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(54) **AGRICULTURAL WATER RETENTION AND REPLENISHMENT SYSTEM**

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(57) **ABSTRACT**

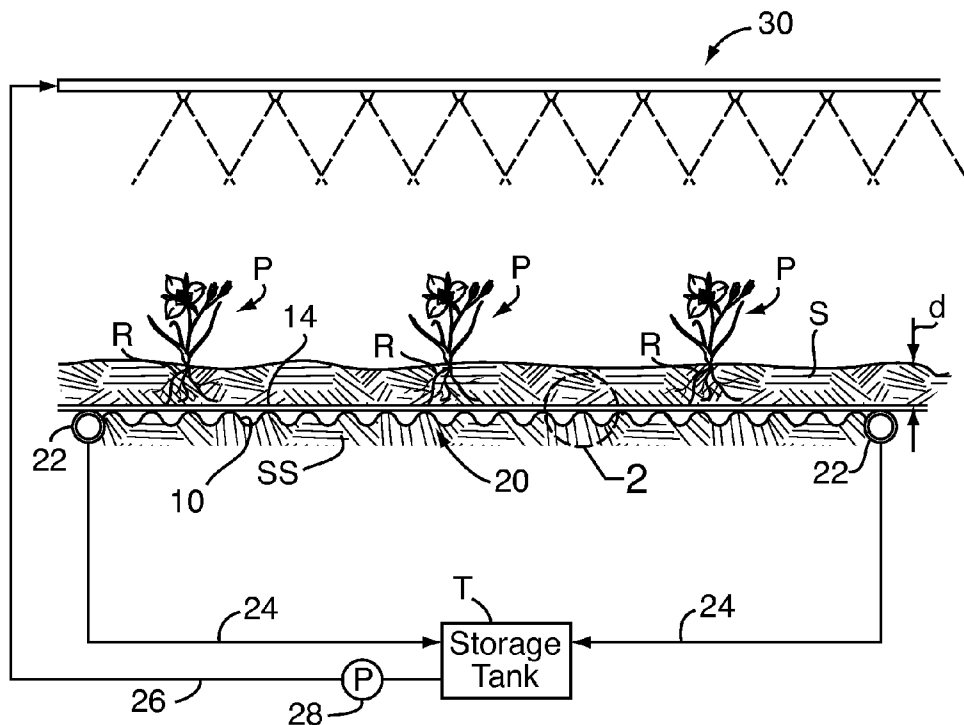
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A water retention structure is provided below the surface of the soil in which plants are to be grown. The soil is excavated to a depth d below the plant's root structure and one, or more, water impervious polymeric sheet 10 is placed in the excavation. Each sheet has raised lands for supporting a non-woven filter cloth 10. Between the polymeric sheet and the cloth filter and among the raised lands, valleys or depressions are defined. Excess water is collected in these valleys for aspiration by the plant roots, and any additional water is fed to a storage reservoir, where the water can be pumped out for use elsewhere, and/or for use in irrigating the same soil during periods of reduced rainfall.



