Nov. 16, 1954 S. P. H. E. HOLGERSSON ET AL 2,694,632

DIGESTERS FOR COOKING CELLULOSE

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FIG. 1.

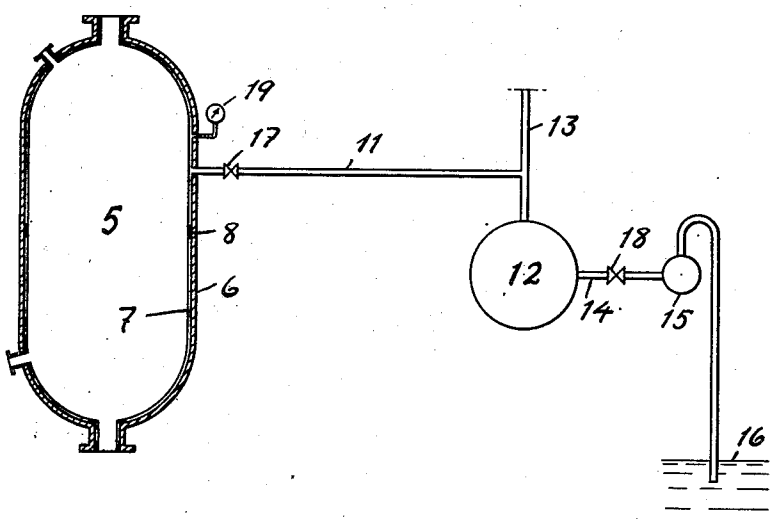


FIG. 2.

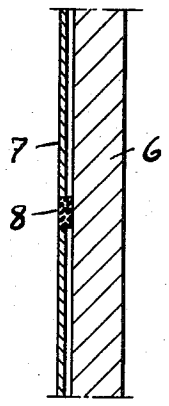


FIG. 3.

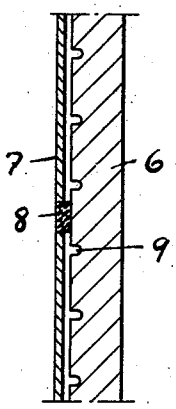
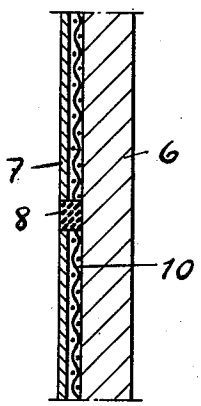


FIG. 4.



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DIGESTER FOR COOKING CELLULOSE

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Claims priority, application Sweden January 30, 1948

5 Claims. (Cl. 92—19)

The invention relates to digesters for cooking lignocellulosic material and more particularly it relates to the lining of such digesters. In accordance with the invention the digester has a lining of sheet metal resistant to the boiling agent employed for digestion and means are provided to maintain between the digester wall and said lining a pressure at most as high as the pressure within the digester but preferably lower.

Hitherto attempts to line digesters with stainless steel plates have not been successful because of the shearing stresses arising at the joints, such stresses being a result of different expansions of the digester wall and the lining material due to great variations in temperature. According to one prior proposal this problem has been attacked by dimensioning the thickness of the lining material, the distance between the jointing surfaces and the size of these latter in predetermined relation to each other and the strength of the material is utilized to the utmost. Another possibility of providing a durable lining would be to attach the sheet metal only at a few points and thus enable it to contract and to expand freely between these points. This proposal is, however, not feasible due to the fact that at certain times the interior of a digester is subjected to subatmospheric pressure which creates high inwardly-directed tensile stresses in the plate lining per se as well as at its points of attachment. With a fairly intimate contact between lining and digester wall such tensile stresses caused by subatmospheric pressure within the digester might be at least theoretically compensated for by the vacuum simultaneously created between digester wall and lining when the latter is bent inwardly at some points, but in practice there is no assurance that the digester wall will be wholly leakproof at every time and small leakages would cause compressing and tearing of the lining. According to the invention, means are provided for evacuating the space between digester wall and lining and the construction of the invention is reliable under any circumstances. Thus the lining may be secured to the digester wall by welding only at a small number of points, for instance around inlets and outlets for pulp, liquid, steam and so on as well as in a number of points along the middle periphery of the digester.

In the case of superatmospheric pressure in the digester a balancing of pressure is, of course, not necessary as the lining is then safely held against the digester wall. In the shorter periods, however, when the digester is partly evacuated there must be a pressure on the outer side of the lining at least as low as the pressure within the digester, i. e. at the inner side of the lining, and such subatmospheric pressure is preferably maintained by means of a suction pump, a steam jet ejector or similar means. However, since a subatmospheric pressure in said space is at no time disadvantageous, it is desirable always to maintain a subatmospheric pressure sufficiently low to accommodate all possible circumstances.

To secure a uniform distribution of a subatmospheric pressure around the lining at its outer side the lining is arranged so that said space between digester wall and lining will be continuous around the periphery of the digester. Generally the inner surface of the digester wall is somewhat uneven or rough and therefore no particular measures are required to provide a continuous space between the wall and the lining. If desired, the inner surface of the digester wall may, however, be provided with peripheral slots or grooves having an insignificant depth, or a grating, such as a metal wire netting for instance, may be inserted in said space, the outer diameter of the lining thus being somewhat smaller than the inner diameter of the digester wall.

