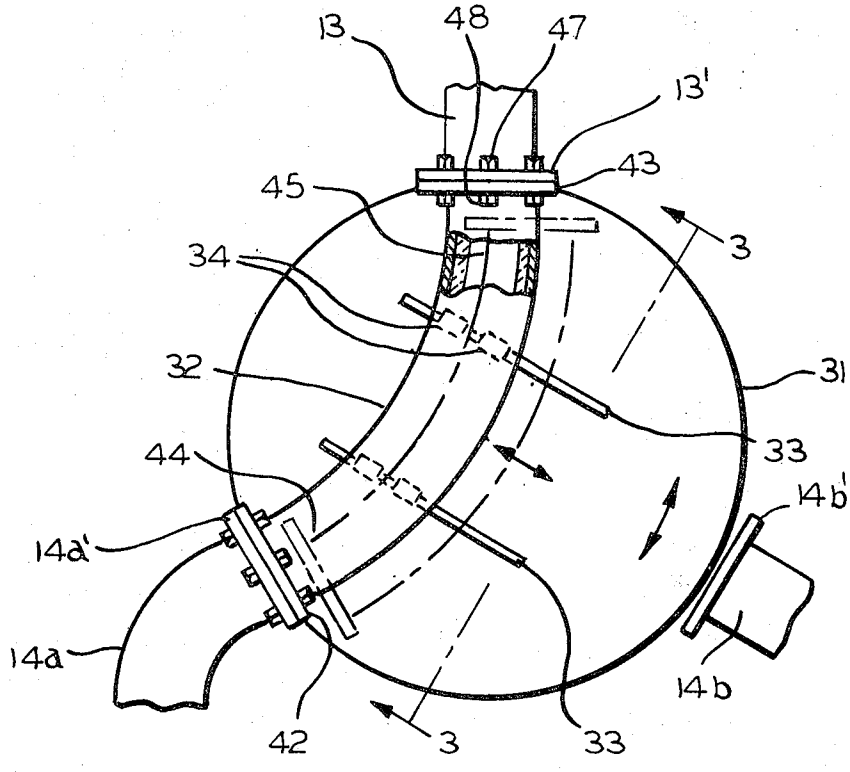
1,644,361	10/1927	Talbot	302/64 X
1,673,103	6/1928	Cochin	137/625.47
2,196,927	4/1940	Larson	137/625.43 X
2,229,931	1/1941	Parker	137/625.43 X
2,308,307	1/1943	Robinson	302/64 X
2,856,150	10/1958	McDonald	137/625.47 X
3,047,020	7/1962	Barrett	137/625.47 X
3,174,806	3/1965	Barber et al.	285/31 X
3,395,731	8/1968	Kauffman	285/184 X
3,473,550	10/1969	Van Scoy et al.	137/625.47 X
3,580,540	5/1971	Heinen	137/625.47 X

Primary Examiner—Richard A. Schacher
Assistant Examiner—W. Scott Carson
Attorney, Agent, or Firm—Fred Wiviott

[57] **ABSTRACT**

A method and apparatus for directing the flow of material between a plurality of storage bins and metallurgical vessels each having a coupling pipe connected thereto. Each of a plurality of interconnected directional switches is coupled to at least one storage bin and vessel and including rotatably mounted pipe coupling sections for connecting alternate flow paths between various bins and vessels when in various alternate positions.