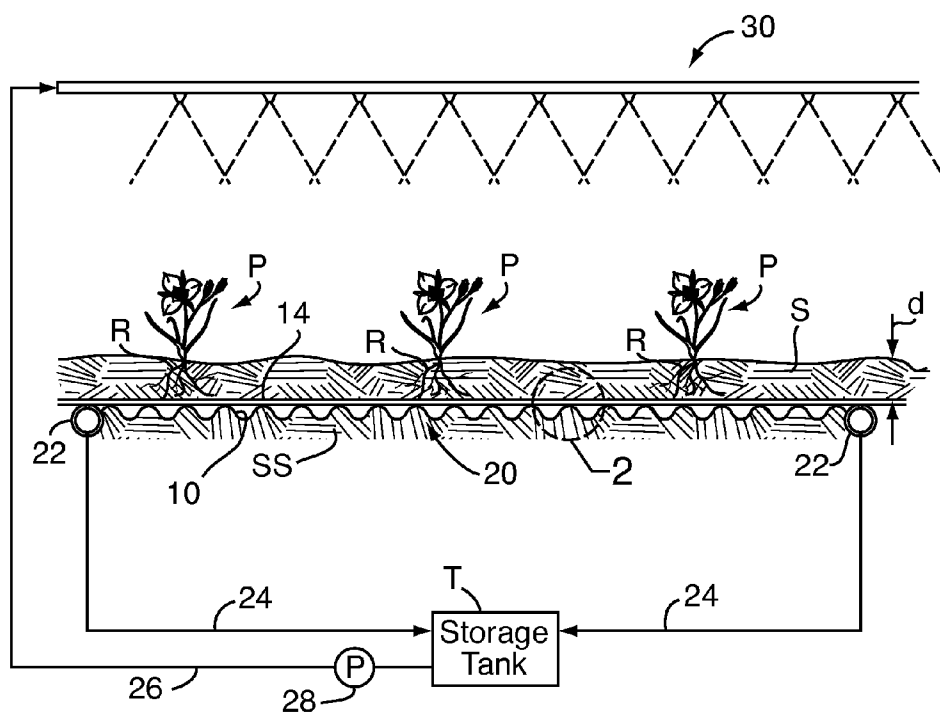


FIG. 1

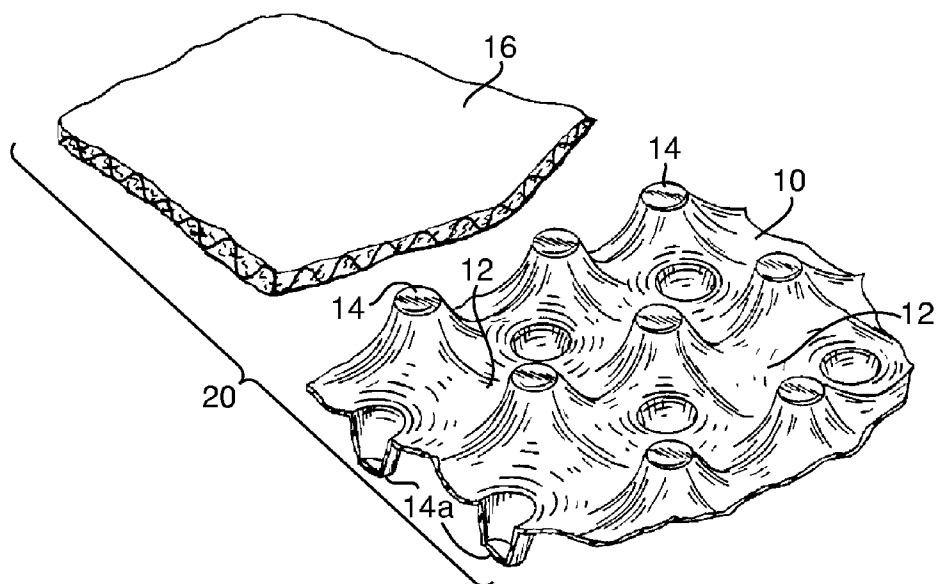


FIG. 2

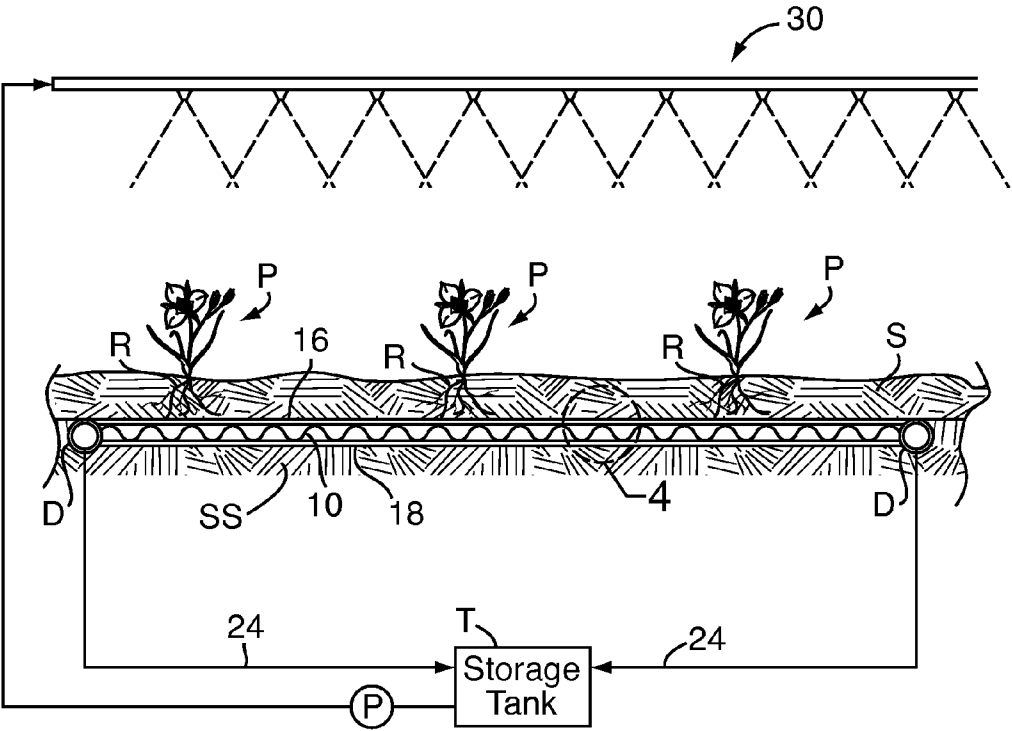


FIG. 3

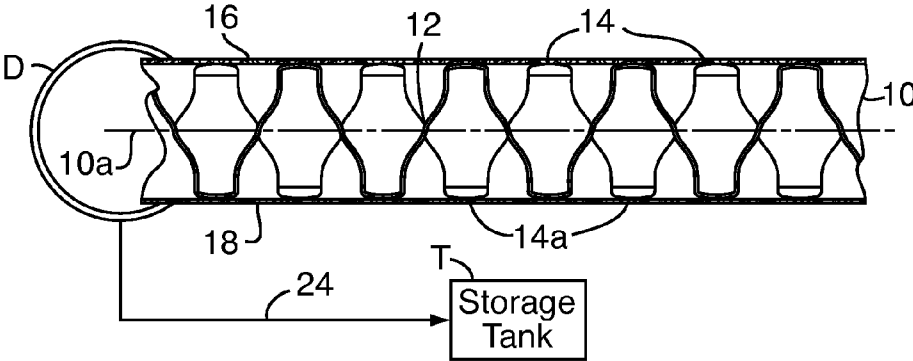


FIG. 4

**AGRICULTURAL WATER RETENTION AND REPLENISHMENT SYSTEM**

**BACKGROUND OF INVENTION**

[0001] This invention relates generally to agricultural irrigation water retention systems, and deals more particularly with efficiently utilizing irrigation water, and rain water, on agricultural land by minimizing run off of the water, as now happens during periods of excessive rainfall.

[0002] Among the advantages of the present invention are avoiding loss of water by underground runoff, and lowering the quantities of water required, to grow crops generally. A further advantage lies in preventing the environmentally insensitive result of failing to prevent the excessive run off of rain water and associated fertilizers and pesticides of the type commonly used on agricultural land generally.

**SUMMARY OF THE INVENTION**

[0003] The present invention accomplishes the retention and collection of water for agricultural purposes, and deals more particularly with a system for subsoil recovery of water, whether rain water or irrigation water, so that the excess water can be stored and reused.

[0004] In accordance with the present invention a plurality of generally horizontally extending water impervious sheets of polymeric material are buried below the surface of the soil at a depth that is sufficient for growing crops above said polymeric sheets without undue interference with the root structure of the plants to be grown in the soil above the polymeric sheet.

[0005] A plurality of polymeric water impervious sheets are provided, each preferably having raised lands, and depressions or valleys surrounding these raised lands. These sheets may be overlapped to provide a continuous water impervious barrier below the soil, taking advantage of any slope in the agricultural land itself, or following an artificial slope created during the excavation required to construct a preferred embodiment of the invention.

[0006] At least one water pervious plastic cloth, preferably non-woven, is provided immediately over the polymeric sheet, and is supported on the raised lands, so as to define, between the plastic cloth and the polymeric sheet, valleys for collecting excess water from the soil above the plastic cloth, or filter.

[0007] A second version of the invention provides the water pervious plastic cloth, preferably non-woven, not only above the impervious polymeric sheet, but providing a second such sheet below the water impervious sheet. When placed in the excavation as described previously, this blanketed water impervious sheet serves two purposes, the first being identical to that described in the preceding paragraph, the second result being that excess water provided in the ground below the resulting structure will tend to aspirate upwardly in the subsoil. The extent the pressure generated in the underground water will result in any excess water being carried away from both top and bottom of the water impervious sheet by conduits and pipes to a storage facility for reuse.

