Dec. 18, 1956 T. O. ANDERSON ET AL 2,774,577

HOMOGENIZERS FOR OIL WELL LIQUIDS

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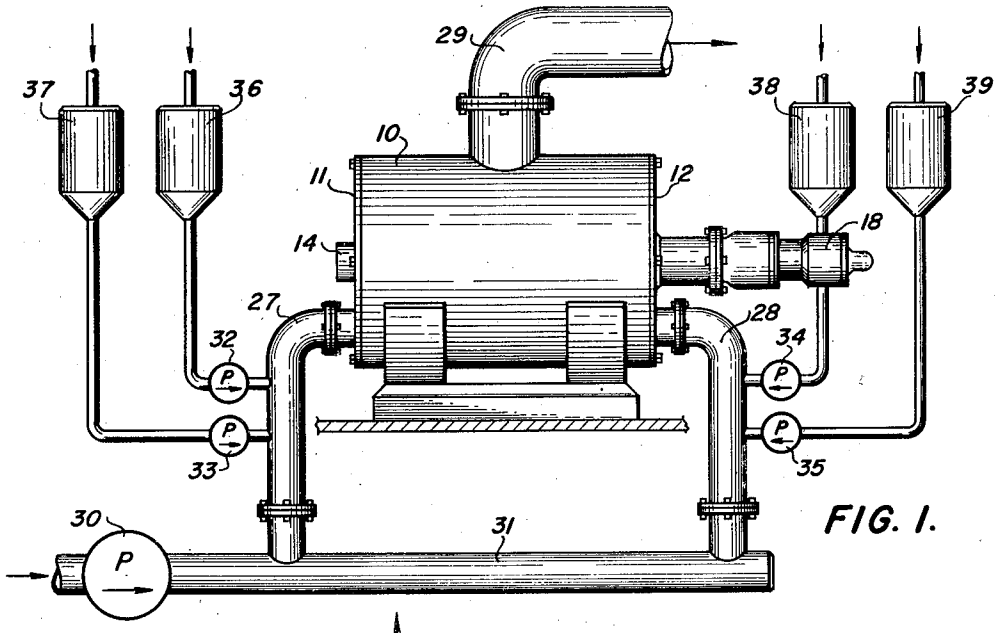


FIG. 1.

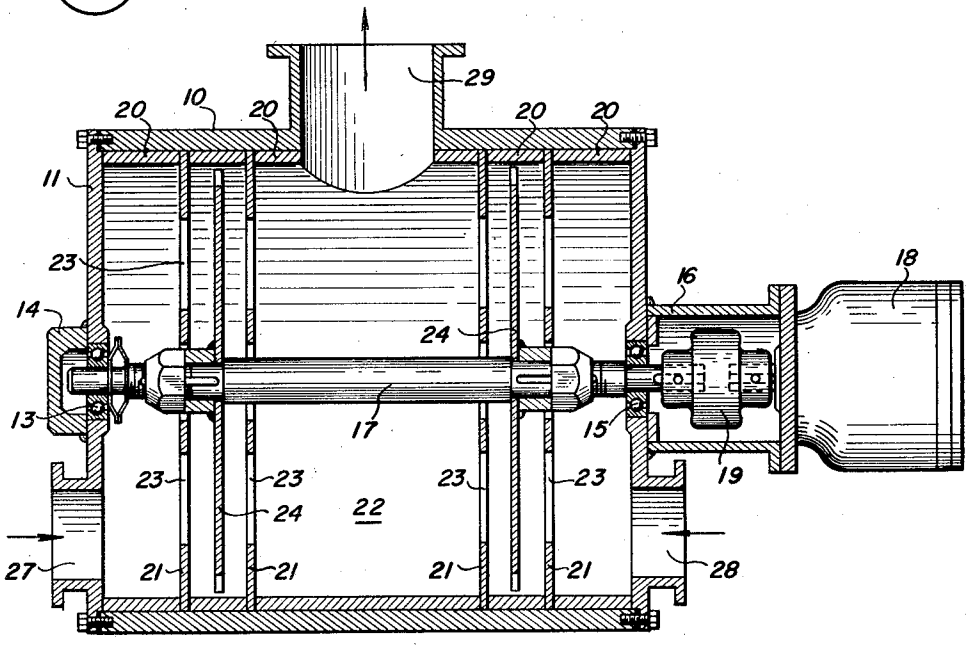


FIG. 2.

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FIG. 3.

