

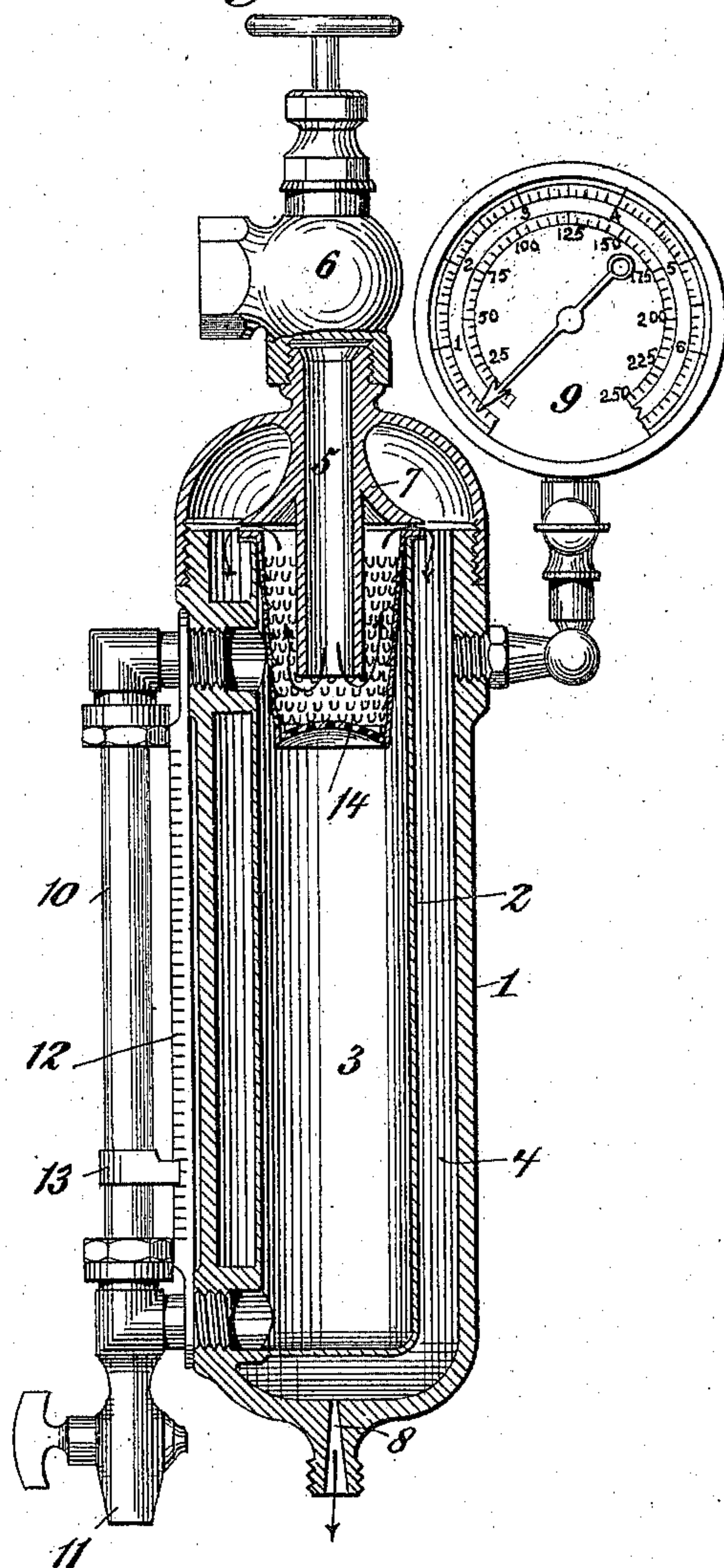
(No Model.)