[0008] Conduits are provided, at least partially around the periphery of these plastic filters and polymeric sheets for carrying away excess water collected in the valleys of the polymeric sheets. From the reservoir, or water storage facility the water is pumped back to a water irrigation system for use on the agricultural land, to be revisited on the same plants, or

to other fields for irrigation purposes, or to other uses of water such as are common to agricultural farms generally.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0009] FIG. 1 is a schematic view of a first preferred embodiment of the invention;

[0010] FIG. 2 is a fragmentary exploded view of the structure shown in FIG. 1.

[0011] FIG. 3 is a schematic view of a second preferred embodiment of the invention;

[0012] FIG. 4 is a fragmentary exploded view of the structure shown in FIG. 3.

**DETAILED DESCRIPTION OF THE FIRST EMBODIMENT (FIGS. 1 & 2)**

[0013] FIG. 1 shows an agricultural field in which the soil S is provided to a depth d above a water retention structure 20 of the present invention, and as best shown in FIG. 2.

[0014] More particularly, plants to be grown are suggested generally at P, and each plant has a root structure R provided in the soil S above the structure 20 so as to afford a sufficient depth d to grow the plants without interference between this root structure R and the structure 20 to be described.

[0015] The structure 20 is shown in a fragmentary view in FIG. 2 as comprising a dimpled polymeric sheet 10, with raised lands 14, 14 and valleys or depressions 12,12 defined between these lands. The polymeric sheet 10 may be dimpled or cusped on both sides as shown on FIG. 2, with the result that the same configuration may be provided on the lower side of the sheet 10. However, these lands 14, 14 are especially required on the topside of sheet 10 to support the non-woven cloth 16. The downwardly directed lands 14a, 14a are useful to collect some water in the valleys on the sheet top side so that the growing plants will be nurtured by aspiration of that water from these voids in the sheet. While some water remains in the valleys, excess water flows between the cuspsations through "channels" out away from the sheet 10 for storage and reuse.

[0016] In further accordance with the present invention the structure 20 includes the water pervious cloth filter 16, that may be woven or unwoven, but is preferably of non-woven needle punched polypropylene. The polymeric dimpled water impervious sheet 10 is preferably of polystyrene material for rigidity, and resistance to deterioration in the soil generally. The polystyrene sheet 10 may be surrounded by the non-woven filter material 12, as suggested in my prior U.S. Pat. No. 4,490,072. Being water pervious this filter material allows aspiration upwardly of the excess water gathered in the cuspsations 14a, 14a.

[0017] Still with reference to the structure 20, referred to previously with reference to FIG. 1, conduits 22, 22 are provided peripherally at least part way around the sheet 10, and around the filter material 16, for collecting excess water which finds its way through the soil S to the structure 20. This excess water is carried away by the conduits 22,22 through intermediate pipes 24 to a storage tank T. Although only one sheet 10 and cover cloth 16 are shown in FIG. 1 it will be apparent that many such generally rectangular water impervious polystyrene dimpled or cusped sheets are required to be placed in an excavated depression in the field, at a depth d below the surface of the soil S. Correspondingly, additional conduits 24 are required for carrying away the excess water

from a field fitted with the agricultural water retention and replenishment system of the present invention.

[0018] FIG. 1 also shows a conventional irrigation system illustrated schematically at 30. This irrigation system 30 provides water to the plants P, and their roots R when rainwater is not sufficient to grow the plants at a satisfactory rate. It is a feature of the present invention that such a conventional irrigation system 30 can be provided with water from the storage tank T through the system of pipes 24 fed by pump P with the water from the storage tank T so that a supply of water is available for irrigation purposes from water that would otherwise run off the field depicted in FIG. 1. The present invention provides a system for reclaiming that water for reuse, as in irrigation system 30.

Brief Description of the Second Preferred Embodiment (FIGS. 3 & 4)

[0019] Turning next to a more detailed description of the second preferred embodiment in FIG. 3, the same storage tank T is provided either below ground or at some remote location suitable for receiving excess water provided from the pipes 24,24 and collected by slotted ducts or conduits D,D from both the top and bottom surfaces of the water impervious polymeric sheet 10.

[0020] This polymeric sheet 10 is similar in structure to that described above with reference to FIG. 1 & FIG. 2, and includes both upwardly and downwardly directed lands, between which lands are defined valleys or channels through which the excess water to be collected by this polymeric sheet is eventually stored and/or reused as described previously.

[0021] FIG. 4 illustrates the polymeric sheet 10 in greater detail, and it will be apparent that the truncated portions, projecting both upwardly and downwardly from the center line of the polymeric sheet 10 (the center line being illustrated at 10a) will define miniature wells, and also serve to define channels, on the upper and lower sides of the polymeric sheet 10 for collecting and providing excess water to the slotted ducts D,D.

