United States Patent

Moulton

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[45] **Dec. 5, 1972**

[54] **SELF PROPELLED IRRIGATION SYSTEM**

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[73] Assignee: **Moulton Irrigation Company,** Somerset, Wis.

[22] Filed: **Sept. 8, 1971**

[21] Appl. No.: **178,633**

[52] **U.S. Cl.** **239/177,** 239/212

[51] **Int. Cl.** **B05b 3/00**

[58] **Field of Search** 239/177, 212, 213; 137/344

[56] **References Cited**

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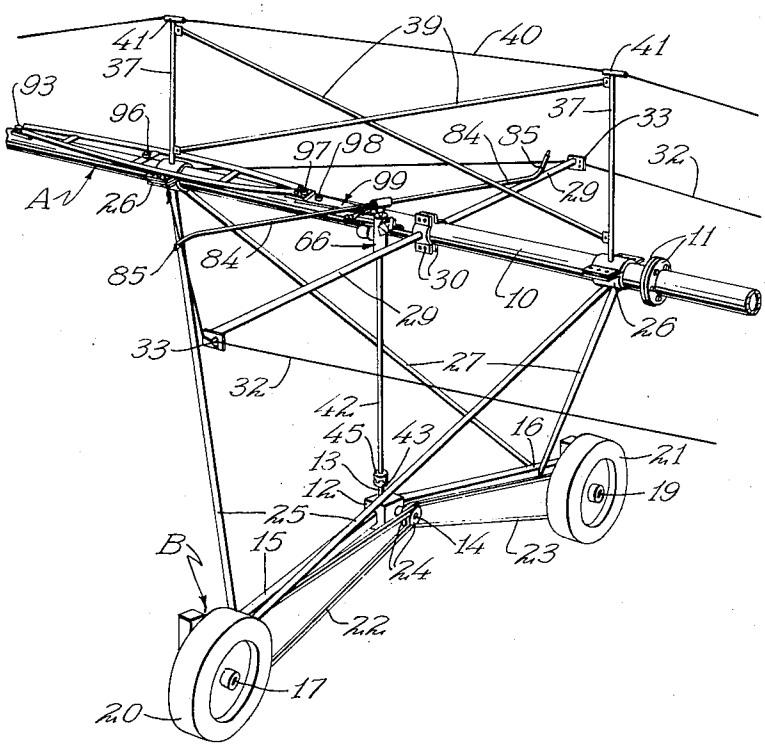
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[57] **ABSTRACT**

An irrigation system includes an elongated water distribution pipe supported by wheeled supports and rotatable about a water supply source. The wheeled supports are driven by power derived from the rotation of the sprinkler heads. Means is provided for increasing or decreasing the speed of each sprinkler head to keep the pipe straight. Means is also provided for instantly disconnecting each carriage from the sprinkler head when desired.

