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(54) IMPROVEMENTS IN OR RELATING TO PLANTS FOR THE TREATMENT OF SEWAGE

71) We, DRYSDALE & COMPANY LIMITED, a British Company, of Bon-Accord Works, Yoker, Glasgow, W.4, Scotland, do hereby declare the invention, for which we
5 and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to sewage plants and particularly to sewage treatment plants intended to employ the contact stabilization process of sewage treatment.

15 Sewage treatment plants operating on the contact stabilization process are already known, such plants consisting of a sewage-receiving and aeration compartment, a settling compartment arranged to receive outflow from the receiving compartment and provided with a treated effluent-discharge
20 outlet, a sludge re-aeration compartment in communication with both the settling compartment and the aeration compartment and so arranged that spent sludge is transferable from the settling compartment into the re-aeration compartment for reactivation and
25 from there into the aeration compartment, and an aerobic digester compartment arranged to receive excess sludge deposited in the re-aeration compartment and to treat the excess sludge to the stage where the sludge
30 is completely inert, in which condition the sludge is disposable as an innocuous waste.

35 Such an existing plant is a continuous plant i.e. there is a constant intake of sewage and a constant outflow of effluent. The continuous nature of the plant causes it to be somewhat inflexible in operation since any change in the working conditions in
40 any part of the plant is rapidly communicated to the other parts of the plant. It is an object of the present invention to provide a contact stabilization sewage treatment plant which provides a greater degree of flexibility in operation in that the working conditions
45 in any part of the plant can be varied with-

out changing to an appreciable extent the working conditions in other parts of the plant.

50 In the following description the word "fluid" is used to mean liquid together with any contained solid matter whether or not in suspension. Also, the expression "sewage treatment" means the aeration of sewage in the presence of activated sludge and the consequent bacterial activity resulting in the digestion and conversion of the sewage to a
55 harmless residue which is allowed to settle out.

60 A sewage plant according to the invention incorporates a sewage-receiving and aerating compartment and two sewage treatment compartments, means in each compartment for introducing air into the fluid-holding space of the compartment, fluid transfer means for transferring fluid between the sewage-receiving compartment and each sewage
65 treatment compartment, the intake of each fluid transfer means being at a level lower than the level of its outlet, discharge means in each sewage treatment compartment in the upper portion of the compartment for
70 discharging effluent, fluid transfer control means arranged to control operation of the fluid transfer means in such wise that during operation of the plant the fluid transfer
75 means is operative to provide one and then the other of two settings of the fluid transfer means, one setting providing for the transfer of fluid from the sewage-receiving compartment to one of the sewage treatment compartments and at the same time for the
80 transfer of fluid from the other sewage treatment compartment to the sewage-receiving compartment, and the other setting providing for the transfer of fluid to said other sewage treatment compartment from the
85 sewage-receiving compartment and at the same time for the transfer of fluid from said one sewage treatment compartment to the sewage-receiving compartment, and air con-
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5 trol means operative to control the air-intro-
 ducing means to admit aerating air con-
 tinuously during operation of the plant to
 the sewage-receiving compartment but to
 10 admit air to one or other selected sewage
 treatment compartment, the selected sewage
 treatment compartment being that in which
 the liquid sewage level is dropping because
 of transfer of fluid to the sewage-receiving
 15 compartment by the fluid transfer means.

Conveniently the plant is arranged with
 the receiving compartment as a central com-
 partment with the two treatment compart-
 20 ments encompassing the perimeter of the
 sewage-receiving compartment. Alternatively
 the three compartments may be arranged in
 side by side formation with the sewage-
 receiving compartment between the two sew-
 age treatment compartments.

20 The means for transferring fluid from one
 compartment to another may be airlift
 means.

The discharge means from each treat-
 25 ment compartment may be a weir over which
 the treated sewage from the sewage treat-
 ment compartment flows when the level of
 treated sewage in the compartment rises to
 an appropriate height.

30 An extra compartment for digestion of
 sludge may be incorporated in the plant, said
 sludge-digesting compartment being con-
 nectible to both sewage treatment compart-
 ments by fluid transfer means and being
 35 equipped with aerating means. The sludge-
 digesting compartment may be provided with
 an overflow opening leading into the sewage-
 receiving compartment.