14 Claims, 7 Drawing Figures



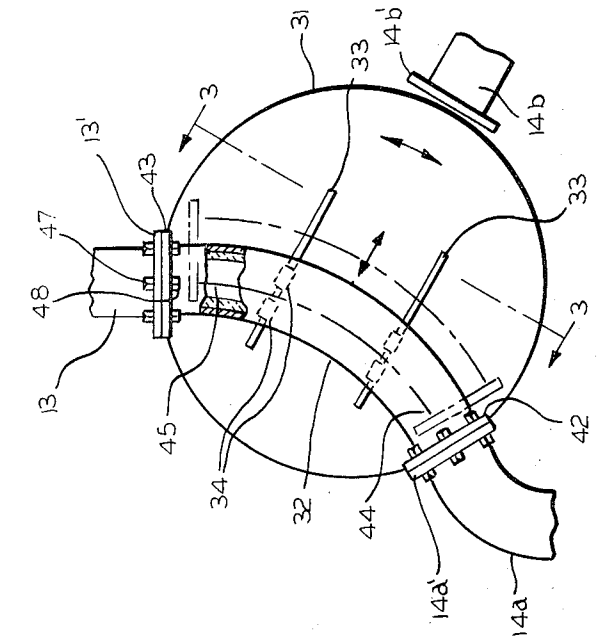

31
33
14b'
14b
3
13'
43
47
48
13
45
34
32
44
14a'
14a
42
33
3

FIG.2

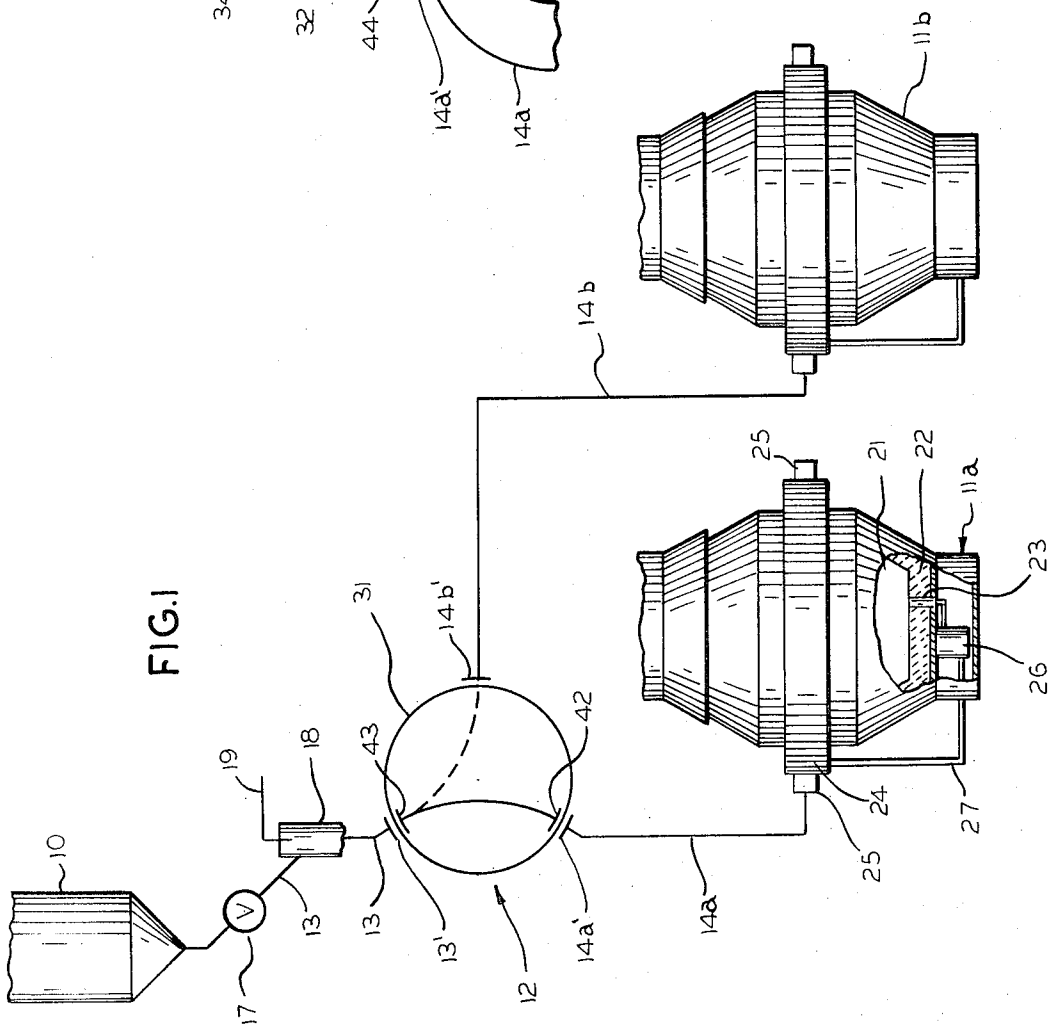

11b
14b
25
21
22
11a
23
26
24
27
25
14a
14a'
12
13'
13
13
18
19
17
10
V
31
14b'
43
42

