United States Patent [19]

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[54] **TARGET LAUNCHER**

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[21] Appl. No.: **116,866**

[52] **U.S. Cl.** .....**124/11 R**, 124/32, 124/51 A

[51] **Int. Cl.** **F41f 1/04**

[58] **Field of Search** .....124/11, 50, 51 R, 51 A, 53; 273/26 D

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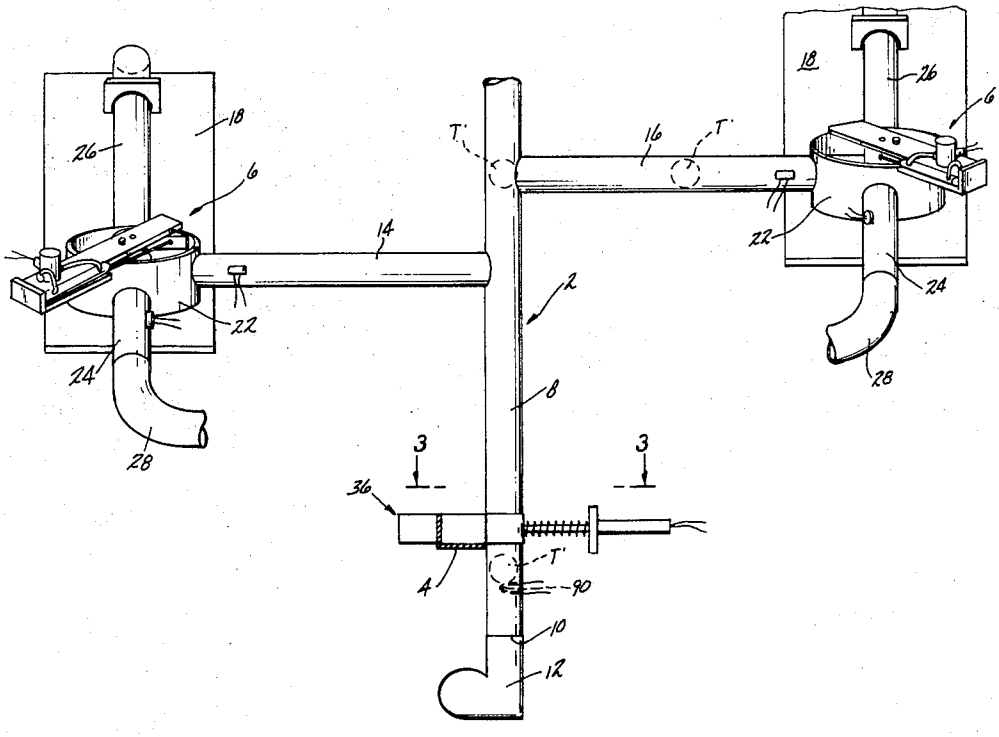
[57] **ABSTRACT**

Apparatus for launching spherical targets into the air including a tubular pneumatic conveyor system having a main trunk portion and branch portions. A transfer mechanism is connected to a remote end of each of the branch portions of the conveyor to receive a target from the conveyor and deposit the targets is a pneumatically actuated launching tube. Targets are thus fed from a source through the conveyor and into the launching tubes to be propelled into the air.

