

Feb. 20, 1923.

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1,446,097.

INSTRUMENT FOR RECORDING DIFFERENTIALS IN PRESSURES.  
ORIGINAL FILED JAN. 6, 1921.

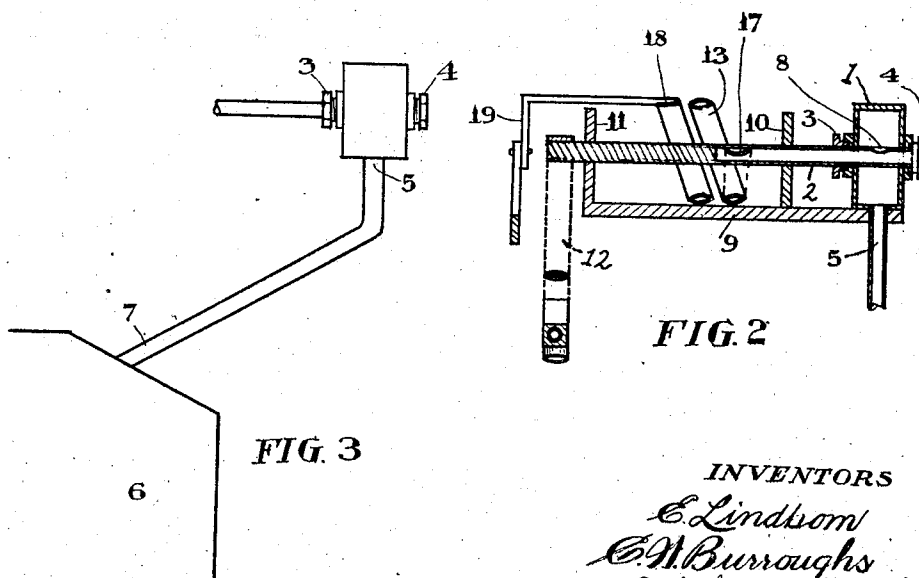
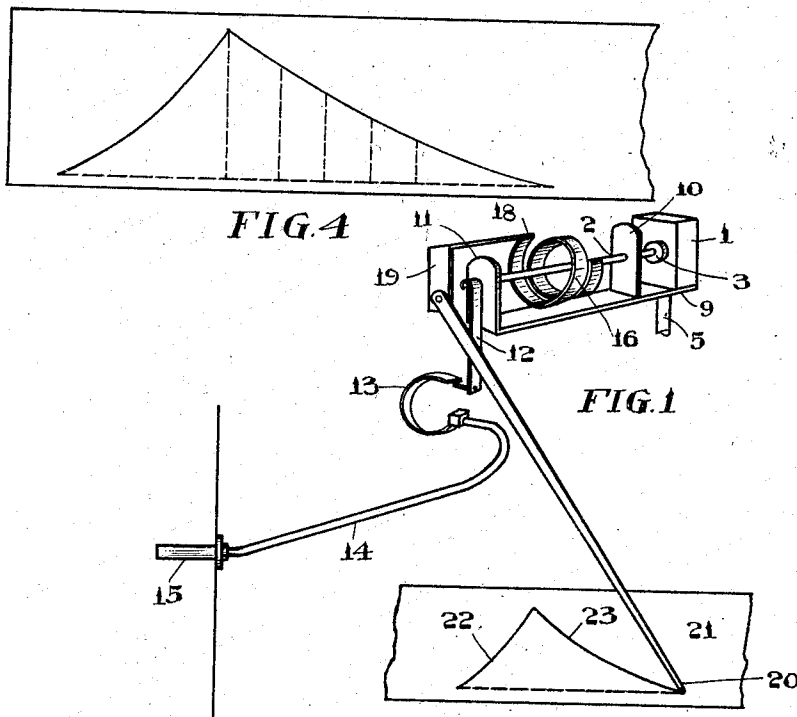


FIG. 3

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## UNITED STATES PATENT OFFICE.

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## INSTRUMENT FOR RECORDING DIFFERENTIALS IN PRESSURES.

Application filed January 6, 1921, Serial No. 435,509. Renewed November 20, 1922.

*To all whom it may concern:*

Be it known that we, ENOCH LINDBOM, a subject of the King of Sweden, and residing in the village of Chandler, in the Province of Quebec, in the Dominion of Canada, and CHARLES WESLEY BURROUGHS, a subject of the King of Great Britain, of the city and district of Montreal, in the Province of Quebec, in the Dominion of Canada, have invented a new and useful Instrument for Recording Differentials in Pressures, of which the following is the specification.

The invention relates to a pressure recording instrument, as described in the present specification and illustrated in the accompanying drawings that form part of the same.

The invention consists essentially in the novel means employed whereby the pressures of two fluids are relatively recorded on a chart in order that the reader may readily differentiate between the component pressures within said container.

The objects of the invention are to automatically record the difference between the total pressure and the pressure due to steam, which difference is called the gas pressure existing within a digester used in the cooking of pulp incident to the manufacture of paper and paper boards; to establish a permanent record that may be read from time to time and the conditions altered or changed without resorting to abstruse calculations following the reading of the pressure gauges and thermometers; to facilitate the operations in pulp mills or in any other place where like pressures may exist within a container; and generally to provide a reliable instrument useful in any art where the pressure due to the steam and the other component of the total pressure are to be differentiated.

