United States Patent [19]

De Koning

[11] **3,772,805**

[45] **Nov. 20, 1973**

[54] **METHOD AND SUCTION DREDGING INSTALLATION FOR CONVEYING DREDGING SPOIL**

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[22] Filed: **Mar. 3, 1969**

[21] Appl. No.: **803,915**

[30] **Foreign Application Priority Data**

Mar. 6, 1968 Netherlands 6803191

[52] **U.S. Cl.** **37/58**, 37/195, 37/DIG. 19, 137/4, 137/7, 137/92, 333/19, 417/19, 417/63, 417/300

[51] **Int. Cl.** **E02f 3/90**

[58] **Field of Search** ..... 417/19, 63, 300; 37/58, 59, 195, DIG. 19; 166/68; 137/4, 92, 88, 7, 12, 3; 73/32; 302/35, 42; 333/19

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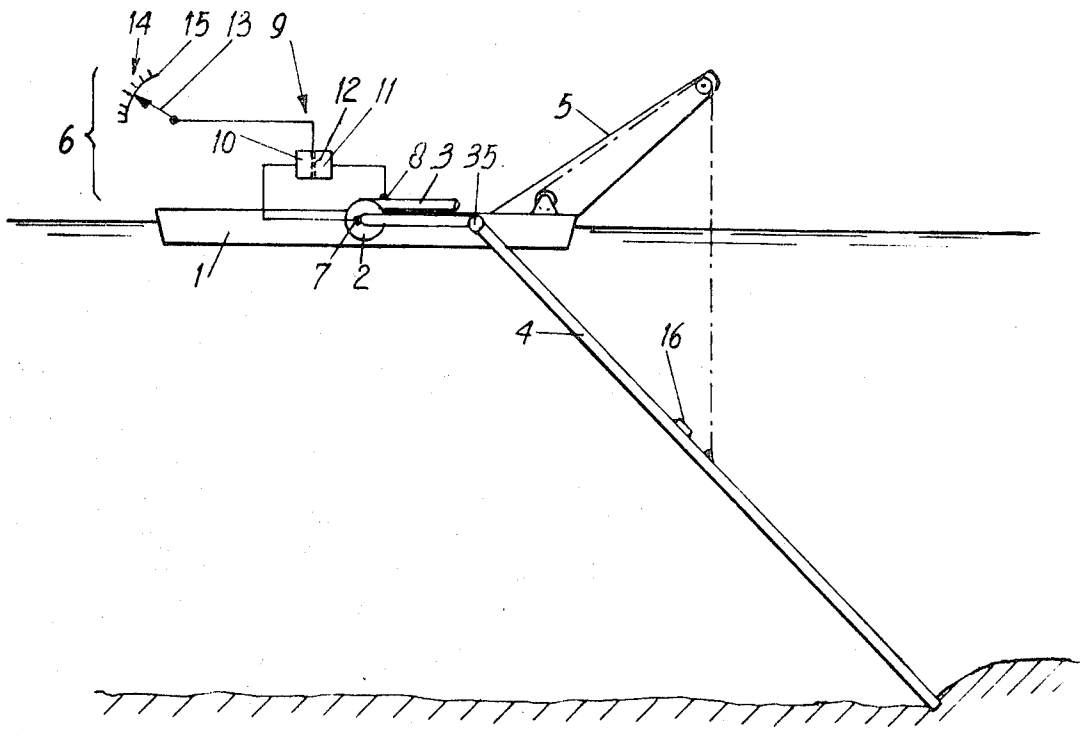
Assistant Examiner—Clifford D. Crowder
Attorney—Imirie, Smiley, Snyder and Butrum

[57] **ABSTRACT**

The pressure difference across the pump of a suction dredging installation and/or the rate of change of this pressure difference are determined. The suction pipe is connected to the pump for withdrawing a suspension of the dredged material and the dredging operation is controlled in accord with the pressure difference related values determined to maintain the pump working at optimum conditions.

