PULSED SUBSOIL INPUT OF FERTILIZERS SOLUTIONS AT SUNFLOWER GROWING.

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SUMMARY

Sunflower is a warmth-loving plant, and for its growth, development and high-grade ripening moisture with useful components in soil is required. Using oversoil irrigation and open soil watering loss of irrigation water makes about 30 %. Therefore undersoil irrigation is the most perspective and ecologically pure. For effective photosynthesis under solar beams action subsoil input of fertilizers solutions into the root system of sunflower plant by means of hydraulic impacts is offered, that is no less effective - pulses for dry soil resistance overcoming.

INTRODUCTION

Productive sunflower growing can be supplied by photosynthesis under plentyful solar energy action of and simultaneous root system feeding by nutritives in a kind of fertilizers solutions. For these purposes realization pulsed input of fertilizers solutions into the root system of sunflower plants is offered in the dry soil conditions. It is reached at the expense of combined centrifugal and plunger (piston) pumps, connected in parallel - consistently with a systemof nozzles in plane-cut claws of a self-propelled carriage.

For liquid input into firm dry soil it is expedient to use plunger or piston pumps without air caps; thus unsteady process of liquid movement in the pipelines, causing sudden pressure increase and decrease in the head pipeline, occurs. This process is accompanied by periodic hydraulic impacts, capable to destroy firm dry soil.

Head at hydraulic impacts is calculated under the N.E.Zchukhovsky formula:

$$H = H_o \pm C\,\Delta W / g, \qquad (1)$$

where H_o - the initial head in the given point, m:

C - the speed of distribution of a shock wave, m/s;

ΔW - the value of liquid current speed alteration, that is the difference of liquid current speed before and after hydraulic impact, m/s;

g - the free fall acceleration, m/s^2 (9,81 m/s^2).

The speed of shock wave distribution for pipelines, transporting water, is determined on a equation:

$$C = 1435\sqrt{1 + E_L\, d / E_s\, \delta} \qquad (2)$$

where E_L - the module of volumetric elasticity of a liquid, MPa;

E_s - the module of elastic deformation of pipes material, MPa;

d and δ are the internal diameter and thickness of pipes walls, mm.

The module E_L in general case depends on a kind of liquid, its temperature and pressure, and also in large extent on the contents of non-soluble gases in a liquid. On the average for a water:

$$E_L = E_w = 2{,}06 * 10^3 \text{ MPa.}$$

SUBSOIL IRRIGATION UNIT DESCRIPTION

Subsoil irrigation unit for sunflower plantation (fig.1,2) contains a self-propelled carriage 1 with working bodies in a kind of knife-resembling racks 2 with plane-cut claws 3, located across the longitudinal axis of a self-propelled carriage 1, connecting channels 4 of the working bodies, connected with nozzles 5, directed horizontally in both sides across the direction of carriage 1 movement, tank 6 for water or water solutions of fertilizers, centrifugal pump 7 for water or water solutions submission from the tank 6 into working bodies channels 4 through the return valve 8 and into the soaking branch pipe of plunger pump 9. Moreover, forcing branch pipe of a centrifugal pump 7 is connected with forcing branch pipe of the plunger pump 9 by means of a return valve 8, ensuring liquid passage from forcing pipeline of the centrifugal pump 7 into forcing pipeline of the plunger pump 9. Such connection does not