To avoid the inconveniences caused by compressive stresses in the lining, these stresses arising from the fact that as a result a higher temperature or a greater coefficient of thermal expansion the lining material has a greater expansion than the digester wall, the lining may be arranged so that in the case of a superatmospheric pressure on its inside and/or a subatmospheric pressure on its outside, it will be stretched in such a way that there arises in the lining an initial tensile stress not exceeding the limits of the strength and elasticity of the material. Thus there may be provided a sufficient space between the lining and the digester wall or the grating. With respect to a lining material having a tensile strength of 1400 kg./cm.^{2} and a module of elasticity of 1,800,000 kg./cm.^{2} such a free space may without danger have a width amounting to about 0.08% calculated on the outer radius of the lining. A corresponding rule is to be observed in mounting the plate lining onto the conical or curved top and bottom portions of the digester so as to obtain desirable tensile stresses also in directions perpendicular to the digester periphery.

Preferably the device according to the invention is arranged with the digester wall bored through from its outside and said space is connected to a suction pump by one or more pipe lines. If desired, it is possible for this purpose to use the pumps or ejectors which are normally used to evacuate the digester and thus a branch may lead from the pump etc. to the space between digester wall and lining. It is, however, preferred to insert a separate exhaustion system in which a pump or pumps of small dimensions may be used in which leakage is quite insignificant. A manometer may also be inserted through the digester wall to control the subatmospheric pressure. In using a suction pump of a common type it is easy to maintain a pressure as low as 50 mm. Hg or even lower. Still a pressure of 100 mm. Hg might be quite sufficient to the purpose in question.

Preferably a relatively large vacuum tank is inserted between the pump and the digester, In such case when the pump stops for a short time this will not affect the pressures in the digester. Of course, a cut-off valve is inserted between the pump and the tank.

If desired more than one digester may make use of the same pump. In this case the exhaustion pipe lines leading to the several digesters may be put into communication with a single vacuum tank connected to the suction side of the pump. Valves are also inserted in the lines leading to the digesters so that a digester may be shut off, if required. Thus any leakage in a digester space may be controlled by closing the valve in such a suction conduit and observing the manometer mounted on the digester connected to that conduit.

In the drawings there are shown some embodiments according to the invention though it is evident that these constructions are not to be considered as limitative of the invention.

Fig. 1 is a diagrammatic view of a common digester, as seen in longitudinal section, and provided with the arrangements according to the invention.

Fig. 2 is an enlarged vertical sectional view of the portion of the digester shown in Fig. 1 showing details of the digester wall-lining construction;

Fig. 3 is a similar view showing a modified form of digester wall, and

Fig. 4 is a similar view showing another modified construction.

Similar reference numbers refer to similar details in the different figures.

5 designates a digester of common type having inlets **5***a*, **5***b* and outlets **5***a'*, **5***b'* for liquid, wood chips and pulp. **6** is the digester wall and a lining **7** of stainless steel is fixed thereto by welds **8**.

As seen in Fig. 1, welding joints are provided around said inlets and outlets and also along the middle periphery of the digester. Said lining may be made from a relatively thin sheet material and is mounted so as to form a narrow space between it and the adjacent wall.

As seen in Fig. 2 such a narrow space may be in itself

sufficient under certain conditions, as described above. In Fig. 3, however, peripheral grooves **9** are formed in the digester wall **6** to ensure a continuous space. According to Fig. 4 the space is somewhat wider and a supporting metal netting **10** is put in it.

Returning to Fig. 1, a pipe line **11** connects said digester space to a vacuum tank **12**. **13** indicates a branch leading to a second digester (not shown). A pipe line **14** connects the tank **12** to a suction pump, **15** the outlet or pressure side of which ends in a water trap indicated by **16**. A valve **17** is inserted in line **11** and another valve **18** is inserted in line **14**. A manometer **19** is inserted through the digester wall **6**.

We claim:

1. A digester for cooking lignocellulosic material adapted to be subjected to subatmospheric pressure comprising an outer rigid casing, a relatively thin elastic stainless steel lining disposed concentrically adjacent the inner surface of the walls of said casing but providing a substantially continuous narrow space therebetween, said space being of substantially the same width along substantially all of the surface of said lining and being sufficiently small in width on all sides of the lining that the elastic limit of the stainless steel lining is not exceeded when said lining is pressed from its normal spaced position into engagement with the surface of the casing walls, said lining being supported by said walls of the casing and receiving support from said rigid casing on all sides, a vacuum pump, and a conduit connecting said vacuum pump with said space.

2. A digester for cooking lignocellulosic material as defined in claim 1, wherein the inner surface of the walls of said casing is formed with peripheral grooves.

3. A digester for cooking lignocellulosic material as defined in claim 1, wherein a metal netting is inserted in said space between said casing and said lining.

4. A digester for cooking lignocellulosic material as defined in claim 1, wherein said casing is provided with inlets and outlets and said lining is attached to said inlets and around said outlets and at points along the middle periphery of the casing.

5. A digester for cooking lignocellulosic material as defined in claim 1, wherein a vacuum tank is interposed between said suction pump and said space.

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