5 Claims, 9 Drawing Figures



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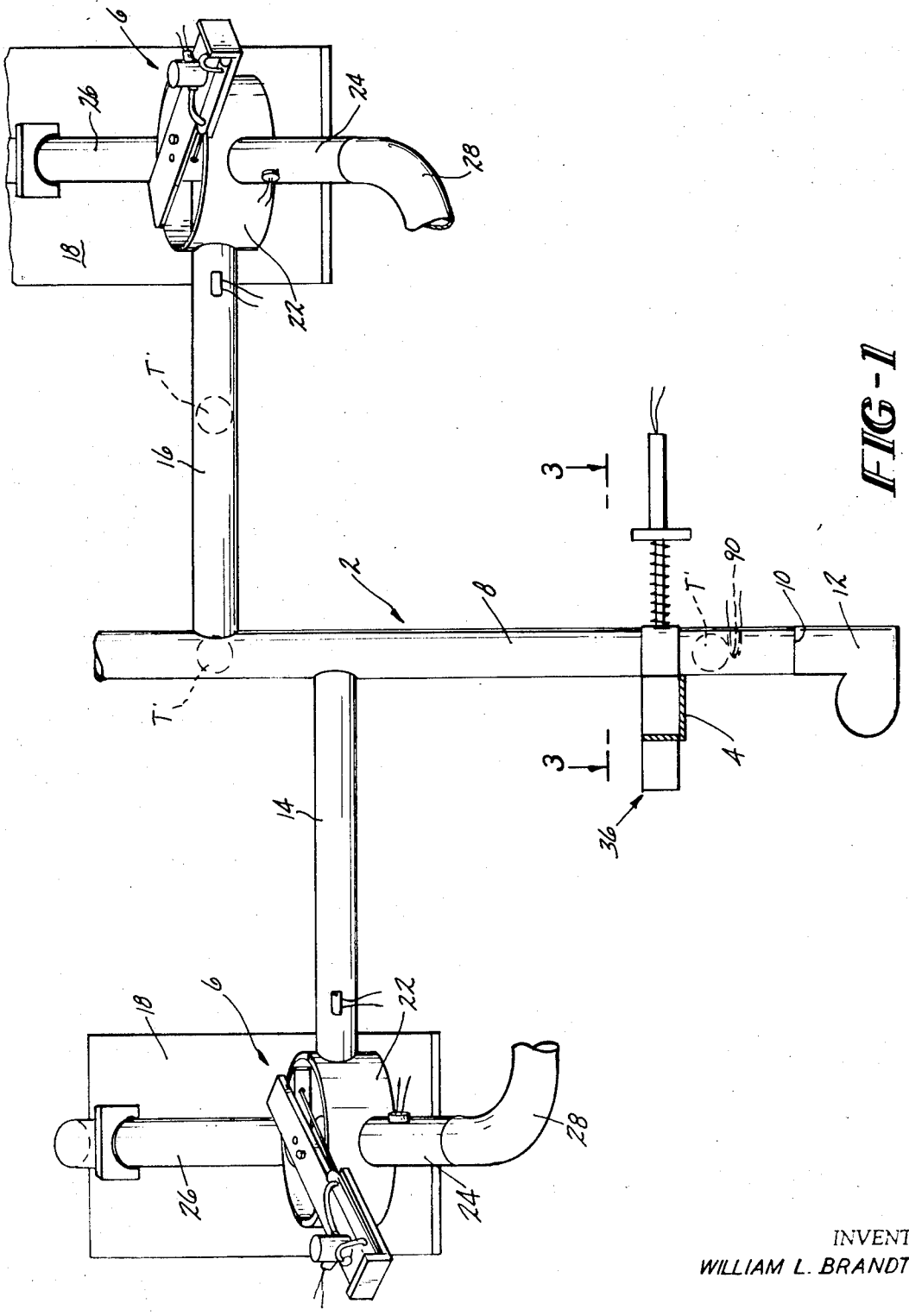

FIG-1

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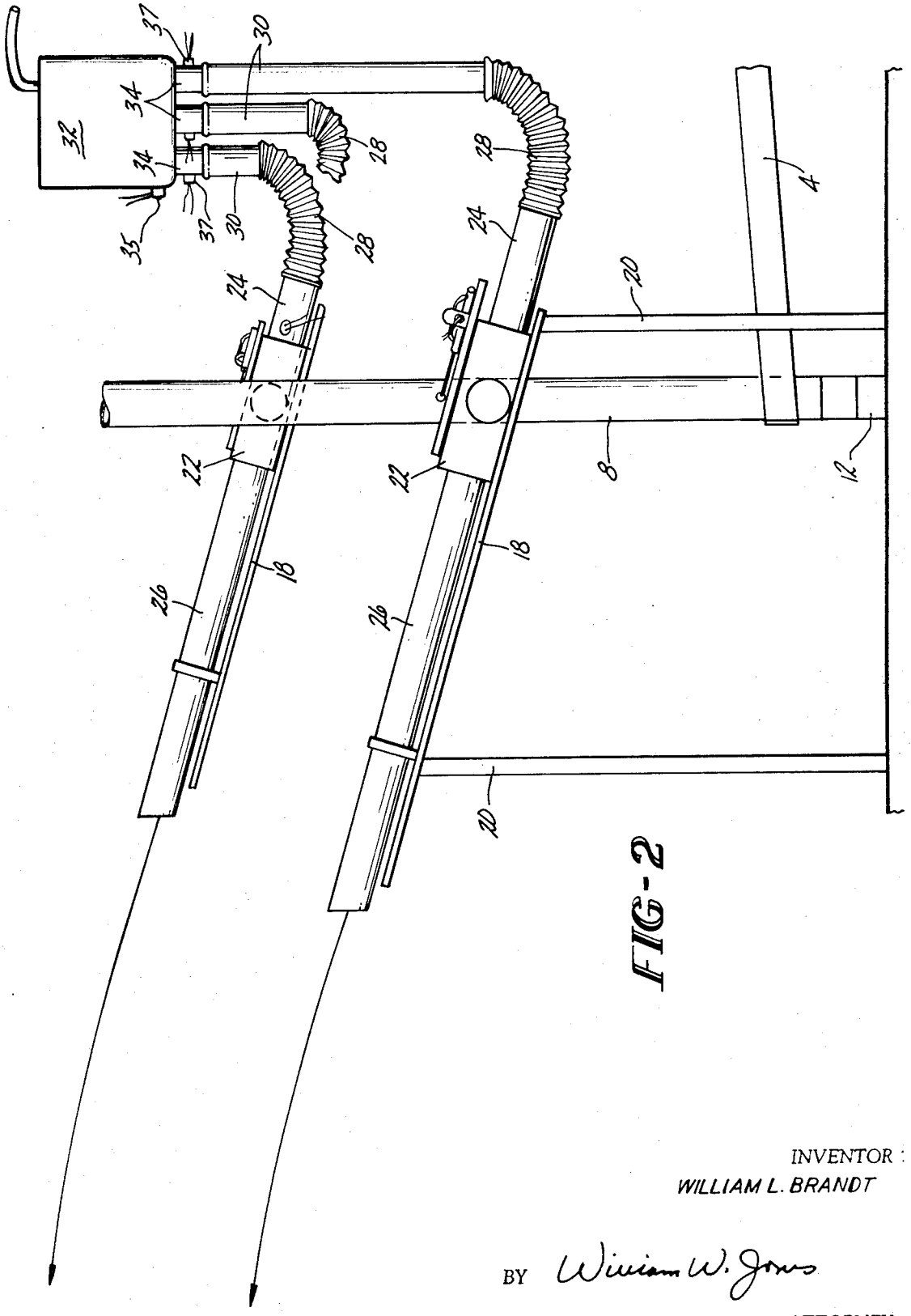