FIG.1

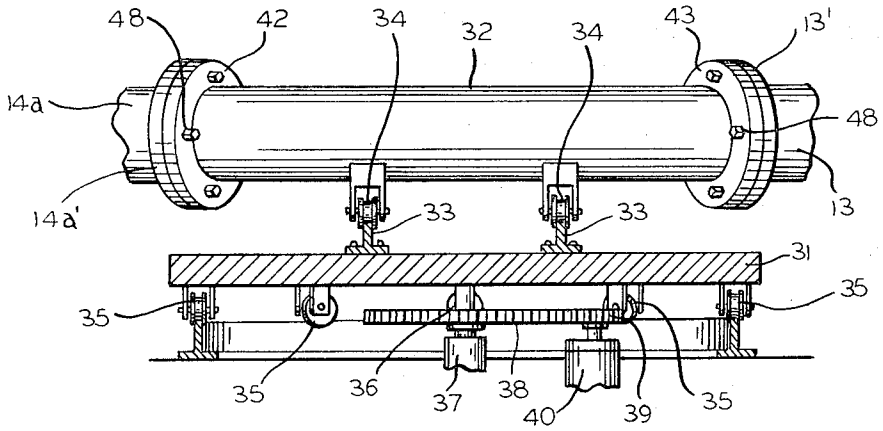

48
42
34
32
34
43
13'
14a
48
14a'
33
33
13
31
35
35
35
36
37
38
40
39
35

FIG.3

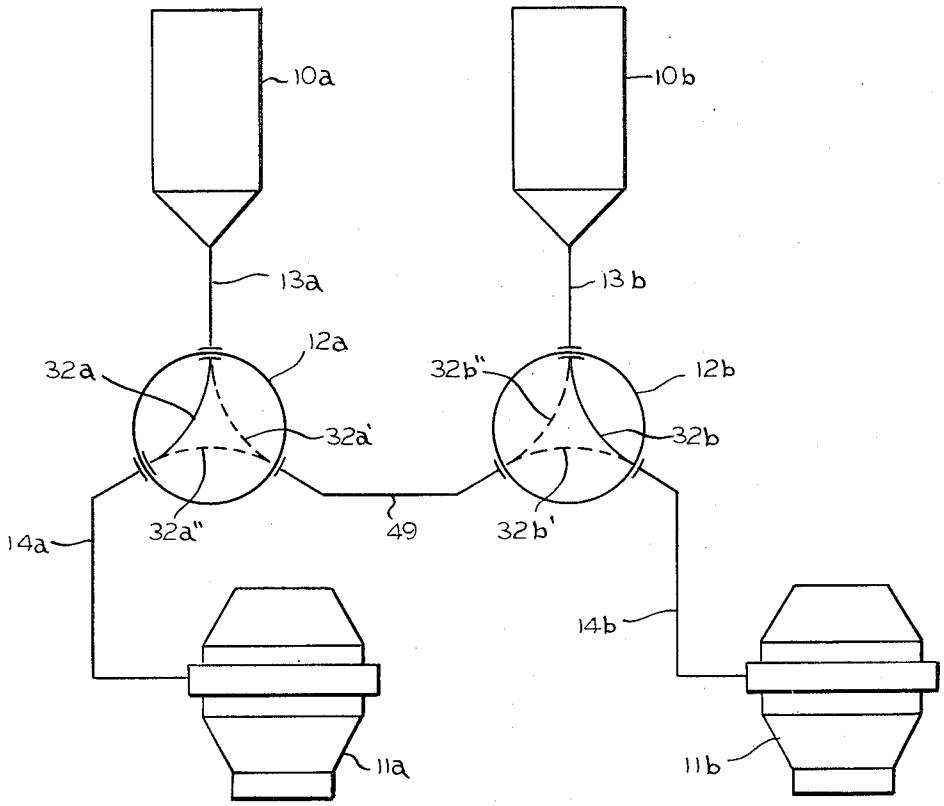
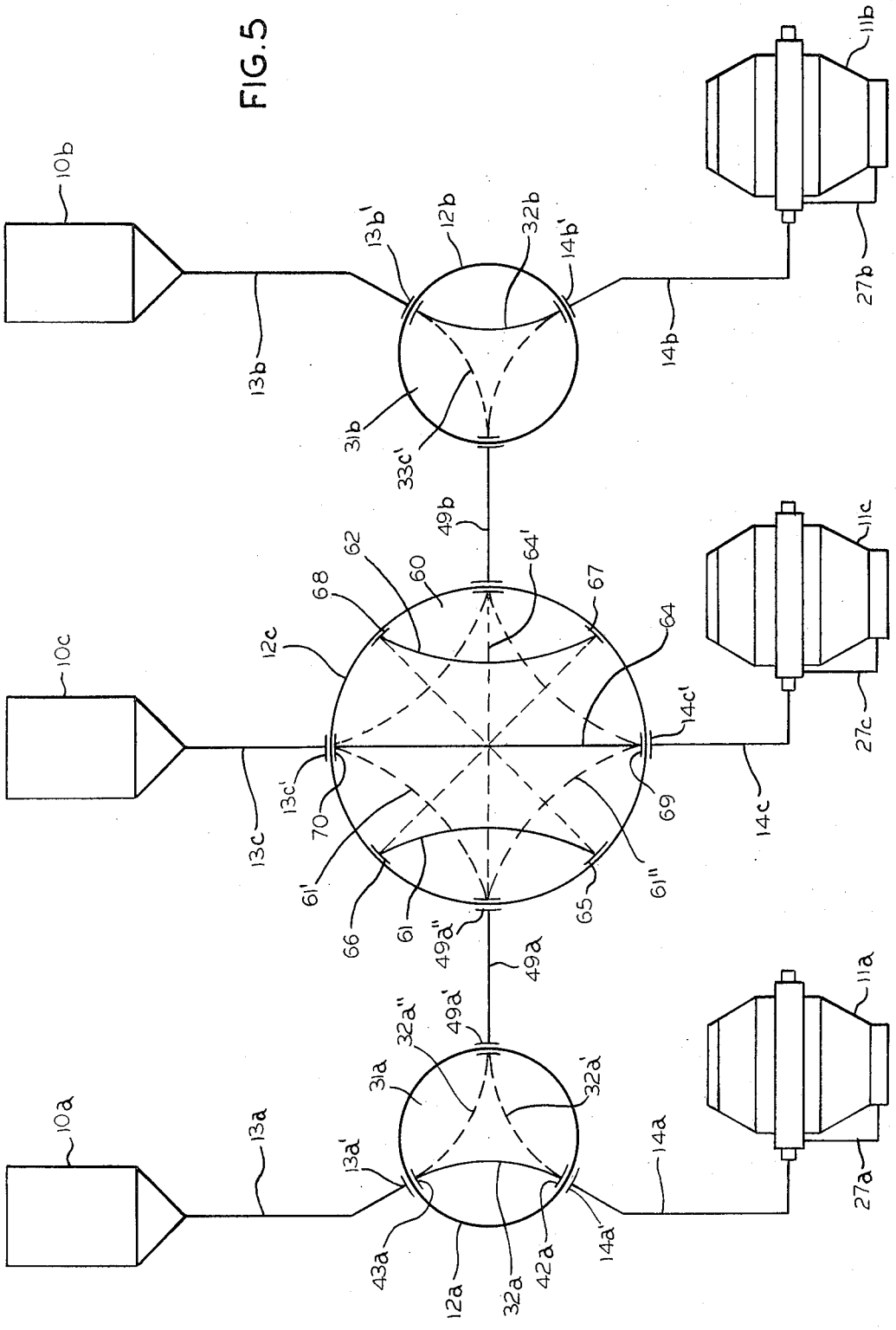

10a
10b
13a
13b
12a
32a
32b"
12b
32a'
32b
14a
32a"
49
32b'
14b
11a
11b

FIG.4

FIG. 5


10b
13b'
12b
32b
14b'
11b
13b
14b
27b
31b
33c'
49b
62
60
64'
68
67
64
12c
11c
10c
14c'
27c
13c'
13c
70
69
14c
61'
61''
66
61
65
49a''
49a
49a'
32a''
32a'
31a
10a
13a
13a'
14a
11a
27a
43a
12a
32a
42a
14a'