11 Claims, 10 Drawing Figures



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SHEET 1 OF 3

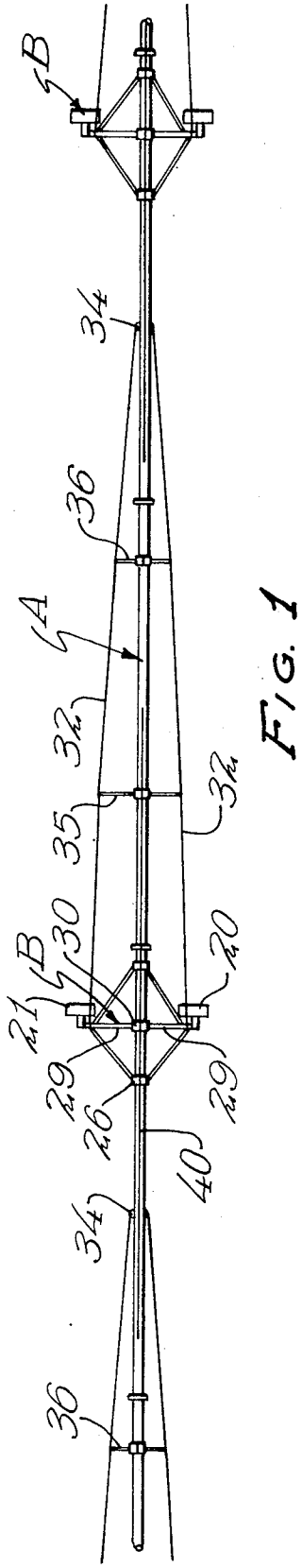


FIG. 1

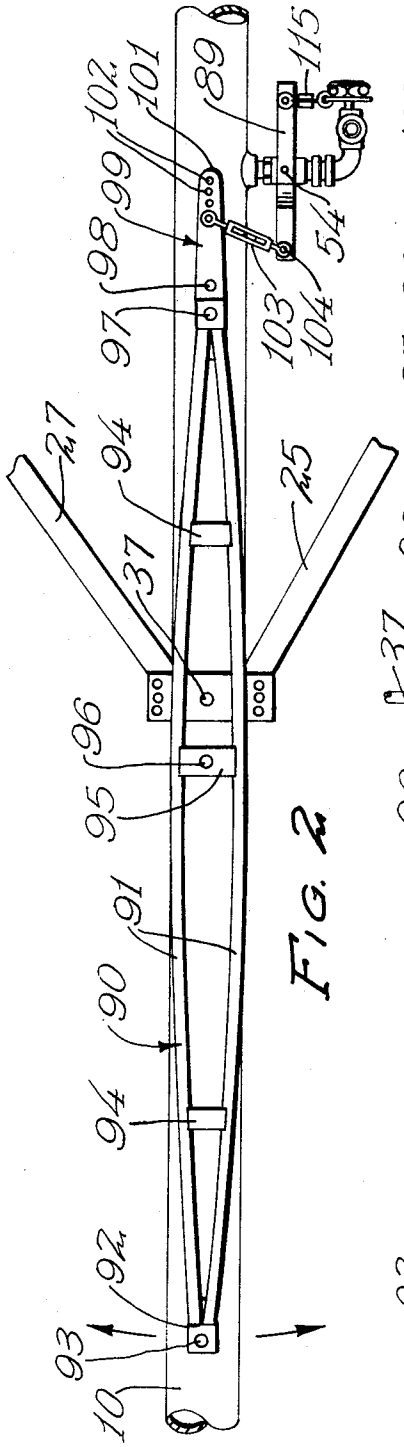