FIG-2

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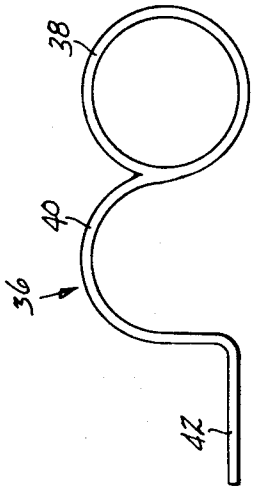

FIG-4

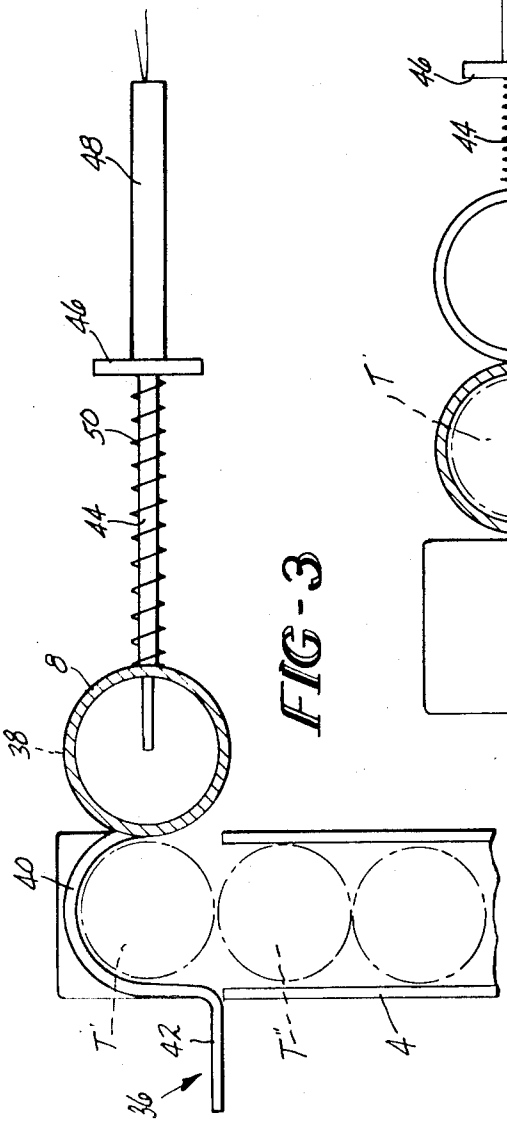

FIG-3