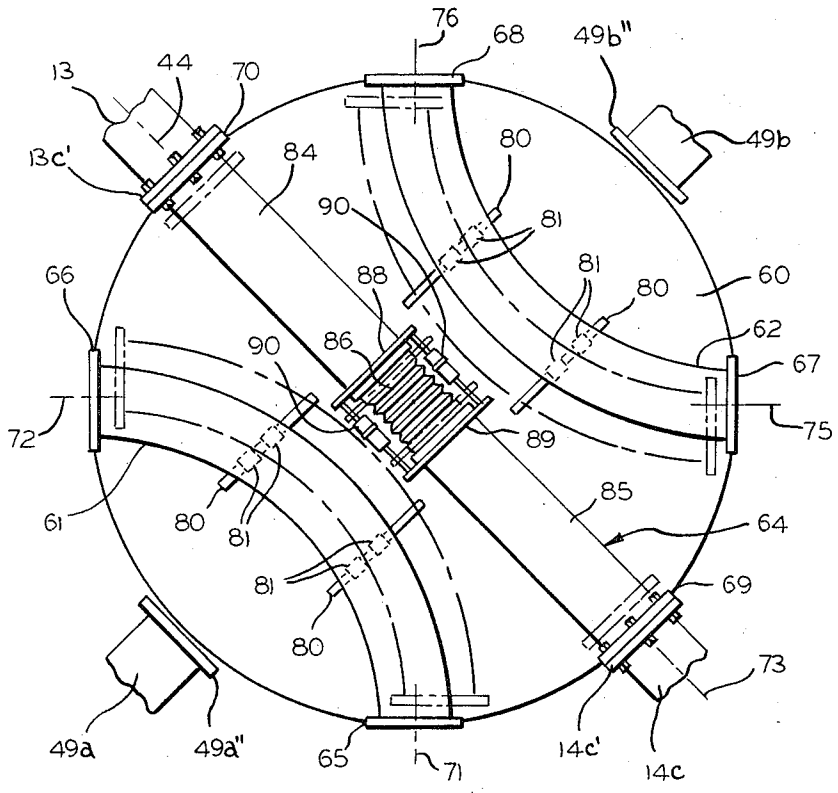

76
68
49b"
13
44
70
49b
13c'
84
80
90
81
81
66
88
80
60
62
90
86
67
72
89
75
85
61
80
81
64
81
69
80
73
49a
49a"
65
71
14c'
14c

FIG.6

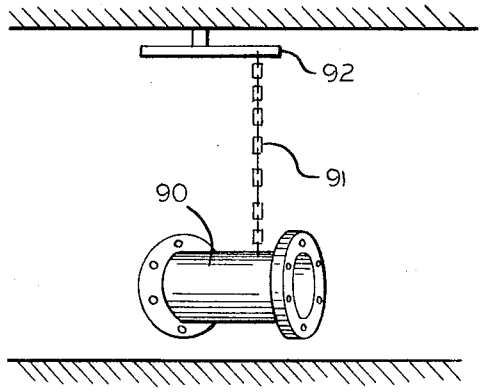

92
91
90

FIG.7

METHOD AND APPARATUS FOR DIRECTIONAL SWITCHING OF PNEUMATIC MATERIAL TRANSPORT PIPING

BACKGROUND OF THE INVENTION

This invention relates to means for transporting finely divided material to a metallurgical vessel from one of a number of storage bins.

In various metallurgical processes various materials are added to the molten metal bath from time to time. For example in the conversion of molten pig iron to steel, lime, limestone, fluorspar, burnt lime, carbonaceous materials, iron oxides, desulfurization agents and the like. In pneumatic steelmaking process, where various gases such as oxygen, argon and the like are blown beneath the surface of the molten metal, these additive materials are often reduced to a powdered form and entrained in the gas stream for transport and injection into the molten metal.

In the pneumatic transport of finely divided materials, such as powdered lime, limestone, iron oxide, etc., valving in the pneumatic transport lines may be subject to rapid wear due to abrasive action of the finely entrained particles. This is especially true in high pressure, high speed systems such as are used, for example. In such systems, the finely divided materials which may be stored in convenient bins, is entrained in a process gas and transported to the converter vessel where they are injected into the hot metal. In shops containing a plurality of vessels, it becomes desirable to have the capability of feeding the powdered material to a particular vessel from different ones of the storage bins. Because of the abrasive action of such powdered materials, which would be particularly destructive of switching valves, the switching of material sources has been largely a manual operation.

To those familiar with the art of pneumatic transport, it will be cleat that the transport pipes for abrasive material are normally lined internally with abrasion resistant material, such as refractory, concrete, or metallic materials such as tungsten carbide. For the high speed transport of lime, a typical transport pipe lining material may be basalt, a naturally found volcanic rock consisting typically of up to 50 percent silica. Such linings are prepared by casting molten basalt into the desired shape for installation into the transport pipe. Typically, a transport pipe of this type employed in connection with a metallurgical vessel may have an inner diameter of approximately 11½ inches and an outer diameter of 16 inches. For pipe bends, a minimum radius of approximately 6 feet is common with a typical 90° bend or elbow composed of three 30° or two 45° flanged pieces. When the material is entrained in the process gas of a metallurgical vessel, which may be at pressures in excess of 150 psi, heavy flanges are required for the transport pipe section joints. Such heavy flanges and the relatively large size of the transport pipe and lining make the manual disconnection and reconnection of such piping sections an arduous task.

SUMMARY OF THE INVENTION

A general object of the invention is to provide a new and improved apparatus for directional switching of pneumatic material transport piping.

A further object of the invention is to provide a system for selectively coupling individual metallurgical vessels to selected material storage means.

DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically illustrates a metallurgical process system incorporating material distribution means according to the present invention;

FIG. 2 illustrates in greater detail a portion of the system shown in FIG. 1;

FIG. 3 is a view taken along line 3—3 in FIG. 2;

FIGS. 4 and 5 schematically illustrate alternate embodiments of the invention;

FIG. 6 shows in greater detail a portion of the system illustrated in FIG. 5; and

FIG. 7 illustrates yet another alternate embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 schematically illustrates the material transport and distribution system in accordance with the preferred embodiment of the present invention employed in connection with bottom blown converter vessels, although it will be appreciated that the invention has application to other types of pneumatic steelmaking vessels as well. The system includes a material storage container **10,** converter vessels **11***a* and **11***b* and switching assembly **12.** Storage container **10** is connected by pipe **13** to switching assembly **12** and converter vessels **11***a* and **11***b* are respectively connected to said switching assembly **12** by pipes **14***a* and **14***b*.