FIG. 2

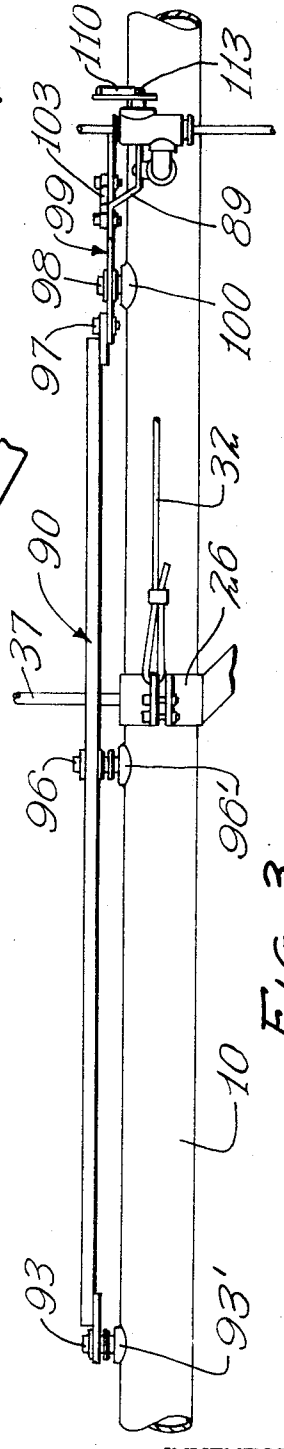


FIG. 3

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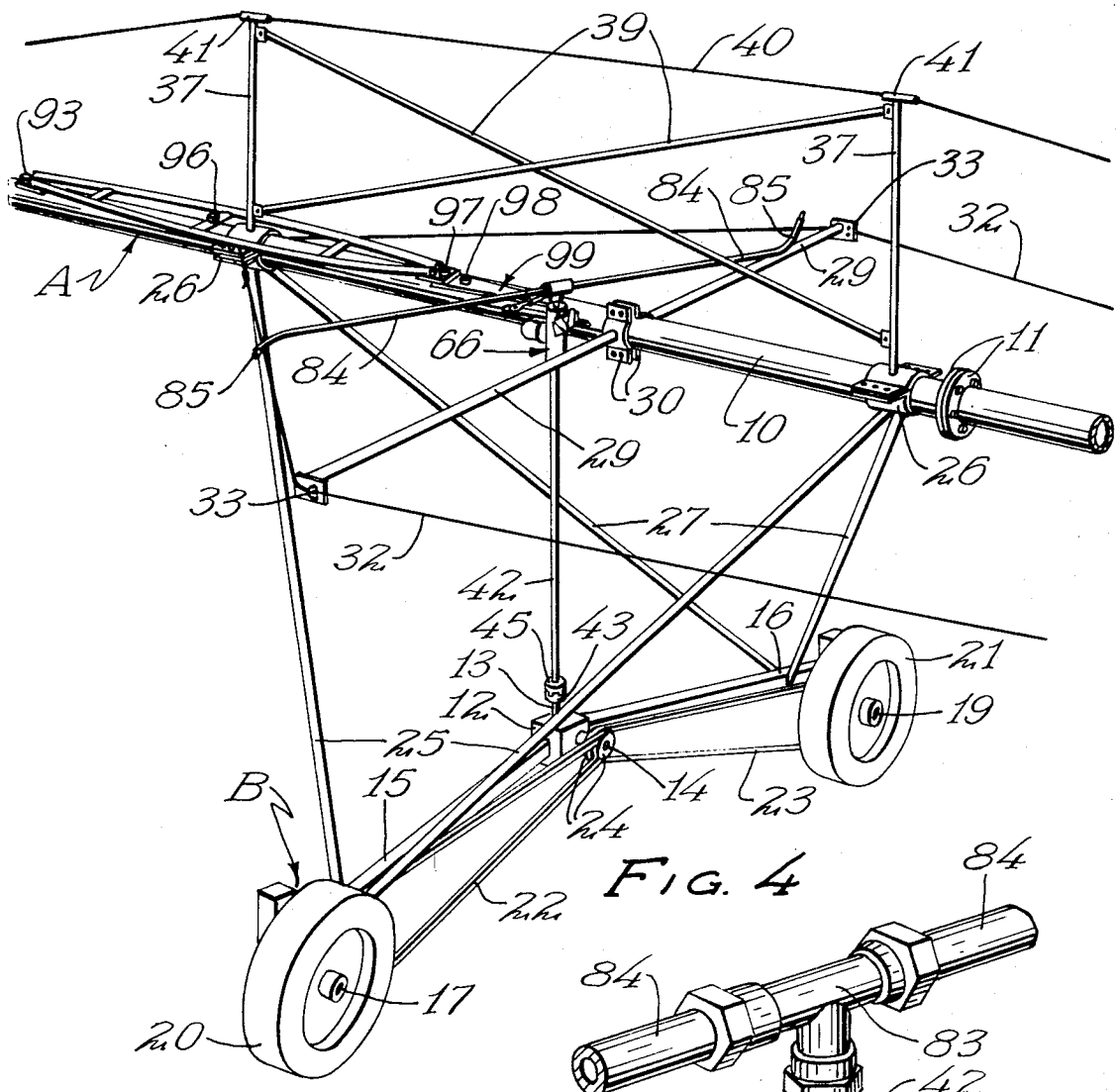