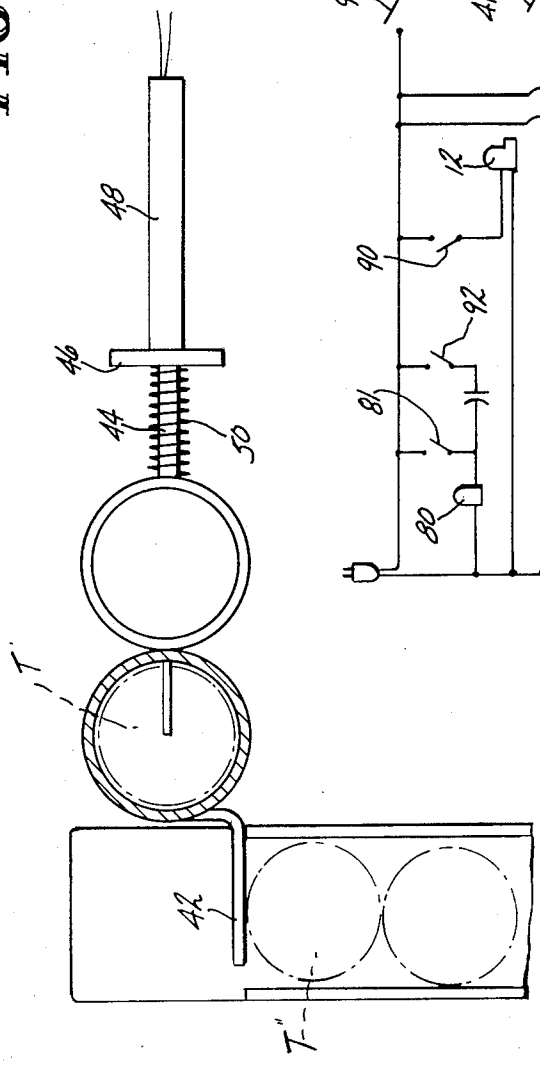

FIG-5

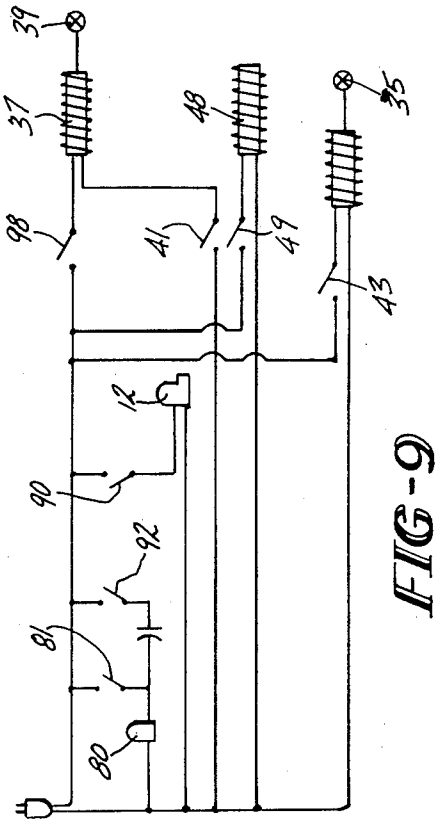

FIG-9

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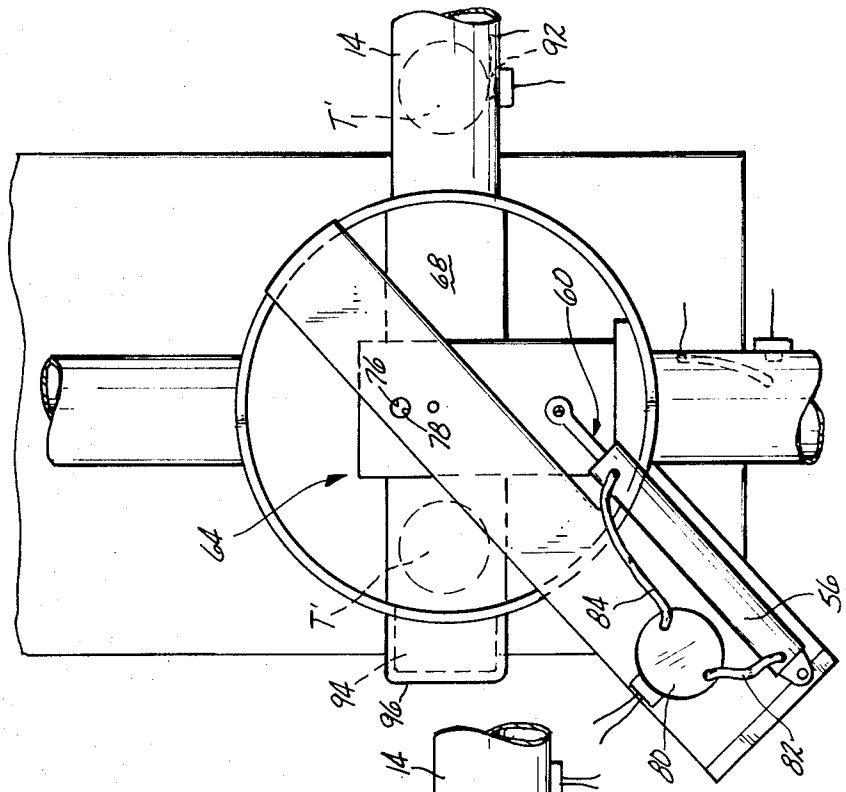