12 Claims, 4 Drawing Figures



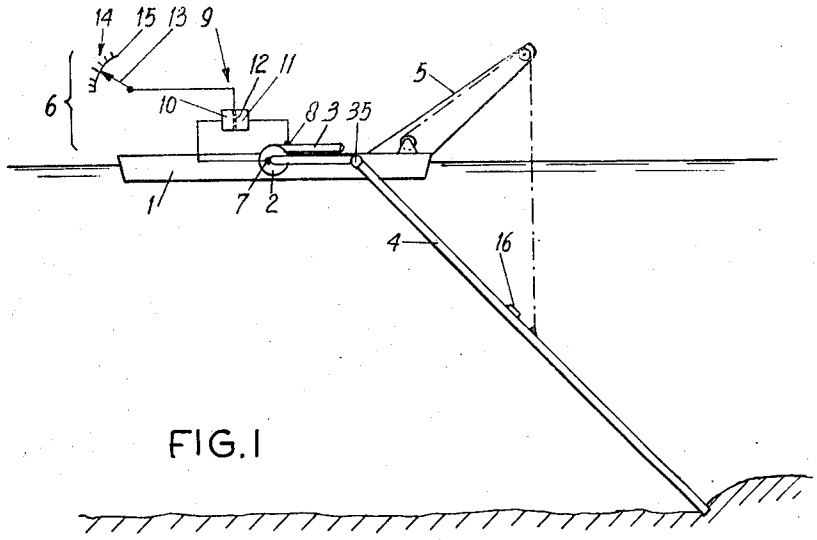


FIG. 1

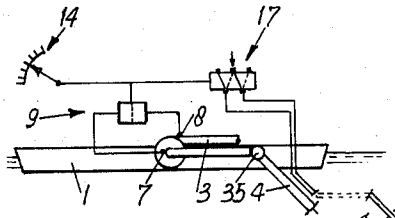


FIG. 2

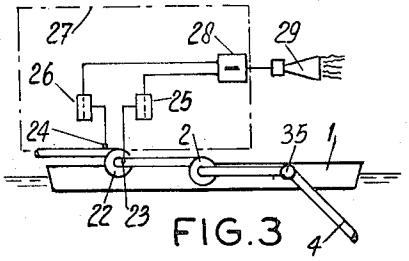


FIG. 3

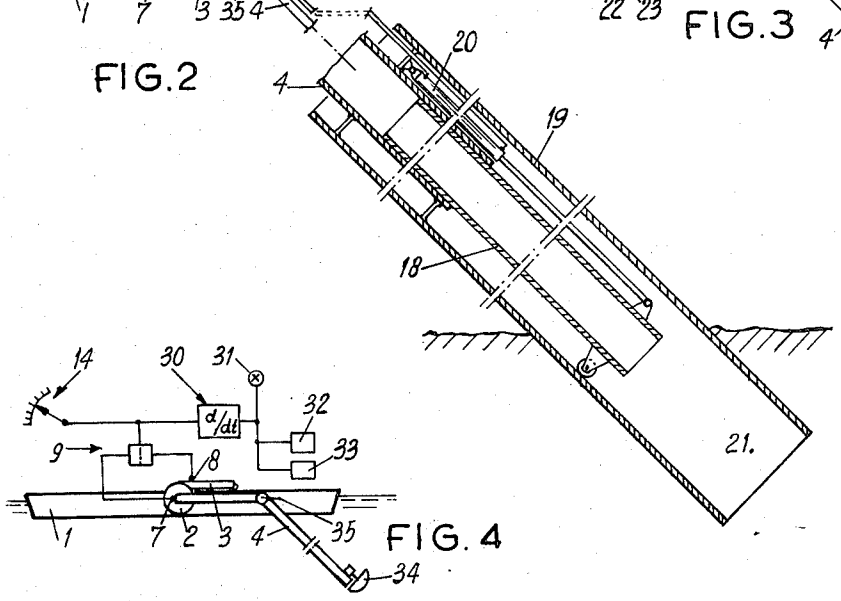


FIG. 4

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BY Smith & Smiley

ATTORNEYS

METHOD AND SUCTION DREDGING INSTALLATION FOR CONVEYING DREDGING SPOIL

The invention relates to a method for conveying dredging spoil through a pipe of a suction dredging installation by means of at least one pump and to a suction dredging installation for the performance of such a method.

It is known to measure the pressure difference across a pump during its operation in order to determine the working condition of the pump as well as other factors.

The invention provides a method, with which during operation the pressure difference between the suction and the pressure side of the pump is picked up. This pressure difference is an important indication about the working condition of the pump. By measuring this pressure difference the pump can be adjusted into its optimum working situation so that the suction dredging installation produces much more. The extent of cavitation of the pump can be confined easily in this way to an admissible limit. The pressure difference provides further a clear information about the efficiency of the conveyance.