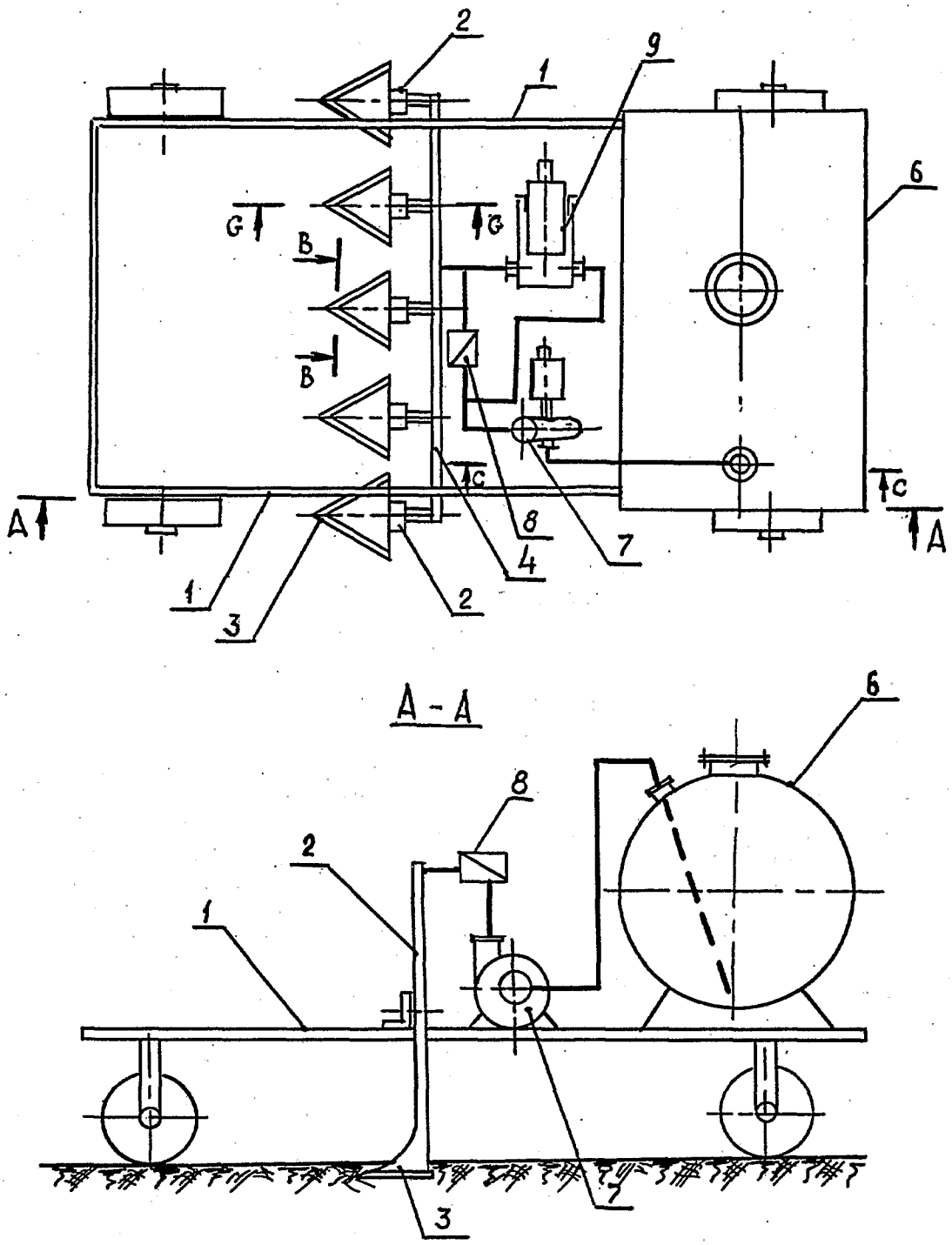

Fig.1. The installation for pulsed input of fertilizers solutions into the soil.