FIG-7

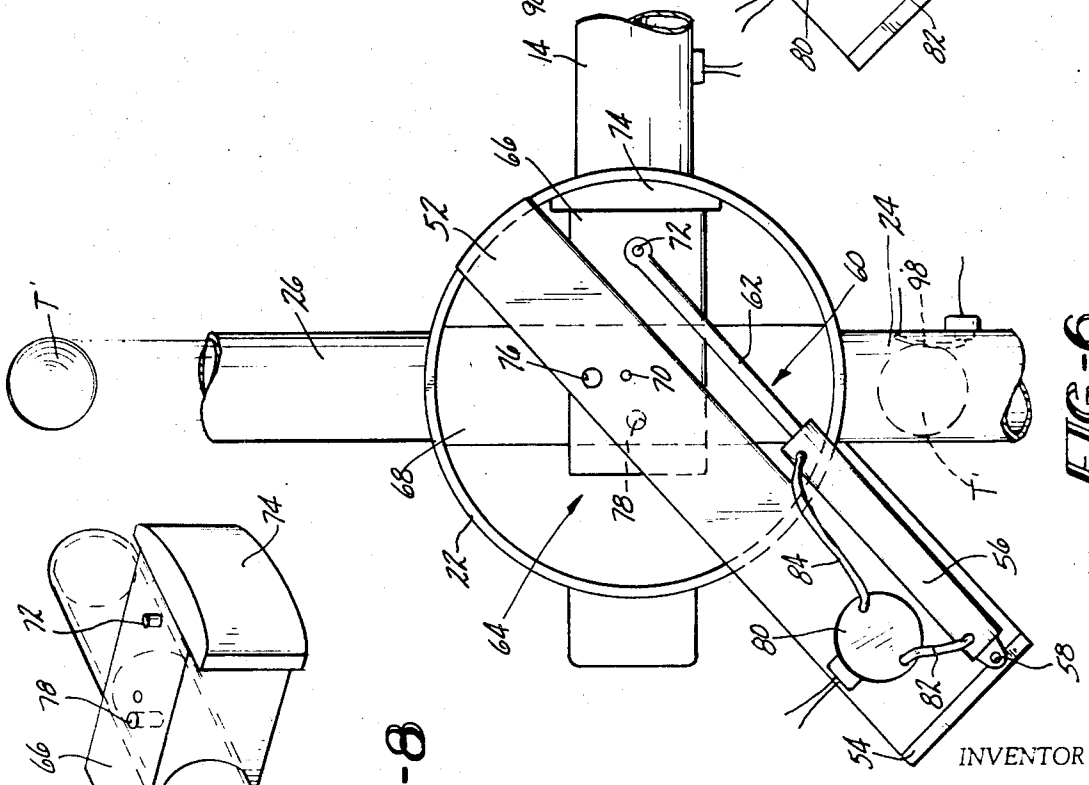

FIG-6

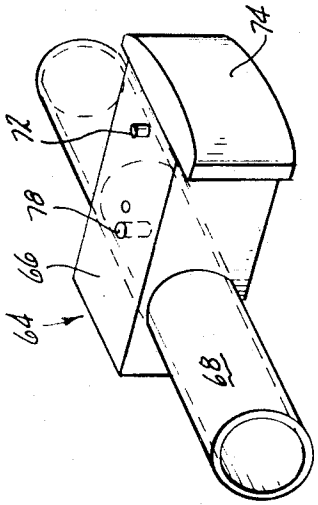

FIG-8

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TARGET LAUNCHER

This invention concerns an apparatus for launching spherical targets into the air to be fired upon by a shooter. The launching apparatus includes a plurality of launching mechanisms into which targets can be fed from a central source by way of a pneumatic conveyor system. The conveyor system selectively feeds a target from the source to only one of the plurality of launching mechanisms with the result that the shooter does not know exactly from whence the target is coming until the target is actually launched.