FIG. 4

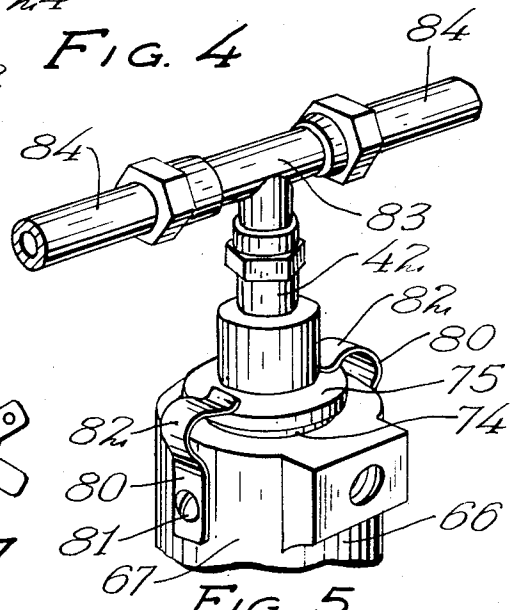


FIG. 5

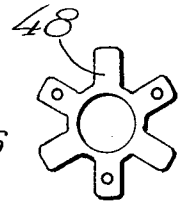


FIG. 7

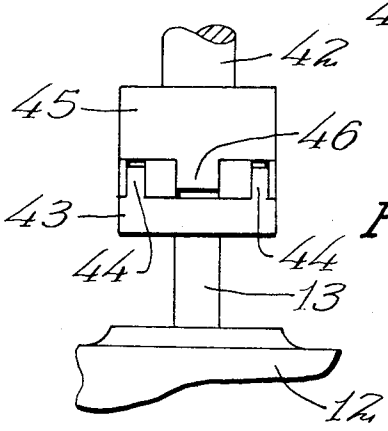


FIG. 6

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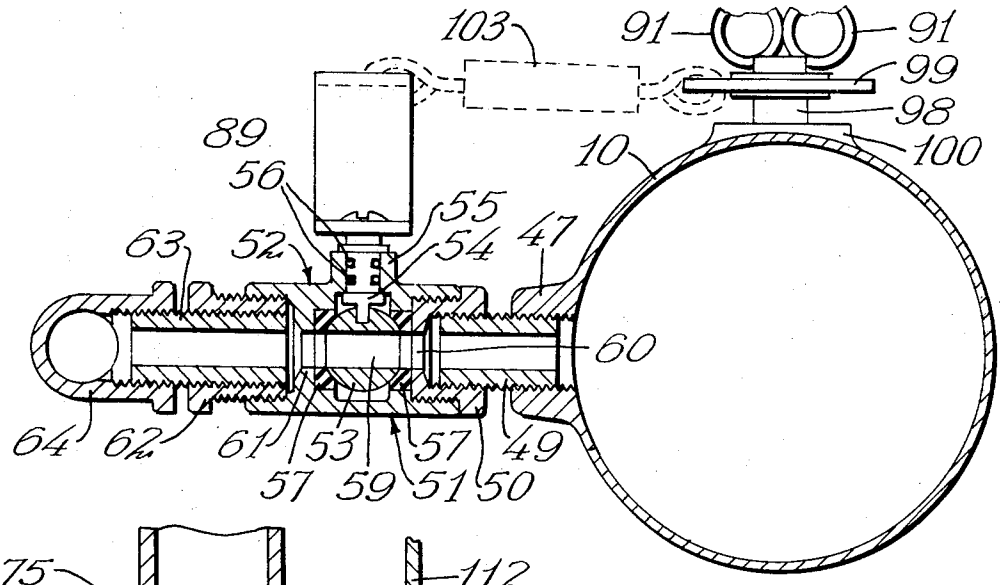


FIG. 8

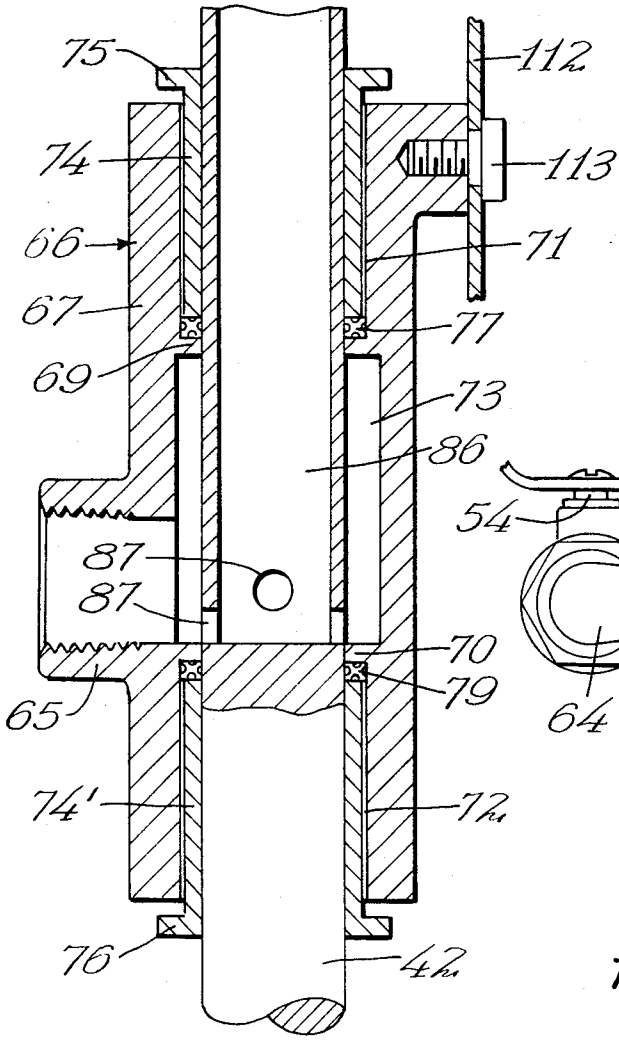


FIG. 9

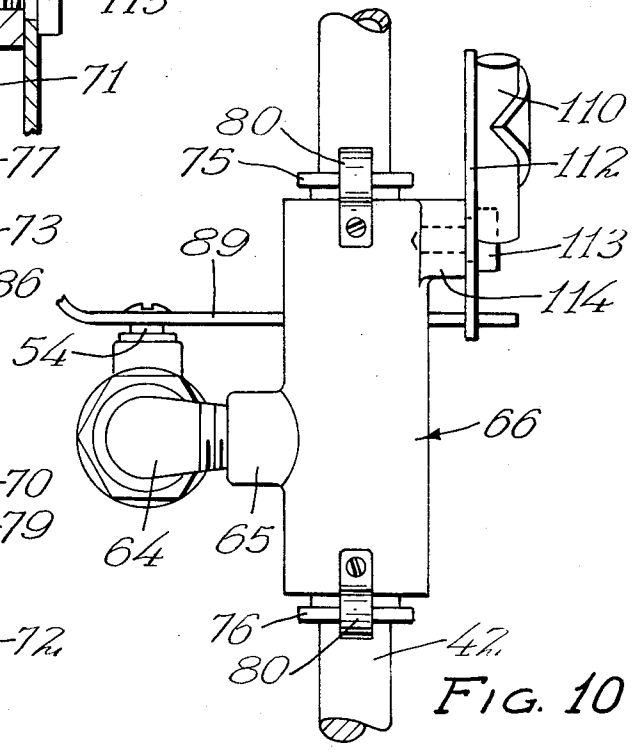


FIG. 10

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SELF PROPELLED IRRIGATION SYSTEM