40 Practical embodiments of the invention
 are illustrated in the accompanying drawings
 in which Figs. 1-4 are diagrammatic cross
 sections through a plant incorporating three
 compartments disposed side by side and Figs.
 5 and 6 are a plan view and a side ele-
 45 vation respectively of an alternative form of
 plant in which the two treatment compart-
 ments and the sewage-receiving compartment
 surround a sludge-digesting compartment.

In the drawings and referring particularly
 50 to Figs. 1-4, 1 denotes a sewage-receiving
 and aerating compartment and 2A and 2B
 denote treatment compartments flanking the
 receiving compartment 1. Means 3, 3A and
 3B are provided for introducing air below
 55 the normal liquid level in the compartments
 1, 2A and 2B respectively. 4 denotes fluid
 transfer means for transferring fluid from the
 compartment 1 to the compartment 2A, 5
 denotes fluid transfer means for transferring
 60 fluid from the compartment 1 to the com-
 partment 2B, 6 denotes fluid transfer means
 for transferring fluid from the compartment
 2A to the compartment 1, and 7 denotes
 fluid transfer means for transferring fluid
 from the compartment 2B to the compart-

ment 1. 8 denotes means for introducing
 sewage into the compartment 1, and 9A and
 9B denote means for discharging treated
 sewage from the compartments 2A and 2B
 respectively. The means 9A and 9B may
 conveniently be weirs. 10 denotes fluid
 70 transfer control means controlling operation
 of the fluid transfer means 4, 5, 6, 7, and 11
 denotes air control means operative to con-
 trol the air-introducing means 3, 3A and
 3B, the air control means 11 being inter-
 75 connected with the fluid transfer control
 means 10 so that the latter is operative to
 control the respective air-introducing means
 according to the fluid transfer means which
 80 has been set in operation by the fluid control
 means.

In the embodiment illustrated in Fig. 5
 and 6 all the parts enumerated in connection
 with the embodiment of Fig. 1-4 carry the
 same reference numerals. This embodiment
 85 contains a sludge-digesting compartment 12
 surrounded by the settling compartments 2A
 and 2B and the sewage-receiving compart-
 ment 1. 14 denotes a stilling well which is
 operative to receive partly settled surface
 90 fluid from the compartment 12 when the
 fluid level in the compartment 12 is raised
 by the introduction of fresh sludge from the
 treatment chambers 2A or 2B. The well is
 in connection with the sewage-receiving com-
 95 partment 1 and serves to prevent agitated
 fluid containing sludge from being returned
 to the receiving compartment 1. 15 denotes
 splash guards for preventing splashing of
 fluid between the compartments 1, 2A, 2B
 100 and 12. 16 denotes a gangway for facilitat-
 ing access to the compartment 12.

In practice, sewage is continually intro-
 105 duced by the means 8 into the receiving
 compartment 1 and is aerated continuously
 there by the air-introducing means 3. Aerated
 sewage liquor is then transferred from
 near the bottom of the compartment 1
 into one of the treatment compartments for
 example 2A, by the fluid transfer means 110
 causing its level to rise so that the surface
 fluid flows through the discharge means 9A
 and is discharged as treated effluent. At the
 same time sewage liquor containing sludge
 is being aerated in the other treatment com-
 115 partment 2B by air admitted to that com-
 partment by the air-introducing means 3B
 and the sludge is being reactivated by the
 air. This reactivated sludge is transferred
 by the fluid transfer means 7 into the top of
 120 the receiving compartment 1 while the
 aerated sewage liquor already referred to is
 being transferred to the treatment compart-
 ment 2A. (See Fig. 1). After a certain
 period the fluid transfer control means 10
 125 operates to change the settings of the fluid
 transfer means 4, 5, 6, 7 to cause fluid i.e.
 sewage liquor to be transferred by the fluid
 transfer means 5 from the receiving compart-