Storage tank **10** may contain finely divided or powdered materials required in pneumatic steelmaking processes such as burnt lime, lime, limestone, iron oxide, carbonaceous materials, desulfurizing agents or the like. As those skilled in the art will appreciate, vessel **10** may be pressurized by means which are not shown but which are well known in the art. Normally means are provided in the lower end of vessel **10** for fluidizing the powdered materials but this has not been shown since it is well known in the art. A selectively operable valve **17** couples the vessel **10** to the pipe **13** and in addition a nozzle **18** is coupled in pipe **13** and is connected to the process gas by pipe **19.** The finely divided or powdered material enters pipe **13** and is propelled along pipe **13** by high pressure gas emanating from nozzle **18.** Details of the valve **17** and the nozzle **18** form no part of the present invention and will not be described in detail for the sake of brevity. For more complete description of these components, reference is made to United States application Ser. No. 207,822 filed Dec. 14, 1971, now U.S. Pat. No. 3,771,365 and assigned to the assignee of the present invention.

The metallurgical vessels **11***a* and **11***b* may be any well known converter of the pneumatic type wherein an oxygen containing process gas is provided to a hot metal bath. For purposes of illustration, the vessels **11***a* and **11***b* are of the bottom blown type and are shown in FIG. **1** to generally include a metallic shell **21,** a refractory lining **22,** and one or more tuyeres **23** extending through the refractory lining for delivering process gas beneath the surface of a bath hot metal contained therein. Each of the vessels is supported on a trunnion ring **24** having a pair of trunnion pins **25** extending from the opposite side thereof so that the vessel may be

tilted for the purpose of charging, deslagging, and discharging hot metal. A distributor **26** may be provided at the lower end of the vessel to insure proper dispersion of the particles in the process gas prior to injection through the tuyeres **23.** Pipes **27** may be provided for connecting the distributors **26** to the respective delivery pipes **14***a* or **14***b* through the trunnion pins **25.** Those skilled in the art will appreciate that the tuyere **23** may comprise concentric pipes with the oxygen or oxygen containing gas delivered to the inner pipe and a shielding gas, such as propane, delivered to the outer pipe. For a more complete description of the tuyere and vessel design, reference is made to application Ser. No. 239,666 filed Mar. 30, 1972 and assigned to the assignee of the present invention and for more complete description of the gas and particulate delivery system, through the trunnion pins **25,** reference is made to copending application Ser. No. 213,386 filed Dec. 29, 1971, now abandoned and replaced by continuation in part application Ser. No. 332,650, filed Feb. 15, 1973, assigned to the assignee of the present invention.

As indicated above, storage vessel **10** is connected to switching station **12** by pipe **13** and converter vessels **11***a* and **11***b* are respectively connected to said switching station by pipes **14***a* and **14***b*.

Switching assembly **12** is shown in FIGS. **2** and **3** to include a circular, generally horizontally arranged, turntable **31** and an arcuate pipe section **32.** A pair of rails **33** are mounted in a horizontally spaced apart relation on the turntable **31** and the opposite side of a plane bisecting the same. The pipe section **32** has pairs of rollers **34** suitably mounted on the lower end thereof and in spaced apart relation for engaging the rails **33.** Turntable **31** is supported by means of a plurality of rails and rollers **35** which are arranged in a circulate array adjacent the lower periphery thereof for engaging annular rails and rollers **35** mounted therebelow. In addition, a vertical shaft **36** is affixed axially of the turntable **31** and extends downwardly from the lower end thereof for engaging a bearing **37.** A gear **38** is affixed to shaft **36** and is meshingly engaged by a pinion **39** which is adapted to be rotated by a motor **40.**

Pipe **32** carries flanges **42** and **43** on its opposite ends for matingly engaging the flanges **13'**, **14***a'* and **14***b'* on pipes **13, 14***a* or **14***b*. The arc of pipe **32** is such that an angle of approximately 120° is formed between the intersection of the axes **44** and **45** of flanges **42** and **43** respectively. In addition the pipes **13, 14***a* and **14***b* are arranged at angles of approximately 120° around the periphery of turntable **31.**

When the pipe section **32** is in its position shown by full lines in FIG. **2,** its flanges **42** and **43** are in registry with flanges **14***a'* of pipe **14***a* and **13'** of pipe **13.** The flanges may be secured in a sealing relation in any suitable manner such as by nuts **47** and bolts **48.** Those skilled in the art will also appreciate that suitable gasketing for sealing the various flanges may also be provided.

Initially when the switching assembly **12** is in its position shown in FIG. **1,** storage container **10** is coupled to vessel **11***a*. Should it be desired to couple container **10** to vessel **10***b*, the nuts **47** and bolts **48** are released freeing flanges **42** and **43** from flanges **14***a'* and **13** respectively.

The pipe section **32** may then be moved in the direction of the tracks **33** and along a line which bisects the angle formed by planes containing the flanges **14***a'* and **13'**. After pipe section has been moved to a position where its flanges **42** and **43** are within the periphery of turntable **31** and so that they will not engage flanges **42** and **43** upon rotation, turntable **31** may be rotated 120° clockwise by operation of motor **40** acting through pinion **39** and gear **38.** This places flange **42** of pipe section **32** opposite flanges **13'** of pipe **13** and flange **43** opposite flange **14***b'* of pipe **14***b*. The rails **33** now span the center line **44** of pipe flange **14***a'*. As a result, movement of pipe **32** upwards and to the right as viewed in FIG. **2** will move flange **43** into engagement with flange **14***b'* and flange **42** into engagement with flange **13'** whereupon the flanges may be secured by nuts **47** and bolts **48.**

FIG. **4** shows an alternate form of the invention to include a pair of material storage containers **10***a* and **10***b* and a pair of switching assemblies **12***a* and **12***b*. Pipes **13***a* and **13***b* extend from containers **10***a* and **10***b* to switching assemblies **12***a* and **12***b* and pipes **14***a* and **14***b* extend from switching assemblies **12***a* and **12***b* to vessels **11***a* and **11***b*. In addition a pipe **49** extends between switching assemblies **12***a* and **12***b*. The containers **10***a* and **10***b*, vessels **11***a* and **11***b*, switching assemblies **12***a* and **12***b*, piping **13***a*, **13***b*, **14***a*, and **14***b* may be identical to the correspondingly numbered structure illustrated in FIGS. **1–3** and accordingly these portions of the apparatus will not be discussed in detail for the sake of brevity.