The time differential of the pressure difference between the suction and the pressure side of the pump may be used to derive the extent and in which sense the working situation of the pump changes. The pressure difference picked up and/or its differential can be observed by means of an indicator, for example an indicator provided with a scale division. The pressure difference and/or its differential is able to switch on an acoustically or visually observable warning device when exceeding or declining a maximum or minimum value respectively. The pressure difference picked up and/or its differential can be used in particular as input signal of an automatic regulating apparatus for regulating the dredging process.

The invention provides also a new suction dredging installation of the type mentioned which is characterised by a pressure difference pick-up, which picks up the pressure difference between the suction and the pressure side of the pump.

The mentioned and other features of the invention will be elucidated in the following description with reference to a drawing.

Therein represent schematically:

FIG. 1: a suction dredging installation according to the invention;

FIG. 2: a further development of the suction dredging installation of FIG. 1;

FIG. 3: a performance variation of the suction dredging installation of FIG. 1 and

FIG. 4: a further developed suction dredging installation according to the invention.

The suction dredging installation of FIG. 1 comprises a vessel 1, a pump 2, a pressure conduit 3 connected to the pressure side of the pump 2, a suction pipe 4 connected to the suction side of the pump 2, which suction pipe 4 is suspended swingably around an axis 35 on a lifting device 5, and a measuring device 6 for measuring the pressure difference between the suction and the pressure side of the pump 2.

This measuring device 6 consists of a pressure difference pick up 9 having a membrane 12, of which pick up the one chamber 10 is influenced by the pressure in the suction pipe 4 at measuring point 7, which is arranged close before the pump 2, and of which pick up 9 the other chamber 11 is influenced by the pressure in the pressure conduit 3 at measuring point 8, which is arranged close behind the pump 2. The pressure difference pick up 9, which is for example of the known electric type, is connected with a pointer 13 of an indicator 14 with a scale division 15, which indicator 14 is mounted on a control panel of the suction dredging installation. By means of this indicator 14 the suction pipe 4 is kept in place to retain the existing concentration of the suspension or is put deeper or less deep into the breach for sucking up a suspension with an equal remaining, respectively to obtain higher and lower concentrations of sand in the suspension. If the indicator 14 inclines to indicate a very low value at which the danger of an excessive cavitation arises, a valve 16 may be opened, by means of which extra water is admitted into the suction pipe 4. At the same time more of less fuel can be supplied to the sump-driving engine (not shown) by adjusting its regulator so as to overcome the condition tending to cause cavitation. The suction dredging installation of FIG. 2 differs from the suction dredging installation of FIG. 1 in that the pressure difference pick up 9 controls a regulating valve 17 and in that the lower end of the suction pipe 4, which is represented on a larger scale, comprises a sliding pipe 18 telescopically cooperating with the suction pipe 4, a jacket 19 enveloping the lower end of the suction pipe 4 and a hydraulic cylinder 20 which works in both directions and which drives the sliding pipe 18. When the suction mouth 21 at the lower end of the jacket 19 is put into the breach during sucking up sand, more or less water can be brought from the upper end of the jacket 19 into the suction pipe 4 by respectively raising and lowering the sliding pipe within the suction pipe 4. By this operation the concentration of sand in the suspension to be conveyed can be regulated. The regulating valve 17, which is controlled by the pressure difference pick up 9, regulates the supply and the outlet of the liquid at both sides of the piston of the cylinder 20 and therewith the position of the sliding pipe 18.

The suction dredging installation of FIG. 3 comprises besides a pump 2 mounted between a suction pipe 4 and a pressure conduit 3, a pump 22 mounted in the pressure conduit 3 and a pressure difference pick up 27 for picking up the pressure difference between the suction and the pressure side of the second pump 22 on the measuring points 23 and 24 close before and behind the pump 22 respectively. This pressure difference pick 27 consists of two absolute pressure pick ups 25 and 26, which pick up the pressures in the conduit 3 on the measuring points 23 and 24 respectively and of a subtracting circuit 28. The values picked up by these absolute pressure pick ups 25 and 26 are subtracted from each other in the subtracting circuit 28. The output of the subtracting circuit 28 is connected to an acoustic signaller 29, which starts when a selected maximum or minimum value respectively is attained.