ment 1 into the treatment compartment 2B while fluid is now transferred by the fluid transfer means 6 into the receiving compartment 1 from the treatment compartment 2A. (See Fig. 2). Once this fluid transfer operation is well under way air is supplied by the air-introducing means 3A to the treatment compartment 2A by operation of the air control means 11 linked to the fluid transfer control means 10, while the air supply is cut off from the treatment compartment 2B. (See Fig. 3). This action is allowed to continue until the level in the treatment compartment 2B rises to the stage where treated effluent is discharged from the surface through the discharge means 9B. After sufficient discharge has taken place from the treatment compartment 2B and when the period has been long enough to permit the sludge in the other treatment compartment 2A to become reactivated the fluid transfer control means 10 and the air control means 11 operate to change the settings of the fluid transfer means 4, 5, 6, 7 and the air-introducing means 3, 3A, 3B back to the original setting. The conditions illustrated in Fig. 4 continue until the conditions illustrated in Fig. 1 are attained and the cycle described is repeated. This cycle is continuously repeated.

The sludge which settles out in each compartment 2A, 2B in turn and which has become spent is reactivated by the introduction of the air at the appropriate time to that compartment.

It will be seen that the plant according to the present invention, although receiving sudge continuously and discharging treated effluent more or less continuously, operates as a batch process. This permits individual treatment conditions to be varied during operation of the process without affecting other conditions.

In the plant illustrated in Figs. 5 and 6 which is equipped with a sludge-digesting compartment 12 excess sludge forming in the treatment compartments 2A, 2B when the plant is operated for a long period under full load is transferred by sludge transfer means 13 to the sludge-digesting compartment 12 in which it is aerated and rendered completely inert. The fluid coming over with the sludge is returned to the receiving compartment 1 by way of the stilling well 14 to be mixed with the incoming sewage, and passes again through the plant. The inert sludge can be removed from time to time from the compartment 12 and disposed of without causing nuisance. Otherwise the plant illustrated in Figs. 5 and 6 operates in exactly the same manner as the plane illustrated in Figs. 1 to 4.

WHAT WE CLAIM IS:—

1. A plant for the treatment of sewage

by aerating sewage in the presence of activated sludge incorporating a sewage-receiving and aerating compartment and two sewage treatment compartments, means in each compartment for introducing air into the fluid-holding space of the compartment, fluid transfer means for transferring fluid between the sewage-receiving compartment and each sewage treatment compartment, the intake of each fluid transfer means being at a lower level than its outlet, discharge means in each sewage treatment compartment in the upper portion of the compartment for discharging effluent, fluid transfer control means arranged to control operation of the fluid transfer means in such wise that during operation of the plant the fluid transfer means is operative to provide one and then the other of two settings of the fluid transfer means, one setting providing for the transfer of fluid from the sewage-receiving compartment to one of the sewage treatment compartments and at the same time for the transfer of fluid from the other sewage treatment compartment to the sewage-receiving compartment and the other setting providing for the transfer of fluid to said other sewage treatment compartment from the sewage-receiving compartment and at the same time for the transfer of fluid from said one sewage treatment compartment to the sewage-receiving compartment, and air control means operative to control the air introducing means to admit aerating air continuously during operation of the plant to the sewage-receiving compartment but to admit air to one or other selected sewage treatment compartment, the selected sewage treatment compartment being that in which the liquid sewage level is dropping because of transfer of fluid to the sewage-receiving compartment by the fluid transfer means.

2. A plant as claimed in claim 1 in which the sewage-receiving compartment is arranged as a central compartment with the two sewage treatment compartments encompassing the perimeter of the sewage receiving compartment.

3. A plant as claimed in claim 1 in which the three compartments are arranged in side by side formation with the sewage receiving compartment between the two sewage treatment compartments.

4. A plant as claimed in claim 1 in which the means for transferring fluid from one compartment to another is airlift means.

5. A plant as claimed in claim 1 in which the discharge means from each sewage treatment compartment is a weir over which the treated sewage from the sewage treatment compartment flows when the level of treated sewage is in the compartment rises to an appropriate height.