The conveyor apparatus includes a central tubular portion or trunk having an internal passage into which targets are fed from a source thereof. A blower or fan is disposed in communication with the trunk portion of the conveyor, the blower beIng activated when a target is placed in the conveyor. Actuation of the blower causes a fluid pressure rise within the trunk of the conveyor which fluid pressure pushes on the target. The conveyor also includes a plurality of branch portions which extend laterally from the trunk at different locations along the latter. Each branch portion terminates in a transfer mechanism which can receive a target from the conveyor and deposit the target in a launcher tube. The transfer mechanisms are movable between a target-receiving position and a target-launching position and are normally positioned in the latter position. When a launch is desired, one of the transfer mechanisms is electrically signalled and is thus caused to move to its target-receiving position. A fluid bleed port is simultaneously opened in the area of the selected transfer mechanism so as to open the appropriate conveyor branch to the atmosphere thus causing a pressure drop at the selected transfer mechanism. The target is thus caused to move through the trunk portion of the conveyor system and then laterally through the selected branch portion to the selected transfer mechanism by means of the flow of air from the blower to the opened bleed port.

After the target has entered the selected transfer mechanism, the latter is caused to return to its target-launching position to position the target in the selected launch tube. The target is then blown out of the launch tube by a blast of gas, the target being thus propelled into the air in view of the shooter who fires at the flying target.

It is therefore, an object of this invention to provide an apparatus for launching spherical targets into the air by propelling a target through a launch tube with a blast of gas.

It is a further object of this invention to provide an apparatus of the character described which further includes a pneumatic conveyor operative to move a target from a source thereof to the launch tube.

It is yet another object of this invention to provide an apparatus of the character described wherein the pneumatic conveyor includes a trunk portion and a number of branch portions extending laterally therefrom, each branch portion being associated with a separate launch tube whereby a target may be launched from any one of a number of different locations.

It is an additional object of this invention to provide an apparatus of the character described which further includes a transfer mechanism associated with each launch tube adjacent an end of each branch of the conveyor to receive a target from the conveyor and transfer the target into the launch tube.

These and other objects and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a rear view of a representative portion of the apparatus of this invention showing a preferred embodiment of the trunk and branch portions of the conveyor, and a pair of associated transfer mechanisms and launch tubes;

FIG. 2 is a side view of the apparatus of FIG. 1 as viewed from the left hand side of FIG. 1;

FIG. 3 is a horizontal sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a plan view of the target feeding mechanism shown in conjunction with related components in FIG. 3;

FIG. 5 is a sectional view similar to FIG. 3 but showing operation of the target feeding mechanism transferring a target from the source into the conveyor tube;

FIG. 6 is a plan view of the transfer mechanism as It appears in the normal target-launching position;

FIG. 7 is a plan view similar to FIG. 6 but showing the transfer mechanism in its target-receiving position;

FIG. 8 is a perspective view of the rotOr portion of the target transfer mechanism; and

FIG. 9 is a circuit diagram showing electrical circuitry which may be used with the apparatus of this invention.

Referring now to FIGS. 1 and 2, the apparatus of this invention includes a tubular conveyor system indicated generally by the numeral 2, through which spherical targets are carried from a source thereof, such as a ramp 4, to be target transfering mechanism, indicated generally by the numeral 6. The conveyor 2 includes a central or trunk portion 8 in the form of a hollow tubular passage. The lower end 10 of the trunk portion 8 opens into a blower or fan 12 which is selectively actuated to blow a jet of air into the trunk 8 to increase the air pressure therein. The conveyor 2 also includes a plurality of branch portions 14 and 16 which are in the form of hollow, tubular passages which extend laterally from the trunk portion 8 and open thereinto. It is noted that the branches 14 and 16 open into the trunk 8 at points longitudinally offset on the trunk 8, and the axis of each branch 14 and 16 is preferably perpendicular to the axis of the trunk 8. Each target transfer mechanism 6 is mounted on a supporting plate 18 which is vertically inclined, as is shown most clearly in FIG. 2. The plates 18 may be carried by a plurality of posts or the like 20. It is also noted that the ramp 4 is also inclined vertically so that targets will roll down toward the conveyor trunk 8, although other means, such as conveyor belts or the like can alSo be used for this latter purpose.

Each target transfer mechanism 6 includes an annular wall part 22 through which the branch portions 14 and 16 of the conveyor 2 extend. A pair of diametrically opposed target launching tubes 24 and 26 open into the wall part 22 at points preferably about 90° offset from the branch portion 14 or 16 of the conveyor. Each of the launcher tubes 24 is connected to a flexible tubular coupling 28 which in turn is connected to a tube 30 depending from a tank 32 containing a supply

of compressed gas, such as compressed air. A valve housing 34 containing a solenoid-actuated valve 39 (shown schematically in FIG. 9) is interposed between each tube 30 and the tank 32, the valves 39 in the housings 34 being normally closed to prevent the compressed gas from flowing through the tubes 30.