When the switching assemblies **12***a* and **12***b* are in their positions shown by full lines in FIG. **4,** container **10***a* is connected to vessel **11***a* and container **10***b* is connected to vessel **11***b*. However, should it be desired to couple either of the vessels **11***a* or **11***b* to a different one of the material storage ontainers **11***a* or **11***b*, the switching assemblies **12***a* and **12***b* will be rotated appropriately. For example, if it is desired to couple container **10***a* to vessel **11***b*, pipe sections **32***a* and **32***b* are respectively disconnected from pipes **13***a*, **14***a*, **13***b* and **14***b* and are moved inwardly as discussed with respect to FIGS. **2** and **3.** Switching assemblies **12***a* and **12***b* are then each rotated clockwise to place pipe sections **32***a* and **32***b* in the positions shown by phantom lines **32***a'* and **32***b'* in FIG. **4.** On the other hand if it is desired to connect storage container **10***b* to vessel **11***a*, the switching assemblies **12***a* and **12***b* are placed in the positions wherein pipe sections **32***a* and **32***b* are in the positions shown by phantom lines **32***a''* and **32***b''* in FIG. **4.**

FIG. **5** schematically illustrates an arrangement including three material storage vessels **10***a*, **10***b* and **10***c*, three metallurgical vessels **11***a*, **11***b* and **11***c*, and switching assemblies **12***a*, **12***b* and **12***c*. Storage containers **10***a*, **10***b* and **10***c* are respectively connected by pipes **13***a*, **13***b* and **13***c* to switching assemblies **12***a*, **12***b* and **12***c* and converter vessels **11***a*, **11***b* and **11***c* are respectively connected to said switching assemblies by pipes **14***a*, **14***b* and **14***c*. It will be understood that the containers **10***a*, **10***b* and **10***c*, the metallurgical vessels **11***a*, **11***b* and **11***c* and the switching assemblies **12***a* and **12***b* may be identical to the correspondingly numbered apparatus shown in FIGS. **1** and **4.**

Referring now to FIG. **6** which shows the switching assembly **12***c* to include a circular, generally horizontally mounted turntable **60** for supporting a pair of curved pipe sections **61** and **62** which flank a straight pipe assembly **64.** Pipe section **61** includes opposite end flanges **65** and **66**; pipe section **63** includes oppo-

site end flanges **67** and **68**; and pipe assembly **64** includes opposite end flanges **69** and **70.** The axes **71** and **72** of flanges **65** and **66** intersect at an angle of approximately 120° with each other. Further, axes **71** and **72** respectively intersect axis **73** of flange **69** and axis **74** of flange **70** at angles of approximately 45°. Similar relationships exist between axis **75** of flange **67** and axis **76** of flange **68** and the remaining flanges. Pipe sections **61** and **63** each have pairs of rollers **81** mounted in spaced apart relation in the same manner that rollers **31** are mounted below pipe section **32** shown in FIG. **3.** Each of the pairs of rollers **81** are mounted on one of a pair of rails **80** which are disposed in a parallel relation below each of the pipe sections **61** and **63.** In this manner, each of the pipe sections **61** and **62** are movable toward and away from the center pipe assembly **64** and from their positions shown by full lines in FIG. **4** to their positions shown by phantom lines.

The center pipe assembly **64** includes a first rigid pipe member **84** which carries flange **70** at its outer end and a second rigid pipe member **85** which is coaxial with pipe **84** and which carries flanges **69** at its outer end. The inner ends of each of the pipe sections **84** and **85** are spaced apart from each other and are interconnected by a flexible bellows assembly **86.** The pipe sections **84** and **85** also each include flanges **88** and **89** at their inner ends respectively. Flanges **88** and **89** are interconnected by a suitable motive assembly **90,** which may comprise, for example, a hydraulically or pneumatically actuated piston and cylinder. When switching assembly **12***c* is in its position shown in FIG. **6,** flange **70** is bolted to flange **13***c'* of pipe **13***c* and flange **69** is bolted to flange **14***c'* of pipe **14***c*. As a result, pipes **13***c* and **14***c* are interconnected. It will be appreciated that turntable **60** may be mounted for rotation in any suitable manner such as by rollers (not shown) mounted on an annular rail (not shown) in a manner similar to the manner in which turntable **31** is mounted. Similarly, turntable **60** may be rotated in any suitable manner such as by means of a gear system (not shown) and a motor (not shown) in a manner similar to that shown in FIG. **3** with respect to turntable **31.**

Referring again to FIG. **5** when the switching assemblies **12***a*, **12***b* and **12***c* are in their positions shown by full lines, container **10***a* is coupled to converter vessel **11***a* through pipes **13***a* and **14***a* and pipe section **32***a;* container **10***b* is connected to vessel **11***b* through an analogous path; and storage vessel **10***c* is coupled to converter vessel **11***c* through pipe assembly **64.**