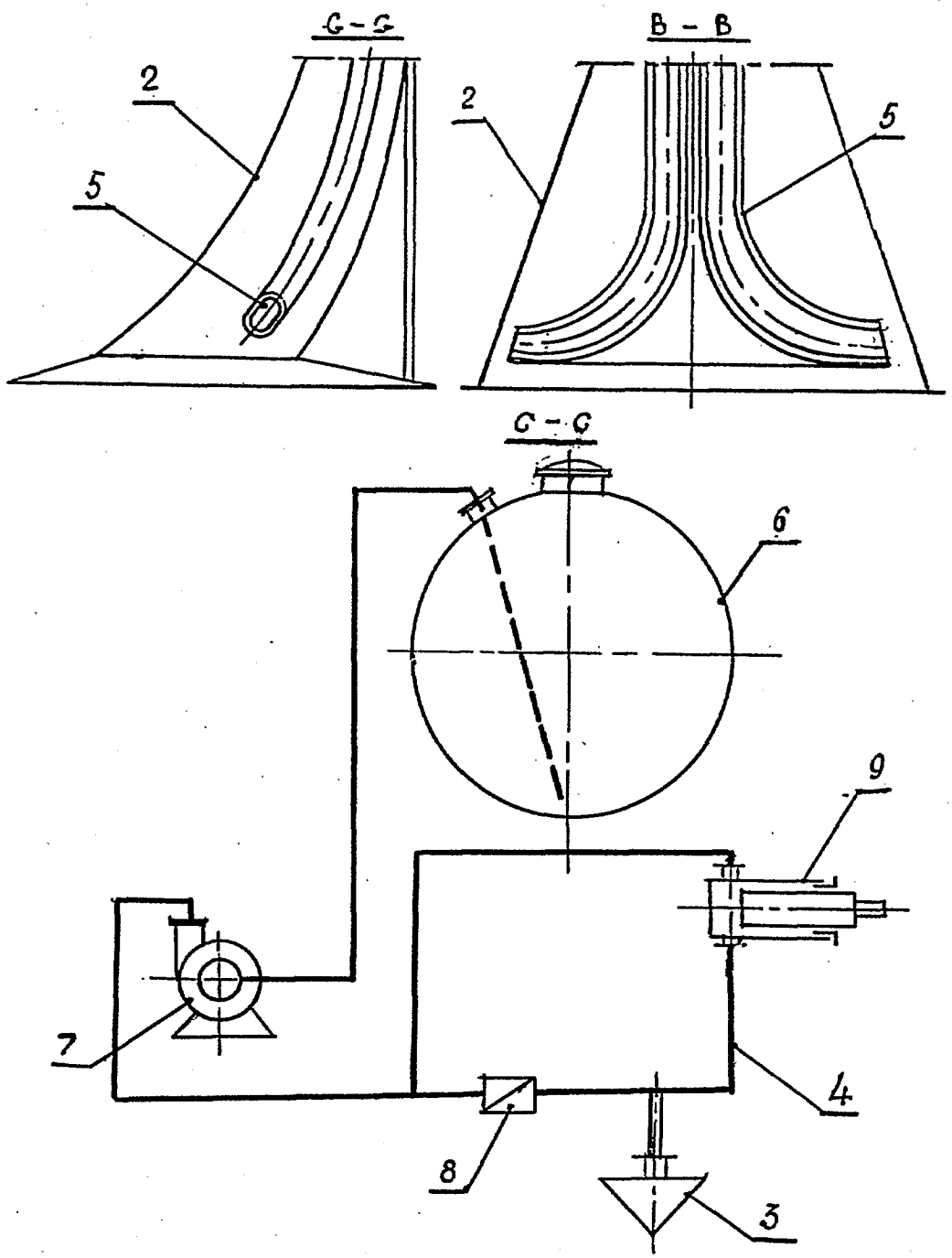

Fig.2. The installation for pulsed input of fertilizers solutions into the soil.

permit liquid passage from forcing pipeline of the plunger pump 9 into the forcing pipeline of the centrifugal pump 7. The combined system of centrifugal 7 and plunger 9 pumps connection permits to supply continuous work of the two pumps system and discontinuous liquid submission of a liquid in a kind of hydraulic impacts in root-inhabited sunflower layer through firm dry soil layers.

The subsoil sunflower irrigation unit works as follows.

The self-propelled carriage 1 (fig. 1,2) with a tank 6, filled with water or water solutions of fertilizers, is removed on the field for subsoil sunflower irrigation. With the help of hydrocylinder working bodies in a kind of knife racks 2 with plane-cut claws 3, connecting channels 4 with nozzles 5, are lowered and deepen into the soil on the level of the root-inhabited layer of the sunflower plants. Simultaneously the direct transfer of self-propelled carriage 1 drive, centrifugal pump and plunger pump 9 are included, which submit water or water solutions of fertilizers from the tank 6 along connecting channels 4 through nozzles 5 in the horizontal plane into the root-inhabited layer of sunflower plants. As a result of pulsed liquid submission liquid is capable to penetrate through the layer of firm soil and to loosen it.

Simultaneously penetration of a liquid occurs by its submission with the help of centrifugal pump at smaller pressure. By joint work of centrifugal and plunger pumps under the combined circuit during the period of liquid submission with the help of plunger pump 9 high pulsing pressure and small productivity is provided, and during submission with the help of centrifugal pump 7 high efficiency and small difference of pressure is provided. High difference of pressure for firm soil loosening and high efficiency for liquid submission into the root-inhabited layer is periodically provided in the aggregate. As it is visible from the circuit (fig. 2), centrifugal pump 7 continuously submits liquid from the tank 6 into the soaking pipeline of the plunger pump 9 in the plunger pump 9 soaking period. Simultaneously the centrifugal pump 7 submits liquid from the tank 6 to connecting channels 4 and further into the nozzles 5 through the return valve 8, which is opened only then, when the plunger pump 9 makes soaking period. In the forcing period of the plunger pump 9 return valve 8 will be closed whereas the pressure, created by means of the plunger pump 9, much more surpasses the pressure, created by means of the centrifugal pump 7. In the forcing period of the plunger pump 9 return the valve 8 will be closed, and the liquid will be moved by means of the plunger pump 9 into the nozzles 5, and the centrifugal pump 7 submission will be equal to a zero. Thus the work of centrifugal 7 and plunger 9 pumps under the offered circuit provides discontinuous pulsed liquid submission into the soil

with variable pressure and variable productivity, that creates hydraulic impacts formation conditions, having destructive force at hydraulic resistance in a kind of firm soil sites overcoming. The combined circuit of centrifugal 7 and plunger 9 pumps work is characterized by pulsed submission with sharp pressure difference and productivity changes, those are favorable parameters for economic and effective irrigation, as liquid does not practically fall on the soil surface, that determines economic water consumption.

Depending on particular conditions, the unit can work in modes of continuous movement at various speeds, as well as with periodic stops for subsoil irrigation.

The advantages of offered unit for subsoil irrigation in comparison with analogues consist of simplicity of a unit working elements design with the original circuit of centrifugal and plunger pumps connection use. Then pulsed liquid submission into the root-inhabited layer of plants in wide range of pressure and productivity changes occurs.

KEY WORDS:

Pulsed subsoil input of solutions, hydraulic impact, photosynthesis, root-inhabited layer of sunflower plant, plunger pump, centrifugal pump.