In the drawings, Figure 1 is a perspective view of the instrument as applied to a digester in a pulp mill.

Figure 2 is a sectional view of a receiving box for the gas or liquor from the digester or container.

Figure 3 is an enlarged longitudinal sectional view of the instrument.

Figure 4 is a diagram showing the markings from which the results are gathered.

Like numerals of reference indicate corresponding parts in each figure.

Referring to the drawings, the receiving box 1 is mounted on the hollow shaft 2 between the packings 3 and 4, said box 1 having an inlet 5 at the lower end connected to the digester 6 at the outlet 7 from the upper end or side of this digester. The hollow shaft 2 has an inlet 8 within the box 1 and the box itself is preferably filled with glycerine or other suitable substance to prevent the corrosive liquor from coming in contact with the moving parts of the instrument.

The box 1 is supported on the base 9 at one end thereof, and the brackets 10 and 11 form the bearings for the extended portion of the shaft 2, and beyond the bracket 11 the lever 12 is secured to the shaft, and this lever is connected to a hollow pressure gauge element 13, usually known as a Bourdon tube, and which may be used in the helical form. This tube is connected to the fine bore capillary tube 14, and the latter terminates in a water-filled thermometer bulb 15, which in use is inserted through the wall of the digester intermediate of the height of said wall.

The expansion tube 16 is a hollow tube of the Bourdon type, and communicates with the interior of the shaft 2 through the outlet 17 in said shaft, said tube 16 being in helical form, and terminating in a closed end 18, which is secured to a bracket extension 19 in angular form and carrying the recording pen 20.

In describing the operation of this instrument, it must first be understood that in a digester in which the wood pulp is cooked, the gas generated from the acid liquor accumulates particularly at the upper end of the container, and eventually this pressure becomes so great, if not relieved, that the steam necessary for cooking purposes cannot enter, resulting in the stoppage of the treatment to the wood pulp, but it is a customary thing to have at the upper end of the container a pressure gauge indicating or recording the total pressure within the container, and a thermometer intermediate of the height of said container.

The present invention has to do with automatically finding and recording the pressure due to the gas liberated from the said liquor within the container, so that the continuous treatment of the wood pulp will not be interrupted, for the conditions in the

interior of the container may be read at any time by the attendant, and in this instrument the gas accumulating in the upper portion of the container, and generated from the acid liquor, flows into the receiving box of the instrument, and in this box it immediately, and together with the glycerine, causes the expansion of the Bourdon tube 16, with the result that this tube partially uncoils and draws the recording pin 20 partially across the chart 21, as shown by the line 22, but the rise of the temperature, due to the ingress of the steam, results in a second pressure, indicated by the heating of the water-filled thermometer bulb 15. The steam generated by the heating of this water flows through the steam pipe 14 into the C-shaped Bourdon tube, which it expands, and the expansion of said tube tends towards straightening out, which draws on the lever 12, and turns the shaft. This action will immediately change the direction of travel of the pin 20 on the chart 21, result being a line as indicated by the numeral 23, as of course the chart is travelling continuously during the operation of the instrument.

This chart is shown as a ribbon form of chart, but it is more than likely that a circular chart will be used in place thereof. The differential is found by drawing an imaginary line from the beginning of the chart line 22 to the end of the chart line 23, and from this base line measurements may be made to the line 23, and this will give the differential in the pressures.

What I claim is:

1. In an instrument for recording differentials in pressures, a container having two sources of fluid pressures, a curved tubular member communicating with said container and adapted to uncoil coincidentally with the increase of pressure, a pen sup-

ported from an end of said tubular member, a second tubular member adapted to uncoil, and communicating with said container, and operatively connected with said pen to change its direction, and a chart blank under said pen.

2. In an instrument for recording differentials in pressures, a pulp digester having a gas outlet, a travelling chart, a pen in contact with said chart, a bracket supporting said pen, a coiled tubular member secured at one end to said bracket and adapted to uncoil coincidentally with gas pressure from said digester, a hollow rotatable shaft communicating with said tubular member and with said digester, a tubular coil spring operatively connected to said shaft, and a steam pipe having a generating bulb end adapted to be inserted into the digester.

3. In an instrument for recording differentials in pressures, a pulp digester having a gas outlet, a travelling chart, a pen in contact with said chart, a bracket supporting said pen, a helical spring tubular member secured at one end to said bracket, a hollow shaft suitably supported and journaled and having inlet and outlet openings, the latter communicating with said tubular member, a receiving box containing a comparatively dense fluid and enclosing the shaft at the inlet opening and communicating with the digester, a base supporting said box and shaft bearings, a lever at one end of said shaft, a tubular C-spring operatively connected to said lever, a steam pipe connected to said C-spring and a water filled thermometer bulb connected with said steam pipe and inserted in said digester.

Signed at Montreal, Quebec, Canada, this 31st day of December, 1920.

ENOCH LINDBOM.

CHARLES WESLEY BURROUGHS.