In the event it becomes necessary or desirable to provide material from one of the containers **10***a*, **10***b* or **10***c* to one of the converter vessels **11***a*, **11***b* or **11***c*, other than those which they are shown to be connected in FIG. **5,** the switching assemblies **12***a*, **12***b* and **12***c* can be operated to accommodate any such feeding arrangement. For example, assume that it is desired to feed converter vessel **11***a* from storage vessel **10***c*. Initially, flanges **42***a* and **43***a* of pipe section **32***a* are unbolted from flanges **13***a'* and **14***a'* and pipe section **32***a* moved inwardly whereupon turntable **31** is rotated 120° counterclockwise to its position shown by phantom lines **32***a'* to place flange **42***a* opposite flange **49***a'* on pipe **49***a* and flange **43***a* opposite flange **14***a'* of pipe **14***a*. Pipe section **32** is then moved radially upwardly until said flanges engage and are then bolted together. This couples pipe **14***a* to pipe **49.** In addition, flanges **70** and **69** of pipe assembly **64** are unbolted from flanges **14***c'* of pipe **14***c* and **13***c'* of pipe **13***c*, respectively. Cylinders **90** may then be operated to move pipe sections **84** and **85** radially inwardly in a way from flanges **69** and **70** and turntable **60** rotated 45° clockwise as viewed in FIG. **5** to place flanges **65** and **66** of pipe section **61** opposite flanges **49***a''* of pipe **49** and **13***c'* of pipe section **13***c* respectively. Pipe section **61** is then moved radially outwardly to move the flanges into engagement whereupon they may be secured together. Pipe section **61** is then in the position shown by line **61'** in FIG. **5** whereupon vessel **11***a* is connected to storage vessel **10***c*.

Assume on the other hand with the turntables **31***a*, **31***b* and **60** in their initial position shown by full lines in FIG. **5** and it is desired to connect container **10***a* to vessel **11***c*. The flanges of pipe section **32***a* and pipe assembly **64** are intially unbolted and moved radially inwardly. Turntable **31***a* is then rotated 120° clockwise and turntable **60** rotated 45° counterclockwise. This places pipes **32***a* and pipe **61** in positions shown by phantom lines **32***a''* and **61''**. After the appropriate flanges are bolted pipe **13***a* is coupled to pipe **49***a* which in turn is coupled to pipe **14***c*.

Assume again when the switching assemblies **12***a*, **12***b* and **12***c* are in their positions shown by full lines in FIG. **5** and that it becomes desirable to couple container **10***b* to converter vessel **11***a*. This is accomplished by suitably uncoupling the various flanges of the three switching assemblies **12***a*, **12***b* and **12***c* and rotating turntable **31***a* 120° counterclockwise to its position pipe **32***a* at **32***a'* turntable **61** 90° to position pipe assembly **64** in its position shown by dashed lines **64'**; turntable **31***b* 120° counterclockwise to position pipe section **32***b* in its position shown by phantom line **32***c'*. The various pipe sections are then moved outwardly and the flanges bolted whereupon tank **10***b* is coupled to vessel **11***a* through pipes **13***b*, **32***c*, **49***b*, **64**, **49***a*, **32***a* and **14***a*.

From the foregoing it will be appreciated how the various containers **10***a*, **10***b* and **10***c* can be selectively coupled to any of the vessels **11***a*, **11***b* or **11***c*.

FIG. **7** illustrates an alternate embodiment of the invention wherein a curved pipe section **90** which is substantially identical to one of the curved pipe sections **32,** is suspended by means of chains **91** from an overhead turntable **92.** When it is desired to rotate the pipe coupling **90** from a first position to a second position, it is initially unbolted in a manner discussed with respect to the pipe coupling member **32** of FIGS. **1–4.** Pipe **90** is then pulled inwardly away from the mating flanges of the associated pipe sections and the turntable **92** is then rotated in a suitable manner to position the pipe section **90** in a position adjacent an alternate pair of pipes. Web section **90** may then be moved outwardly into engagement with the mating flanges of the stationary pipe sections and rebolted into position.

Although the invention has been described with regard to one type of converter vessel, it will be appreciated that inventive concept has application to other types of converter vessels as well. Further, modifications to the above described preferred embodiments may be accomplished without deviating from the scope of the inventions. For example, other types of coupling devices besides flanges may be employed to connect and disconnect the pipe sections. Further, flange clearances may be accomplished by providing movable flanges rather than moving the pipe sections. Accord-

ingly, the scope of the invention is not limited to the preferred embodiments disclosed herein but the scope of the appended claims.

We claim:

1. A system for controlling the flow of material between at least three spaced apart stations,

a pipe means associated with each station and each pipe means including one end coupled to its associated station and an open end, each said open end having radially extending first coupling means,

coupling pipe means having first and second open ends adapted to be connected to the open ends of said pipe means, support means to support said coupling pipe means, said support means including means for mounting said coupling pipe means for bidirectional movement on said support means, said support means being rotatable about an axis whereby said coupling pipe means can be selectively rotated into alignment with the open ends of any two of said pipe means, each of said first and second open ends of said coupling pipe means having radially extending second coupling means for engaging and effecting a sealed joint selectively with one of said first coupling means when said coupling pipe means is in a coupling position, said first and second radially extending coupling means interfering with each other and preventing rotation of said coupling pipe means for disengagement with one of said first coupling means to engagement with another when said coupling pipe means is in said coupling position, and

said coupling pipe means being bidirectionally movable on said support means toward said rotational axis to a second position in which said first and second coupling pipe means are spaced from each other to permit rotation of said coupling pipe means with said support means.

2. The apparatus set forth in claim 1, wherein said coupling pipe means is generally arcuate, the angle formed between the axes of the opposite ends of said coupling pipe means being approximately 120°.

3. The apparatus set forth in claim 2 wherein the open ends of said pipe means are arranged around said support means and spaced apart from each other at radial angles relative to said substantially vertical axis of approximately 120°.