This invention relates to an improvement in self propelled irrigating systems, and deals particularly with a structure having a central water supply source and a distributor pipe which is movable in a circular direction about the water supply source.

BACKGROUND OF THE INVENTION

There are a number of patents which have been issued on devices which include a central supply pipe about which an elongated water distributing pipe may rotate. The water distributing pipe is supported on suitable wheeled support for rotation about its central axis. One of the problems involved with devices of this type lie in the fact that they are of considerable length, and difficulty is experienced in keeping the distribution pipe straight. In the first place, the wheeled supports which are near the center of rotation must rotate at a relatively low speed, while the supports for the pipe which are near the end thereof must travel at a considerably higher speed. Furthermore, the travel of the supporting wheels over the ground varies to some extent with the contour of the surface. In other words, if the center portion of the distribution pipe must travel over a hill or a depression, the movement of the supporting wheels is out of normal ratio with the rate of motion of other wheels.

U.S. Pat. No. 2,604,359 shows a self propelled sprinkling irrigating apparatus of the general type in question. The patent contemplated the difficulty experienced in maintaining the distribution pipe straight over uneven terrain, and attempted to provide means for regulating the speed of each supporting wheel carriage in an attempt to maintain the distribution pipe straight. This device comprised a rather complicated system of drive mechanism including a cylinder and piston arrangement which functioned to drive a ratchet wheel. The springing of the pipe was designed to control the speed of operation of the cylinder, and therefore to maintain the distribution pipe in a relatively straight condition.

U.S. Pat. No. 3,314,608 to Curtis et al. and issued Apr. 18, 1967 for a Suspension System Actuated Self Propelled Fluid Discharge Device shows a series of wheeled support for the water distribution pipe in which the supports were driven by rotating sprinkler arms pivotally supported on vertical axes. The rotation of the sprinkler arms acted through a gear reduction member to drive the drive wheels of each carriage at a relatively low speed. Here again, a relatively complicated truss or suspension arrangement was provided for regulating the speed of rotation of the sprinkler arms in order to speed up or slow down the movement of the wheeled carriage. This included a supporting frame on the wheeled carriage which extended well above the distribution pipe and from which the distribution pipe was partially suspended. When the distribution pipe moved relative to the supporting frame, means were provided for controlling the flow of water to the sprinkler arms to change the speed of operation.

SUMMARY OF THE INVENTION

The present invention, in general, is designed to accomplish much the same results as were accomplished in the previous devices. However, the applicant's

device is believed considerably less complicated than those previously employed. An elongated arm is pivotally supported on the water distribution pipe in an area adjoining each wheeled support. The arm, being connected to the pipe at two longitudinally spaced points stays in substantial alignment with the portion of the pipe to which it is secured and projects well beyond these two points. As a result, the projecting portion of the distribution pipe which adjoins the portion to which the arm is attached moves relative to the axis of the pipe when the pipe bends. Means are controlled by the arm for opening or closing a valve controlling the flow of fluid to the sprinkler pipes. When the distribution pipe flexes in one direction, the valve may be opened to a greater extent to direct more water to the sprinkler arms, thus speeding up the rotation thereof, and driving the supporting wheeled carriage at a greater speed. On the other hand, if the pipe bends in the opposite direction relative to the control end of the arm, the valve controlling the flow of fluid to the sprinkler arms is partially closed, slowing the speed of rotation of the sprinkler arms and accordingly slowing the speed of the supporting wheeled carriage. It is understood that the sprinkler arms are mounted upon a rotatable shaft connected to a gear box for driving the wheeled support.

A feature of the present invention resides in the provision of a water distribution pipe of the type described having the elongated arm secured thereto and having an end projecting beyond the points of attachment with the pipe. A lever arm is pivotally supported to the pipe, and pivotally connected to the projecting end of the arm. The lever arm is connected to a valve operating arm which rotates the stem of the valve. Pivotal movement of the lever arm thus actuates the valve operating arm, and opens the same depending upon the direction in which the pipe flexes or bends.