R. C. CARPENTER.  
SEPARATING CALORIMETER.

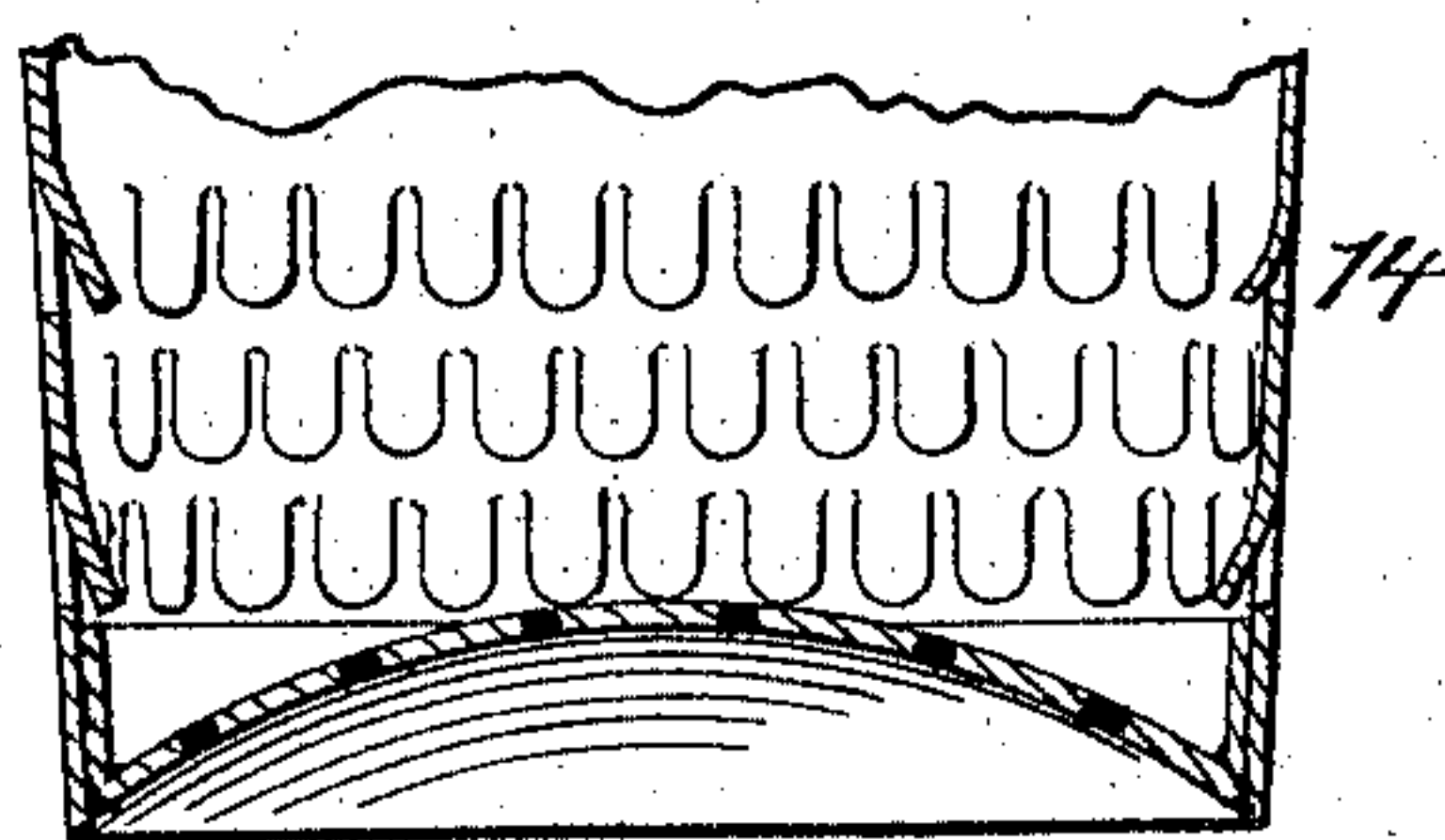
No. 575,391.

Patented Jan. 19, 1897.

*Fig. 1,*



*Fig. 2.*



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## SEPARATING-CALORIMETER.

SPECIFICATION forming part of Letters Patent No. 575,391, dated January 19, 1897.

Application filed February 7, 1896. Serial No. 578,321. (No model.)

*To all whom it may concern:*

Be it known that I, ROLLA C. CARPENTER, a citizen of the United States, residing at Ithaca, in the county of Tompkins and State of New York, have invented certain new and useful Improvements in Separating-Calorimeters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to steam-calorimeters used for determining the percentage of moisture present in the steam, and particularly to separating steam-calorimeters and to a separator particularly adapted for use therein, and which produces a very thorough separation of the moisture from the steam.

The calorimeter herein described is a modification of and improvement upon the separating-calorimeter shown and described in Letters Patent granted to me on March 21, 1893, No. 494,057. In that calorimeter steam is passed through a separator in which the moisture present in the steam is separated therefrom, and this moisture is collected, dry steam from the separator passing into a condensing-chamber, where it is condensed and collected. By measuring the relative quantities of moisture and of condensed steam it is then possible to determine the percentage of free moisture present in the steam before it entered the calorimeter. In my present calorimeter I have improved the construction of the separator, and have provided a more simple, convenient, and easy method of determining the quantity of dry steam which passes from the calorimeter and which does not require a condensing-chamber to be used with the calorimeter, so that thereby the instrument is rendered much more compact and portable.

My invention therefore consists in the novel construction of the separator used, in the novel means provided for determining the quantity of dry steam passing from the calorimeter, and in the novel combination, construction, and arrangement of the parts of the apparatus.

The objects of my invention are, first, to

provide a separating steam-calorimeter which shall produce, as perfect as possible, separation of the moisture from the steam; second, to provide improved means for determining the quantity of dry steam passing from the calorimeter, by which the quantity of such dry steam may be measured more readily than has heretofore been possible, and, third, to provide a separating steam-calorimeter, which shall be more compact, simple, and portable than the calorimeters heretofore used. These objects are attained in the calorimeter herein described, and illustrated in the drawings which accompany and form a part of this application, in which the same reference-numerals indicate the same or corresponding parts, and in which—

Figure 1 is a central vertical section of the calorimeter, and Fig. 2 is an enlarged detail section of the perforated separating-cup used in the separator to obtain more complete separation of the moisture from the steam.