It is understood that, while two branch portions 14 and 16 are illustrated with associated transfer mechanisms 6, the apparatus may employ any number of branches, and the top end of the trunk portion 8 is sealed from the atmosphere.

A target-feeding mechanism, indicated generally by the numeral 36 is mounted adjacent to the ramp 4 and is selectively operable to feed individual targets from the ramp 4 into the trunk portion 8 of the conveyor 2. Details of the target-feeding mechanism 36 are most clearly shown in FIGS. 3, 4 and 5. The mechanism 36 is shown in FIG. 3 in its target-pickup position. The mechanism 36 includes a first cylindrical portion 38 which has a diameter of the trunk 8, and which is normally coincidental with the trunk 8 to form a part thereof, as is shown in FIG. 3.

The mechanism 36 further includes a semi-cylindrical portion 40 which is adjacent to, and preferably integral with the cylindrical part 38. The semi-cylindrical part 40 normally traverses the ramp 4 so as to partially surround a forwardmost target T' (shown in phantom in FIG. 3) positioned on the ramp 4. A planar terminal part 42 extends from the semi-cylindrical part 40 and is normally off to one side of the ramp 4, as shown in FIG. 3. An operating rod 44 is connected to the feeding mechanism 36 and passes through a stationary plate 46. A solenoid 48 is connected to the rod 44 and is operative, when actuated by manually closing a switch 49 (see FIG. 9), to pull the rod 44 and feeding mechanism 36 to the right, as shown in FIG. 5 so as to pull the target T' off of the ramp 4 and into the trunk portion 8 of the conveyor 2. When the feeding mechanism 36 is in its target-feeding position, as shown in FIG. 5, the terminal part 42 of the mechanism 36 prevents the next target T'' from rolling down the ramp 4 until the mechanism 36 returns to its original position. A spring 50 surrounds the rod 44 and is sandwiched between the mechanism part 38 and the plate 46, with the spring 50 being compressed when the feeding mechanism 36 is moved to the target-feeding position. Actuation of the solenoid 48 is of momentary duration since the switch 49 is normally open, so that the spring 50 returns the mechanism 36 to its pickup position after the target T' is dropped into the conveyor trunk 8. When the mechanism 36 returns to its pickup position, the next target T'' moves into the confines of the semi-cylindrical part 40 of the mechanism 36.

Referring now to FIGS. 6, 7 and 8, the details of the transfer mechanism 6 are shown. As previously noted, the transfer mechanism includes an annular or cylindrical wall part 22 upon which is mounted an elongated plate 52 having an upwardly extending end wall 54. A cylinder 56 is pivotally mounted on the plate 52 by means of a pin 58 extending into the end wall 54. A piston 60 is reciprocally mounted in the cylinder 56, the piston 60 having a head portion (not shown) contained within the cylinder 56, and a stem portion 62 extending from the cylinder 56. A rotor assembly 64 is mounted within the confines of the wall part 22, the rotor assembly 64 including a rotor block 66 and a rotor tube 68 which extends through the rotor block 66. The rotor tube 68 has a bore which is substantially the same size as the conveyor tube bores. The rotor assembly 64 is pivotally mounted on a pin 70 which extends through the plate 52. The forward end of the piston rod 62 is pivotally connected to a pin 72 secured to the rotor block 66 so that reciprocal movement of the piston 60 results in rotary movement of the rotor assembly 64. The rotor assembly 64 is normally positioned in a target-launching position which is shown in FIG. 6. In the target launching position the rotor tube 68 is coaxial with the launcher tubes 24 and 26, and a nose piece 74 mounted on the rotor block 66 closes off the open end of the branch portion 14 (or 16) of the conveyor 2. A first hole 76 extends through the plate 52 and a second hole 78 extends through the rotor block 66 and rotor tube 68 and into the bore of the latter. When the rotor assembly 64 is in its normal position shown in FIG. 6, the holes 76 and 78 are angularly offset from each other. An electrically actuated reversable hydraulic or pneumatic fluid pump 80 is mounted on the plate 52, the pump 80 being connected to a first tube 82 communicating with one end of the cylinder 56, and to a second tube 84 communicating with the other end of the cylinder 56.

In order to pivot the transfer mechanism 64 about the pin 70 and into a target-receiving position shown in FIG. 7, an appropriate switch 81 is closed (see FIG. 9) whereby the pump 80 is caused to pump fluid through the tube 84 causing the piston 60 to retract into the cylinder 56. In the target-receiving position, the holes 76 and 78 are aligned, and the tube 68 is coaxial with the branch tube 14.