A further feature of the present invention resides in the fact that the lever arm is connected to the pipe by a pivot which is relatively close to the point of attachment between the lever arm and the fixed arm connected to the pipe. The valve operating lever is attached to the lever arm at a point much farther from the point of pivot of the lever arm. As a result, a small movement of the end of the lever to which the fixed arm is attached is greatly multiplied at the other end of the other arm, so that a small deflection of the pipe will cause a noticable pivotal movement of the valve shaft.

A feature of the present invention resides in the provision of a structure described in which the assembly of the pipe is materially simplified. The trussing arrangement which has been used between the wheeled supports is relatively complicated while the trusses which assist in supporting the pipe links of the present construction are much more simply applied. The arrangement is such that a short length of the pipe may bend more readily than the remainder thereof, and the control is mounted on this bendable area.

A further feature of the present invention resides in the provision of a novel and effective means for driving the gear box which moves the wheeled carriages along the ground. The water distribution pipe is connected to the interior of a bearing supporting a partially hollow shaft through which water is transmitted to the sprinkler arms. The gear box which drives the wheels of the wheeled supports or carriages is provided with an

and exhibits the requisite kinetics of water vapor adsorption.

7. An enclosure for providing a moisture-free environment comprising a container for said environment, having at least some portion of its inner surface coated with a film of the desiccant composition of claim 1.

8. A hemetically sealable container for providing a moisture free environment for enclosing moisture sensitive equipment having at least some portion of its inner surface coated with a film of the dehumidifying composition of claim 1.

* * * * *

the interior of which communicates with the interior of the pipe. A nipple 49 is threaded into the boss 47. A bushing 50 is threaded on the other end of the nipple 49 and is threaded into the body of a valve, the body being indicated in general by the numeral 51. The valve itself is indicated in general by the numeral 52. The valve 52 includes a valve ball 53 rotated by a stem 54 extending through a boss 55 in the valve body 51. The stem 54 projects through the boss through suitable sealing means 56. Seals 57 are provided on opposite sides of the valve ball 53, and a passage 59 through the valve ball may be rotated into or out of axial alignment with the apertures through the seals 57 and the ends 60 of the bushing 50 and an inwardly extending flange 61 in the valve body 51.

A bushing 62 is threaded into the outlet end of the valve body 51 opposite that into which the bushing 50 is threaded, and the bushing 62 is connected by a nipple 63 to an elbow 64. As indicated in FIGS. 9 and 10 of the drawings, the elbow 64 is threaded into a boss 65 extending into a bearing member 66 which is indicated in detail in FIG. 9 of the drawings.

The bearing member 66 includes an elongated sleevelike body 67 having a pair of inwardly extending flanges 69 and 70 which are in spaced relation. The flanges 69 and 70 divide the body 67 into an upper chamber 71, a lower chamber 72, and an intermediate chamber 73. The upper and lower chambers 71 and 72 are designed to accommodate cylindrical bearing sleeves 74 and 74' having flanged outer ends 75 and 76. The bearing sleeves 74 and 74' fit into the ends of the body 67 freely enough so that they can be readily removed. Sealing rings 77 and 79 are interposed between the ends of the bearings 74 and 74' and the adjoining flanges 69 and 70 and seal against the outer surface of the shaft 42 which is rotatably supported therein. The shaft 42 will not become misaligned with respect to the bearings 74 and 74' due to the fact that the bearings are loosely fitted and are supported freely enough so that they can at all times be properly aligned.

The bronze bearings, which are of the oil impregnated or self-lubricating type are held in place by suitable menas such as spring clips 80 (See FIG. 5) which are attached to the body 67 by screws 81 or other suitable means. The springs 80 have hook-shaped ends 82 which engage the flange such as 75 of the adjoining bearing such as 74 to hold the bearings in place. The purpose of this arrangement is to permit the quick assembly and diasssembly of the bearings without the use of elaborate tools. It will be understood that water being pumped for irrigation purposes usually contains sand which has an abrasive effect upon the supporting bearings. The bearing sleeves are replaceable in an extremely short period of time by removing the sprinkler head and sliding the bearing sleeves 74 and 74– from the bearing 66 and replacing these sleeves.

As indicated in FIG. 5 of the drawings, a T connection 83 is attached to the upper end of the sprinkler head shaft 52 and sprinkler arms 84 are threaded into opposite ends of the T 83. The curved ends 85 of the sprinkler arms 84 are arranged to direct water in a manner well known in the art to cause rotation of the shaft 42.