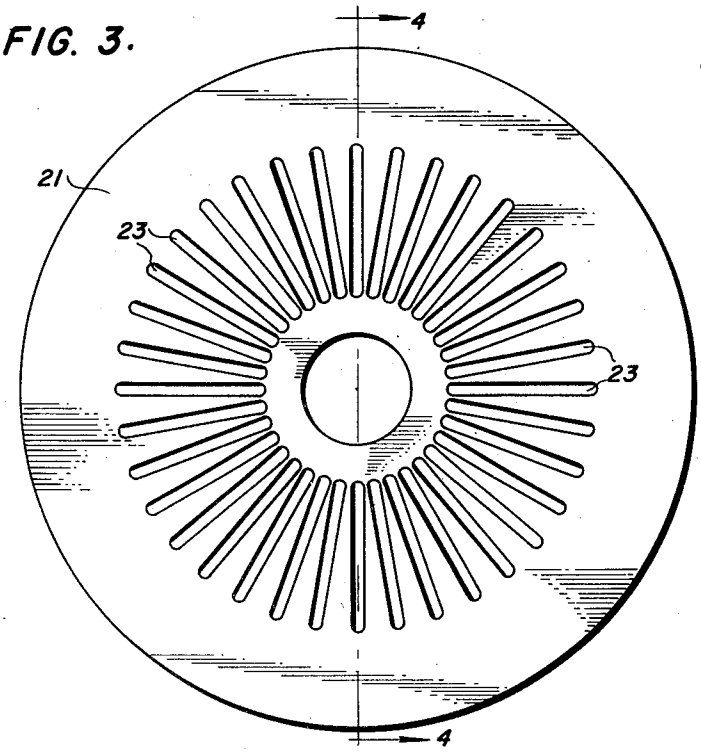


FIG. 4.

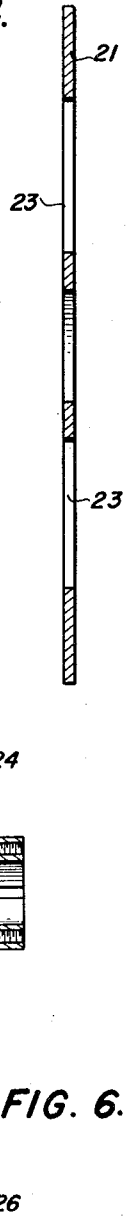


FIG. 5.

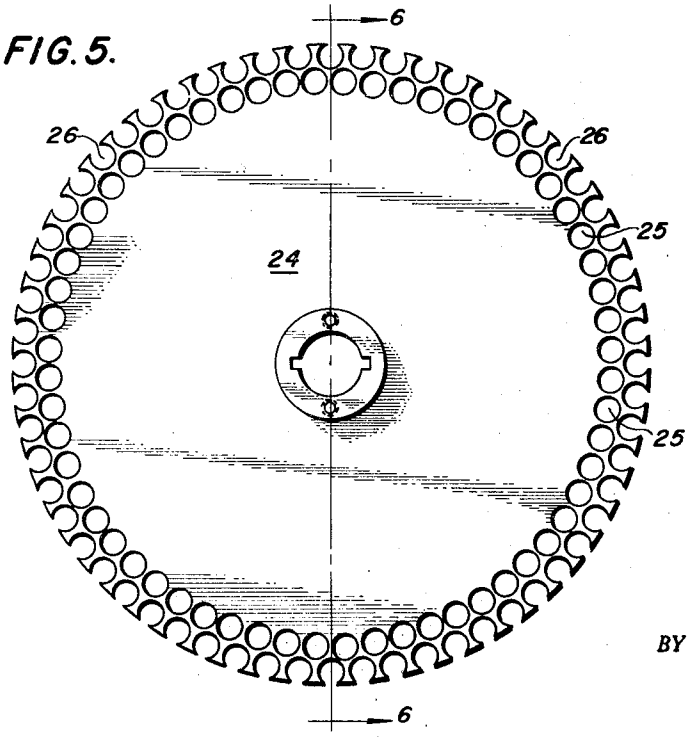


FIG. 6.

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HOMOGENIZERS FOR OIL WELL LIQUIDS

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2 Claims. (Cl. 259—9)

This invention relates to homogenizers for oil well liquids and more particularly to continuously operated homogenizers which may be connected to the discharge line of a large volume pump to mix diesel oil, kerosene, crude oil or the like with chemicals which cause the oil either to gel or to emulsify.

It is now common practice in the oil fields to fracture earth formations, to increase the production of oil therefrom, by injecting into them, under high pressure, an oil, such as kerosene, which has been specially treated to increase its viscosity so that it may suspend or carry sand or other "propping" agents. It is also common practice to form emulsions of oil and water for use as a drilling fluid or for other purposes.

The present invention is directed to the provision of a machine particularly designed to homogenize or emulsify oil. The machine is coupled into the discharge line of a pump and is capable of handling four or five barrels of liquid per minute. In accordance with the invention, the homogenizer is provided with two sets of disks, some of which are stationary and some of which rotate. The oil, under pressure from the pump, is caused to flow through the two sets of disks in opposite directions and the two streams are caused to meet with considerable impact in a mixing chamber. Soap or water or other chemicals which are to cause the oil to have an increased viscosity or which cause the oil to emulsify are added to the two streams before they pass through the disks, so that considerable blending action is obtained before the streams converge in the mixing chamber.