4. The apparatus set forth in claim 1 wherein said coupling pipe means includes a generally arcuate pipe member.

5. The apparatus set forth in claim 1 wherein said second coupling means on each end of said coupling pipe means comprises flange means, said first coupling means comprising flange means on the open ends of said pipe means and means for quickly attaching and detaching said second coupling means to adjacent ones of said first coupling means.

6. The apparatus set forth in claim 1 wherein said coupling pipe means includes an outer metallic shell and an inner abrasion resistant lining.

7. The apparatus set forth in claim 1 wherein one of said stations includes means for containing and pressurizing metallurgical process material and the other of said stations include a metallurgical vessel,

said coupling pipe means being adapted when in its coupling position to couple one of said metallurgical vessels to said material containing vessel and being constructed and arranged when in its alternate position to couple said material containing vessel to the other of said metallurgical vessels.

8. The apparatus set forth in claim 7 wherein said coupling pipe means is generally arcuate, the angle formed between the axes of the opposite ends of said coupling pipe means being approximately 120°.

9. The apparatus set forth in claim 7 wherein the open ends of said pipe means are arranged around said support means and spaced apart from each other at radial angles relative to said substantially vertical axis of approximately 120°.

10. A metallurgical process system including a plurality of spaced apart stations,

certain of said stations comprising container means for containing metallurgical process material and others of said stations comprising metallurgical processing vessels,

a plurality of pipe means respectively connected with one of said container means and with one of said metallurgical vessels, each pipe means having an open end,

first and second support means each rotatable between first, second and third alternate positions,

third support means rotatable between a plurality of positions,

first and second interconnecting pipe means each having one end adjacent said third support means and another end extending away therefrom,

first, second and third pipe coupling means mounted on said third support means and being rotatable therewith,

said first pipe coupling means being constructed and arranged to connect said one metallurgical vessel to said one container means when in a first coupling position and for connecting said first interconnecting pipe means to said second interconnecting pipe means when in a second coupling position,

said second pipe coupling means being adapted when in a first coupling position to couple said one metallurgical vessel to said second interconnecting pipe means and to couple said one container means to said second interconnecting pipe when in a second coupling position,

said third pipe coupling means being adapted to connect said one metallurgical vessel to said first interconnecting pipe means when in a first coupling position and said one container means to said first interconnecting pipe means when in a second coupling position, said pipe coupling means each having a first radially extending coupling member at each end and each of said interconnecting pipe means having at said ends adjacent said support means a second radially extending coupling member, the radial extent of said coupling members interfering with rotation of said pipe coupling means with said support means when said third pipe coupling means is in either of its first or second coupling position, and

means for supporting at least a pair of said coupling pipe means for bidirectional movement on said third support means from their coupling positions to a non-interfering position toward and radially away from the rotational axis of said rotatable support means, whereby to enable retraction of said pipe coupling means so that said coupling members are in non-interfering relationship to permit rota-

tion of said pipe coupling means with said third support means.

11. The system set forth in claim **10** wherein said first interconnecting pipe means comprises a pair of coaxial, endwise spaced pipe members, and yieldable means for joining said adjacent ends of said pipe coupling means and said interconnecting pipe members, the means for selectively contracting and extending said first pipe coupling means to alternately position its radially extending coupling members in non-interfering and engaging relation with the adjacent coupling members.

12. The apparatus set forth in claim **11** wherein said second and third coupling pipe means are disposed on the opposite sides of said first coupling pipe means and are generally arcuate, the angle formed between the axes of the opposite ends of said coupling pipe means being approximately 120°.

13. The system set forth in claim **10** and wherein said plurality of spaced apart stations include second and third container means for containing metallurgical process material and second and third metallurgical vessels,

a pipe means associated with each of said second and third container means and metallurgical vessels, and each pipe means including one end coupled to its associated station and an open end,

second and third support means each movable between first, second and third alternate positions,

said first interconnecting pipe means extending between said first and second support means and being open at its opposite ends and said second interconnecting pipe means extending between said first and third support means and being open at its opposite ends,

fourth coupling pipe means mounted on said second support means and being movably therewith, said fourth coupling pipe means being open at its opposite ends for selective connection to said pipe means, said forth coupling pipe means being adapted when said second support means is in its first, second and third position respectively to couple a second container means to a second metallurgical vessle, said second container to said first interconnecting pipe, and said second metallurgical vessel to said interconnecting pipe,

fifth coupling means mounted on said third support means and being movable therewith,

said fifth pipe coupling means being adapted when said third support means is in its first, second and third positions for respectively coupling said third metallurgical vessel to said third container means, said third container means to said second interconnecting pipe and said third metallurgical vessel to said second interconnecting pipe.

14. A system for selectively controlling the flow paths of fluidic process material between a pressurized source thereof and metallurgical processing vessels, comprising:

a first stationary fluidic material source pipe having first pipe coupling flange means on one end,

second and third stationary pipe means each communicating with a different vessel and each respectively having a second and third pipe coupling flange means on one end,

said first, second and third flange means being angularly spaced apart from each other and presented generally toward a common axis,

a curved coupling pipe member having a flange at each of its opposite ends, support means to support said coupling pipe member, said support means including means for mounting said coupling pipe member for bidirectional movement on said support means, said support means being rotatable about an axis whereby said coupling pipe member can be selectively rotated into alignment with a pair of said first, second and third coupling flange means to effect a fluidic material path from said source pipe to one or another of said vessels, said flange means having such radial extent as to interfere with rotation of said coupling pipe member directly from one connected position to another when said coupling pipe member is in a coupled position, and

said coupling pipe member being bidirectionally movable on said support means toward said rotational axis to a second position in which the flanges on said coupling pipe member are spaced from the respective pair of said first, second and third flange means to permit rotation of said coupling pipe member with said support means.

* * * * *