As indicated in FIG. 9 of the drawings, while the lower portion of the shaft 42 may be solid, the upper portion is provided with a hollow passage 86 extending therethrough. The portion of the shaft which is within the intermediate portion 73 of the bearing body 67 is provided with angularly spaced openings 87, some of which may be arranged above the level of others. It will be noted that the boss 65 leads to the intermediate section 73 of the valve body so that water may flow from the pipe 10 through the valve 52 and elbow 64 into the center portion 73 of the bearing. From here the water may flow through the apertures 87 and upwardly through the hollow portion of the shaft 42 to the T connection 83 leading to the sprinkler arms 84. The flow of fluid is regulated by the position of the valve ball 53 in the valve 52.

It will be noted that rotation of the sprinkler arm 84 will cause a corresponding rotation of the shaft 42. This movement is transmitted through the couplings 43, 45 to the input shaft 13 of the gear box 12. This causes rotation of the pulleys 24 and the wheels 20 and 21. The wheels normally travel at a very low speed of rotation in order to thoroughly irrigate the entire area over which the pipe A is propelled. As shown in FIG. 2, a valve arm 89 is secured for rotation with the valve stem and acts to more or less open the valve 52. Means is provided for operating this arm 89 depending upon the deflection of the pipe length 10. It will be understood that the pipe lengths are long and necessarily flexible to some extent. However, there is a maximum degree to which the pipes may flex without causing damage.

As the irrigating apparatus necessarily travels over uneven ground, it is inevitable that one of the wheel carriages will move ahead of the other and the pipe will flex out of alignment. In order to compensate for this flexing, the clamps 34 which connect the cables 32 to the pipe A terminate in spaced relation to the next adjoining wheeled support. As a result, the portion of the pipe between the clamp 34 and the next wheeled supporting carriage is much freer to flex than the remainder of the lengths of pipe, due to the fact that this area is unstayed. A rigid arm 90 (FIGS. 2 and 3) which comprise two outwardly bowed arm members 91 are joined together at one end 92 and are secured by a pivot bolt such as 93 to a boss 93'74' on the pipe length 10. The arm sides 91 are connected intermediate their ends by braces 94 and by an intermediate brace 95. The brace 95 is pivotally connected at 96 to a boss 96' on the pipe length 10. Thus the deflection of the pivot 93 due to the bending of the pipe length 10 causes the arm 90 to pivot about the intermediate pivot 96.

The arm sides 91 are connected at the opposite end of the arm and are pivotally connected at 97 to a lever arm 99 which is pivotally connected to a boss 100 on the pipe length 10 at the pivot 98. The distance between the pivots 97 and 98 is quite short. The other end of the arm which is indicated by 101 includes a series of adjustment holes 102 to which an adjustable connector 103 may be attached at a point relatively far from the pivot 98. The connector 103 is thus connected pivotally to the arm 99 and is connected at 104 to the valve operating arm 89.

With this arrangement, it will be seen that a relatively small deflection of the arm 90 relative to the length of the pipe 10 will move the arm end 101 to a much greater extent. As a result, deflection in the pipe 10 causes the lever arm 99 to pivot upon its axis 98 and to

The dehumidifier film or coat is strongly bonded to the material of a container being dehydrated, so that no additional means or operations are required for securing said dehumidifier composition in said container.

The method of obtaining the present dehumidifying composition in the form of a film or coat comprises applying onto the inner surface of containers a suspension containing 100 parts by weight of zeolite having a humidity of 20–23 wt. percent, 45–280 parts by weight of a thermosetting resin, 120 parts by weight of an organic solvent intended for dissolving said resin, 0–45 parts by weight of a suitable plasticizer, and 0–85 parts by weight of a curing agent.

The suspension applied onto the inner surface of a container is maintained in the air at a temperature of from 5° to 80° C in order to remove the bulk of volatile components, followed by subjecting said suspension to heat treatment in vacuo at a residual pressure of not greater than 10^{-1} mm Hg and at a temperature of from 150° to 180° C. Said heat treatment removes the last traces of volatile components, brings about binder polymerization and results in the formation of film or coat (layer) depending upon the amount of the suspension used, said film (coat) being characterized by a highly extended porous structure which is adhesively bonded to the coated surface and provides for the requisite kinetics of water vapor adsorption. The porous structure of a dehumidifying composition film is defined by the volume of primary pores in zeolite crystals and by the volume of secondary pores. The volume of secondary pores depends primarily on the dispersity of zeolite crystals and binder (resin) particles, as well as on the nature of the binder used, and the type and density of zeolite crystal and binder particle packing.

The volume of secondary pores in the range of equivalent radii of from 291,000 to 31 A equals 0.044 cm^3/cm^3, a significant portion of said volume (0.020 cm^3/cm^3) being due to the pores in the equivalent radius range of from 98 to 31 Å.