The apparatus of this invention operates in the following manner to launch a target into the air. The solenoid 48 is actuated to cause the target feeder 36 to pull a target T' from the ramp 4 into the trunk portion 8 of the conveyor system 2. The target T' drops onto a sensor in the form of an electrical blade switch 90, closing the latter. Closing of the switch 90 causes the blower 12 to blow a stream of air into the conveyor 2. The electrical switch 81 is then manually actuated to cause a preselected one of the pumps 80 to pump fluid through the tube 84 to cause the associated transfer mechanism 64 to pivot to its target-receiving position, wherein the holes 76 and 78 are aligned. Alignment of the holes 76 and 78 provides an outlet to the atmosphere for the air being blown into the conveyor 2 by the blower 12 thus creating a pressure differential within the conveyor 2, and a flow of air from the blower 12 (high pressure) to the aligned holes 76 and 78 (low pressure). The Target T' is thus carried by the air flow through the trunk portion 8 of the conveyor 2 and into the appropriate branch portion 14 toward the aligned holes 76 and 78. As the target T' passes through the branch tube 14 and approaches the target transfer tube 68, the target T' actuates an electrical sensor in the form of a blade switch 92 which closes and sends a delayed electrical impulse to the pump 80. The target T' then passes into the transfer tube 68 and moves therethrough to strike a resilient pad 94 of foam rubber, or the like, positioned in a cup-shaped housing 96 mounted on the annular wall 22. The delayed signal from the sensor 92 then causes the pump 80 to pump fluid through the tube 82

to cause the piston **60** to pivot the transfer mechanism **64** back to its target-launching position. In this manner the target T' is brought into alignment with the launch tube **24** and moves under the force of gravity into the latter and against an electrical sensor in the form of a blade switch **98** to close the latter. Closing of the blade switch **98** permits an electrical impulse to be sent to an appropriate one of the solenoid-actuated valves contained in the appropriate one of the valve housings **34** to open the valve **39** when a launch switch **41** (which is normally open) is closed (see FIG. **9**). Opening of the valve **39** in the housing **34** causes a jet of compressed gas to flow from the tank **32** through the conduits **30**, **28**, **24** and against the target T'. The target T' is thus blown from the tube **24** and through the tubes **68** and **26** and into the air in view of a shooter who fires on the target. The velocity at which the target is launched can be varied by actuating a solenoid operated bleed valve **35** on the tank **32** to lower the pressure inside of the tank **32** before the valve **39** in the housing **34** is actuated. The bleed valve **35** can be opened by manually closing a switch **43** (see FIG. **9**).

It will be readily appreciated that the apParatus disclosed herein will handle relatively frangible targets and will provide for the transmission of a target to be fired upon from a central supply of targets to a selected one of any number of launch sites. Preselection of a desired launcher is made possible and the target can be transported only to the preselected launcher. Operation of the apparatus is semi-automatic after a launcher is selected and a target is deposited in the conveyor. The apparatus is of comparatively simple construction with few moving parts, and is readily adaptable to use indoors as well as outdoors.

Since many changes and variations of the disclosed embodiment of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. Apparatus for launching spherical objects into the air, said apparatus comprising:

a. tubular conveyor means for transporting a spherical object, said conveyor means having a plurality of terminal points;

b. means communicating with said conveyor means for creating a positive fluid pressure condition within said conveyor means;

c. a plurality of tubular launching means, there being one of said launching means adjacent each terminal point of said conveyor means;

d. lateral venting means associated with each of said launching means for venting the interior thereof to the atmosphere;

e. means connected to each of said launching means for selectively opening at least a portion of the interior thereof to the respective terminal points of said conveyor means to permit a spherical object to pass from said conveyor means into said launching means; and

f. means for opening said venting means on a preselected launching means to the atmosphere, said venting means being open to the atmosphere at that time only when the interior of said preselected launching means is opened to the respective terminal of said conveyor means to establish a fluid flow path through said conveyor means to said preselected launching means to transport a spherical object by fluid flow through said conveyor means to said preselected launching means.

2. The apparatus of claim **1**, further comprising feeding means for feeding a spherical object into a first part of the interior of said conveyor means.

3. The apparatus of Claim **1**, wherein said positive fluid pressure creating means is a blower, and further including a blower-actuating means for actuating said blower only when a spherical object is positioned within said conveyor means in contact with said blower-actuating means.

4. The apparatus of claim **1**, wherein said conveyor means includes a tubular trunk portion opening into tubular branch portions extending to each of said terminal points, said branch portions intersecting said trunk portion at points longitudinally offset along the axis of said trunk portion.

5. The apparatus of claim **4**, wherein the axis of each of said branch portions is substantially perpendicular to the axis of said trunk portion at the point of intersection.

* * * * *