6. A plant as claimed in claim 1 incorporating an extra compartment for diges-

ment 1 into the treatment compartment 2B while fluid is now transferred by the fluid transfer means 6 into the receiving compartment 1 from the treatment compartment 2A. (See Fig. 2). Once this fluid transfer operation is well under way air is supplied by the air-introducing means 3A to the treatment compartment 2A by operation of the air control means 11 linked to the fluid transfer control means 10, while the air supply is cut off from the treatment compartment 2B. (See Fig. 3). This action is allowed to continue until the level in the treatment compartment 2B rises to the stage where treated effluent is discharged from the surface through the discharge means 9B. After sufficient discharge has taken place from the treatment compartment 2B and when the period has been long enough to permit the sludge in the other treatment compartment 2A to become reactivated the fluid transfer control means 10 and the air control means 11 operate to change the settings of the fluid transfer means 4, 5, 6, 7 and the air-introducing means 3, 3A, 3B back to the original setting. The conditions illustrated in Fig. 4 continue until the conditions illustrated in Fig. 1 are attained and the cycle described is repeated. This cycle is continuously repeated.

The sludge which settles out in each compartment 2A, 2B in turn and which has become spent is reactivated by the introduction of the air at the appropriate time to that compartment.

It will be seen that the plant according to the present invention, although receiving sludge continuously and discharging treated effluent more or less continuously, operates as a batch process. This permits individual treatment conditions to be varied during operation of the process without affecting other conditions.

In the plant illustrated in Figs. 5 and 6 which is equipped with a sludge-digesting compartment 12 excess sludge forming in the treatment compartments 2A, 2B when the plant is operated for a long period under full load is transferred by sludge transfer means 13 to the sludge-digesting compartment 12 in which it is aerated and rendered completely inert. The fluid coming over with the sludge is returned to the receiving compartment 1 by way of the stilling well 14 to be mixed with the incoming sewage, and passes again through the plant. The inert sludge can be removed from time to time from the compartment 12 and disposed of without causing nuisance. Otherwise the plant illustrated in Figs. 5 and 6 operates in exactly the same manner as the plant illustrated in Figs. 1 to 4.

WHAT WE CLAIM IS:—

1. A plant for the treatment of sewage

by aerating sewage in the presence of activated sludge incorporating a sewage-receiving and aerating compartment and two sewage treatment compartments, means in each compartment for introducing air into the fluid-holding space of the compartment, fluid transfer means for transferring fluid between the sewage-receiving compartment and each sewage treatment compartment, the intake of each fluid transfer means being at a lower level than its outlet, discharge means in each sewage treatment compartment in the upper portion of the compartment for discharging effluent, fluid transfer control means arranged to control operation of the fluid transfer means in such wise that during operation of the plant the fluid transfer means is operative to provide one and then the other of two settings of the fluid transfer means, one setting providing for the transfer of fluid from the sewage-receiving compartment to one of the sewage treatment compartments and at the same time for the transfer of fluid from the other sewage treatment compartment to the sewage-receiving compartment and the other setting providing for the transfer of fluid to said other sewage treatment compartment from the sewage-receiving compartment and at the same time for the transfer of fluid from said one sewage treatment compartment to the sewage-receiving compartment, and air control means operative to control the air introducing means to admit aerating air continuously during operation of the plant to the sewage-receiving compartment but to admit air to one or other selected sewage treatment compartment, the selected sewage treatment compartment being that in which the liquid sewage level is dropping because of transfer of fluid to the sewage-receiving compartment by the fluid transfer means.

2. A plant as claimed in claim 1 in which the sewage-receiving compartment is arranged as a central compartment with the two sewage treatment compartments encompassing the perimeter of the sewage receiving compartment.

3. A plant as claimed in claim 1 in which the three compartments are arranged in side by side formation with the sewage receiving compartment between the two sewage treatment compartments.

4. A plant as claimed in claim 1 in which the means for transferring fluid from one compartment to another is airlift means.

5. A plant as claimed in claim 1 in which the discharge means from each sewage treatment compartment is a weir over which the treated sewage from the sewage treatment compartment flows when the level of treated sewage is in the compartment rises to an appropriate height.

6. A plant as claimed in claim 1 incorporating an extra compartment for diges-

tion of sludge, said sludge-digestion compartment being connectible to both sewage treatment compartments by fluid transfer means and being equipped with aerating means.

- 5 7. A plant as claimed in claim 6 in which the sludge-digesting compartment is provided with an overflow opening leading into the sewage-receiving compartment.

8. A plant for the treatment of sewage

substantially as described with reference to Figs. 1 to 4 or 5 and 6 of the accompanying drawings.

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