An essential feature of the present dehumidifying composition is that it provides the possibility of controlling the kinetics of adsorption by varying the proportion of components of stock suspensions, so that the present dehumidifying composition can be used in devices and instruments of various types and sizes, the desired kinetics of moisture adsorption inside a given device (instrument being attained by selecting an appropriate ratio of suspension components. As compared to the known dehumidifying agents in the form of tablets or thickened silicone oil-based mixtures, the present dehumidifying composition in the form of a film or coat occupies a very small volume inside casings and has an insignificant weight. Said beneficial characteristics of the present dehumidifying composition make it eminently suited for use in conjunction with microminiaturized electronic instruments. The dehumidifying composition contained in an instrument casing (bulb) can be repeatedly regenerated, thereby making it practicable to have a requisite stock of dehumidifier-coated casings, a further advantage of the present dehumidifier being the absence of oil on the surfaces to be welded and, hence, the ease of sealing hermetically the devices or instruments.

The present dehumidifying composition is employed without resorting to mechanical means for securing said composition in instrument (device) casings or to special-type equipment for introducing said composition into instrument (device) casings and is suitable for being introduced into casings (bulbs) of any shape or size at one and the same production section, the latter feature being highly advantageous for the simultaneous production of diverse types of semiconductor instruments. It is expedient to use the present dehumidifying composition irrespective of the scale or automation degree of production processes or when the manufacture of instrument casings and the assembly of finished semiconductor devices are carried out at different plants.

It follows from the foregoing that the present dehumidifying composition used in the form of a film or coat is commercially superior to the known dehumidifiers.

The following examples are illustrative of the manner of carrying out the invention but are not intended to limit the scope thereof.

EXAMPLE 1.

One hundred parts by weight of Type Na zeolite A (moisture content, 25 percent by weight; particle diameter, 4 mc maximum) is mixed with 100 parts by weight of epoxide resin (molecular weight, 370–450; epoxy group content, 18 percent) dissolved in 127 parts by weight of an organic solvent having the following composition, percent by weight: butyl acetate, 10; cellosolve ($C_2H_5—OCH_2CH_2OH$), 8; acetone, 7; butanol, 15; ethanol, 10, and toluene, 50. Dubutyl phthalate (plasticizer) is added to the stirred mixture in an amount of 5 parts by weight, followed by introducing 10 parts by weight of polyethylene polyamine (curing agent). The resulting mixture is thoroughly mixed to obtain a homogeneous suspension. The dehumidifying composition thus prepared is ready for use.

Use is made of a buret, an atomizer or a syringe to apply the composition on the inner surface of instrument metal casings (bulbs) having a volume of 0.25 cm^3. From 10 to 12 mg of said composition is introduced in each bulb, followed by maintaining the bulbs with said composition applied thereonto for a period of 10–20 hours in the air at ambient temperature in order to remove the bulk of volatile components. Next the bulbs are placed in a vacuum drying cabinet, subjected to gradual heating to a temperature of 180° C at a residual pressure of 0.1 mm Hg, and maintained at this temperature for a period of 3 hours. It is pertinent to gradually heat the composition in order to provide in the resultant film an access of zeolite micropores to the ambient atmosphere and to attain good adhesion of the film to the bulb surface. The resultant film displays heat stability up to a temperature of 200°C in the air. The thus-treated bulbs are ready for use as sealing components of instruments or circuits.

Mechanical tests of the film under the conditions prescribed for testing transistors enclosed in bulbs are indicative of the absence of crumbling, dusting or cracking phenomena.

The film obtained by the procedure described herein before is capable of maintaining in the hermetically sealed volume of the bulb a low relative humidity in the temperature range of from −60° to +150°C.

truss means on opposite sides of said pipe and extending from a point adjacent to one of said wheeled supports to a point spaced from the next wheeled support, providing a relatively short untrussed portion adjacent each wheeled support,

a connection between each sprinkler head and said pipe including a valve,

means actuated by the flexing of said untrussed area adjoining each wheeled support for controlling said valve.

11. A sprinkler and irrigation system including a distributing pipe pivotally connected to a central water supply source for movement circularly about said source, and wheeled supports disposed at intervals along said pipe, and sprinkler heads rotatably supported on vertical axes adjoining each of said wheeled supports, the system including:

an elongated arm pivotally connected to said pipe adjoining each wheeled support, said arm being connected to said pipe at two spaced points on parallel pivots,

a lever pivoted to said pipe intermediate its ends adjoining an end of each of said arms,

means pivotally connecting each said lever to one end of its adjacent arm in spaced relation to said two spaced points,

a passage from said pipe to each said sprinkler head, including a valve rotatable about an axis parallel to the axes of said pivot connections,

means connecting the other end of each said lever to an adjoining valve for pivoting the same.

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