[0022] As in the previously described embodiment the depressions defined in the downwardly projecting truncated lands will serve to gather some water for purposes of storage on the polymeric sheet in the manner described previously for the first embodiment of FIG. 1 & FIG. 2.

[0023] However, in the second embodiment of FIG. 3 & FIG. 4, the subsoil SS can be used as a further source of water in certain locations where subsurface water or an excess in rainfall can be such that an excess of water will be provided in the subsoil itself. This excess water in the subsoil will aspirate upwardly toward the underside of the water impervious polymeric sheet 10, with the result that some of this water can pass by capillary action or gravity to the slotted ducts D,D provided peripherally around the polymeric sheet 10, where this water flows by the pipes 24,24, into a storage tank T.

[0024] As in the previously described embodiment this storage tank T can be fitted with a pump P for providing this stored water to a conventional irrigation system represented in FIG. 3 at reference numeral 30.

[0025] In order to provide voids for collecting the upwardly aspirated excess water from the subsoil, a second water pervious blanket 18 is provided, generally similar to the upper blanket 16 referred to previously, with the result that the water impervious polymeric sheet 10 is essentially surrounded by the filter blanket, except for the peripheral edge thereof, which is designed to carry away the excess water provided to

these slotted ducts D,D both from the subsoil SS and from the upper, or topside, of the polymeric sheet 10 as described above with reference to the first embodiment of FIGS. 1 & 2. [0026] In light of the above it is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A water retention and collection system for agricultural soil and comprising:

a plurality of horizontally extending water impervious sheets of polymeric material buried below the surface of the soil at a depth that is sufficient for growing crops above said polymeric sheets;

said polymeric sheets having raised lands in a repeating pattern that allow the sheets to overlap, and having depressions surrounding these raised lands;

a water pervious filter cloth overlying said raised lands and coextensive with said polymeric sheets so as to define between said cloth, and the lands in said polymeric sheet, covered valleys for collecting excess water from the soil there above, and

conduits extending at least partially around the periphery of said polymeric sheets for carrying away excess water collected in said valleys.

2. The system according to claim 1 further characterized by a water collection and retention reservoir downstream of said conduits for receiving water carried away by said conduits.

3. The system according to claim 2 further characterized by water irrigation means associated with said agricultural soil, and piping for delivering water from said water collection and retention reservoir to said water irrigation means.

4. A method for improving water use in agricultural soil comprising the steps of:

excavating the soil to a predetermined depth;

laying a water impervious polymeric sheet in the excavation, the sheet having raised lands to define valleys in which water can be collected, and channels for carrying excess water away;

providing a water pervious cloth filter material above said polymeric sheet;

covering the cloth filter material with soil suitable for growing plants; and

collecting the excess water from these channels for delivering to a suitable reservoir for reuse thereof.

5. The method according to claim 4 further characterized by conduits associated peripherally with the blanketed water impervious sheets to carry away the excess water for such reuse.

6. The method according to claim 4 wherein said polymeric sheet has lands and valleys defined on both sides of said sheet, some of the excess water being stored in said valleys for natural aspiration upwardly through the soil above the cloth filter material to nurture the growing plants.

7. The method for improving water use in agricultural soil comprising the steps of:

excavating the soil to a predetermined depth,

providing a water pervious cloth material in the excavation at a predetermined depth spaced below that of the roots of the plants to be grown in the soil,

providing a water impervious polymeric sheet on said cloth filter material in the excavation, the polymeric sheet having both upwardly and downwardly directed lands to define valleys both above and below the polymeric water impervious sheet,

providing a second water pervious cloth material as a second filter material above said polymeric water impervious sheet, and providing soil above the resulting structure to provide a region for growing plants that allows excess water to be channeled away from the water impervious plastic sheet, and from between the spaces defined above and below the water impervious polymeric sheet by the first and second filtering sheets, this water to be stored and reused, as for example in an existing water irrigation system.

8. The system according to claim 1 further characterized by a water pervious filter cloth underlying said polymeric water impervious sheet, said polymeric sheet having depending lands also in a repeating pattern to engage said second water pervious filter cloth, and said conduits extending at least partially around the periphery of said polymeric sheets serving to carry away excess water from both above and below the water impervious polymeric sheet.

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