The objects and advantages of the invention will be apparent from the following description of a homogenizer, when considered in connection with the accompanying drawings in which:

Fig. 1 is a view in side elevation of a preferred embodiment of the invention with a diagrammatic showing of pumps and reservoirs connected thereto;

Fig. 2 is a vertical cross-sectional view of the homogenizer of Fig. 1;

Fig. 3 is a view, in side elevation of one of the stator disks of the homogenizer of Figs. 1 and 2;

Fig. 4 is a view in vertical cross-section of the stator disk of Fig. 3;

Fig. 5 is a view, in side elevation, of one of the rotor disks of the homogenizer of Figs. 1 and 2; and

Fig. 6 is a view in vertical cross-section of the rotor disk of Fig. 5.

Referring to the drawing in detail, it will be seen that the homogenizer consists of a cylindrical tank or vessel **10** mounted on a suitable base and having end plates **11** and **12** secured thereto. The end plate **11** has a bearing **13** over which is secured a cap **14**. The end plate **12** has a bearing **15** over which is fitted a housing **16**. A shaft **17** is mounted in the bearings **13** and **15**, so as to rotate about the axis of the cylinder **10**. Means such as the hydraulic motor **18** is mounted on the housing **16**. The motor is connected to the shaft **17** by the coupling **19** in

the housing **16** and is adapted to rotate the shaft at a rather high speed, say 1500 to 3000 R. P. M.

By means of spacer rings **20**, a number of stator disks **21** are mounted in the cylinder **10**. As illustrated, there may be four of these stator disks, two near the end plate **11** and two near the end plate **12**, so as to leave considerable space in the center of the cylinder **10** to form two churning sections, one at each end of the vessel, and a central impact or mixing chamber designated **22** (Fig. 2). Each stator disk is provided with a number of radial slots **23** as best shown in Fig. 3. These are disposed some distance inwardly from the circumference of the disk so that liquid cannot readily flow along the inside wall of the cylinder **10**.

Clamped on the shaft **17** are a number of rotor disks **24**. As illustrated, there are two of these rotor disks, one for each set of stator disks, and so mounted as to rotate between them.

The rotor disks are provided with a circle of holes **25** near their perifery and a circle of curved slots **26** in their perifery as shown particularly in Fig. 5.

The disks **24** are of such diameter that the holes **25** and slots **26** are a greater distance from the shaft **17** than the slots **23** in the stator disks **21** so that the liquid flowing through the cylinder **10** across the disks has to travel in a zig-zag pattern. The action is such that centrifugal force is imparted to the liquids in the chamber by the rotor disks **24** but the movement of the liquids, under this force, around the stator plates **21** and through the slots **23** therein causes a great deal of turbulence which assists in mixing and blending the liquids.

An important feature of the invention resides in the fact that there are two streams of liquid subjected to the churning and blending action of the disks and that these two streams are then caused to converge in the mixing chamber **22**. This action is brought about by having two inlets **27** and **28** for the liquids supplied to the cylinder **10** and by having but a single outlet **29**. It will be observed that the outlet **29** is so disposed as to be radial to the chamber **22** rather than tangential, so that the liquids do not leave the chamber **22** smoothly the way they do in a centrifugal pump.

The inlets **27** and **28** supply the liquids to the cylinder **10** on the outside of the two sets of disks so that both streams are subjected to the intense blending action of the disks before being thrown together in the chamber **22**.

In Fig. 1, a single pump **30** is shown for supplying oil to the homogenizer. This may be a large volume pump and be connected to a manifold **31** which is connected to the inlets **27** and **28** as illustrated. This pump causes the liquids to flow through the homogenizer.

The homogenizer is provided with a number of auxiliary pumps such as are illustrated at **32**, **33**, **34** and **35**. These serve to meter liquids supplied thereto from the reservoirs **36**, **37**, **38** and **39** and add them to the streams of oil entering the homogenizer through the inlets **27** and **28**. If the homogenizer is being used to increase the viscosity of the oil, reservoirs **37** and **39** may contain a caustic solution and reservoirs **36** and **38** contain an acid, such as oleic acid. If the homogenizer is being used to form an emulsion, one or more of the reservoirs may contain water. Of course, not all of the reservoirs need be used at the same time, and more than the number illustrated may be provided. The pumps **32**, **33**, **34** and **35** may be synchronized with each other and with the main pump **30**, if desired to insure accuracy in proportioning the liquids.

While only one embodiment of the invention has been shown and described herein, it is obvious that various changes may be made without departing from the spirit of the invention or the scope of the annexed claims.

We claim:

1. A homogenizer for oil well liquids comprising a cylindrical vessel having two, and only two, sets of stator disks mounted therein near the ends thereof so as to provide two churning sections, one at each end of the vessel, and an impact and mixing chamber in the center of the vessel, a shaft mounted for rotation about the axis of the cylindrical vessel, rotor disks mounted on said shaft, there being at least one rotor for each set of stator disks, two inlets for conveying liquids into the vessel, said inlets being disposed outside of the disks at opposite ends of the vessel, and a single outlet for the vessel located centrally thereof so as to be connected to the mixing chamber, the arrangement being such that two streams of liquid

are subjected to churning action by the disks and then caused to converge and be thrown together in the mixing chamber.

2. The homogenizer defined in claim 1 in which the stator disks have radial slots therein and the rotor disks have a circle of holes a greater radial distance from the shaft than the slots in the stator disks.

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