With each of the above-mentioned suction dredging installations the output of the pressure difference pick up 9 is preferably connected to a differentiator 30 of FIG. 4, which differentiates the pressure difference with respect to time. The output of the differentiator 30 is connected to a control light 31, which lights after a selected maximum or minimum value respectively is attained.

The output of the differentiator **30** is furthermore adaptable for controlling various regulating members **32** and **33** of an automatic regulating apparatus for regulating the suction and conveying process. The regulating members **32** and **33** can each be formed by a switch. When the suction dredging installation is formed by a cutter dredger, the regulating member **32** can control, for example, the winches of the side wires of said cutter dredger in order to adjust the velocity of the swinging movement of the driven cutter **34**, which is mounted for rotation at the lower end of the suction pipe **4**, in such way that the pump **2** can pump the sand cut and sucked up at a constantly high efficiency of the dredger.

What I claim is:

1. A suction dredging assembly comprising, in combination;

a suction pipe having an open lower end adapted to be projected into a body of underwater material which is to be dredged;

supporting structure including means for controlling the position of said lower end of the suction pipe;

a pump on said supporting structure having an inlet connected to said suction pipe for withdrawing a suspension of said material therethrough, and having an outlet for discharging such suspension, said pump operating to produce a predetermined pressure difference between its outlet and its inlet when at an optimum pumping efficiency;

a pressure difference pick-up connected between said outlet and said inlet of the pump and having an output which increases when the pressure difference between said inlet and said outlet deviates to exceed said predetermined pressure difference and vice versa; and

means for enabling control of said suction dredging assembly in response to said deviations to maintain said pump operating at or near said optimum pumping efficiency.

2. A suction dredging assembly comprising, in combination;

a suction pipe having an open lower end adapted to be projected into a body of underwater material which is to be dredged;

supporting structure including means for controlling the position of said lower end of the suction pipe;

a pump on said supporting structure having an inlet connected to said suction pipe for withdrawing a suspension of said material therethrough, and having an outlet for discharging such suspension, said pump operating to produce a predetermined pressure difference between its outlet and its inlet when at an optimum pumping efficiency;

a pressure difference pick-up connected between said outlet and said inlet of the pump and having an output proportional to the pressure difference between such outlet and inlet so as to determine both positive and negative pressure difference deviations with respect to said predetermined pressure difference; and

means for enabling control of said suction pipe in response to said deviations to maintain said pump operating at or near said optimum pumping efficiency.

3. A suction dredging assembly as defined in claim **2** wherein said means includes a pressure difference indicator for enabling an operator to control the position of said lower end of the suction pipe.

4. The suction dredging assembly as defined in claim **2** wherein said means includes differentiator means for differentiating said output of the pressure difference pick-up with respet to time to produce a signal indicative of the rate of pressure difference change.

5. The suction dredging assembly as defined in claim **4** wherein said means also includes an indicator connected to the signal of said differentiator means.

6. A suction dredging assembly as defined in claim **4** wherein said means also includes a signaling device connected to the signal of said differentiator means and responsive to a predetermined value of pressure difference rate of change.

7. A suction dredging assembly as defined in claim **4** wherein said means also includes a regulating member connected to said differentiator means for regulating said suspension in said suction pipe.

8. A suction dredging assembly as defined in claim **2** wherein said means includes a signaling device connected to said pick-up and responsive to a predetermined maximum positive deviation in pressure difference across said pump.

9. A suction dredging assembly as defined in claim **2** wherein said means includes a signaling device connected to said pick-up and responsive to a predetermined maximum negative deviation in pressure difference across said pump.

10. A suction dredging assembly as defined in claim **2** wherein said means includes a regulating member connected to said pick-up for regulating the suspension in said suction pipe.

11. A method of suction dredging which comprises the steps of:

a. withdrawing a suspension of material to be dredged through a suction pipe by operating a pump connected to the suction pipe;

b. measuring the pressure difference across the pump; and

c. controlling the dredging operation to maintain the pressure difference within predetermined limits.

12. A method according to claim **11** including the step of measuring the time rate of change of the pressure difference, and wherein the controlling of step (c) is in accord with such time rate of change.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,772,805 Dated November 20, 1973

Inventor(s) Jan de Koning

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet, the assignee should read as follows:

---N.V. Ingenieursbureau voor
Systemen en Octrooien "Spanstaal" --

Signed and sealed this 4th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.