In my present calorimeter, in order to determine the quantity of dry steam passing through the calorimeter in any given unit of time, I have availed myself of the well-known fact that the quantity of steam at any known pressure passing through an orifice of known area within any given unit of time may be calculated with great accuracy. In my present calorimeter I cause the steam leaving the separator to pass through an orifice of known area, and I attach to the calorimeter a pressure-gage, showing the pressure of the steam before it passes through this orifice. Since the quantity of steam passing through this orifice in any given unit of time will always bear a definite known ratio to the pressure of the steam, I graduate this gage to show the quantity of steam passing through the orifice within the selected unit of time for the various steam-pressures which may be indicated by the gage. It is therefore possible at any time to read directly from the gage the quantity of steam passing through the orifice of the calorimeter within the unit of time.

My calorimeter, like most steam-calorimeters, is designed to be connected to the main steam-pipe or other source of supply of the



steam to be tested, and a small portion of the steam from this pipe is passed through the calorimeter and thence into the atmosphere.

In the drawings, 1 is a tubular casing constituting the outer casing of the calorimeter.

2 is a second tubular casing within the casing 1, and which constitutes the separator, having within it a chamber 3, in which the separated moisture is collected. The chamber 4, between the casings 1 and 2, constitutes a steam-jacket, which by surrounding the casing 2 prevents condensation therein, which, did it take place, would cause the calorimeter to show an abnormally high percentage of moisture in the steam.

5 is a tube forming a part of the top of the casing 1 and projecting downward into the interior of the casing 2 for a short distance and through which steam is admitted into the calorimeter, the admission of steam being controlled by a valve 6.

The tube 5 is provided with a deflector-plate 7, which covers the top of the casing 2, leaving but a small space for the passage of steam, and serves to prevent moisture which may condense at the top of the casing 1 from entering the chamber 3, and also causing the steam to pass through a narrow slit at right angles to its direction of movement to produce separation of the moisture from the steam.

8 is a small orifice at the bottom of the casing 1, through which the steam from the steam-jacket may escape.

9 is a pressure-gage connected with the steam-jacket, which, as before explained, is graduated to indicate the quantity of steam passing through the orifice 8 at each steam-pressure which may exist within the jacket 4.

10 is a gage-glass connected at the top and bottom with the chamber 3 and having at its lower end a drainage-cock 11, by which the gage-glass and the chamber 3 may be emptied. By the side of the gage-glass is a scale 12, which may be divided to show the quantity of water present in the chamber 3 and gage-glass 10, and to facilitate reading from the scale there may be mounted upon the gage-glass a sliding marker 13.

14 is a cup suspended within the chamber 3 and surrounding the tube 5. It is open at the top and its bottom and sides are perforated, the perforations in the sides being formed by bending inward portions of the side of the cup, so as to form projecting burs, which will engage the moisture carried upward along the side of the cup.

The operation of my calorimeter is as follows: The calorimeter being connected to the main steam-pipe or other source of supply of steam to be tested, steam is admitted through the tube 5 and passes downward into the cup 14 and thence upward into the steam-jacket 4, through the narrow slit between the top of the casing 2 and the deflector-plate 7. In its passage from the tube 5 into the steam-jacket 4 the steam is thus compelled to make two abrupt turns. The inertia of the moisture

being greater than that of the steam the effect of this change of direction of the flow of steam is to throw the greater portion of the moisture directly downward through the perforations in the bottom of the cup 14 into the chamber 3, while a portion of the remaining moisture is carried against the sides of the cup 14 and is caught by the burs in these sides, by which it is thrown back to the bottom of the cup or is caused to pass out through the perforations in the cup into the chamber 3. The moisture all falls into the chamber 3, however, the steam rising and passing through into the steam-jacket 4. If any moisture be carried by the steam past the burs of the cup 14, it will be thrown up against the deflector-plate 7 and will trickle down into the cup 14, so that no moisture can be carried over into the steam-jacket 4. From the steam-jacket the steam passes out through the orifice 8 into the atmosphere, and, if desired, may be led away to a convenient point, the casing 1 being provided with a nipple for the attachment of tubing for this purpose. By noting the rise of the water-level in the gage-glass 10 within a selected unit of time the quantity of moisture which has been collected in the chamber 3 within that time may be read from the scale 12. The reading of the pressure-gage shows directly the amount of dry steam which has passed from the calorimeter within the same unit of time, and from these two quantities the percentage of the moisture present in the steam may be determined.

It is evident that the perforated cup 14 may be used in other types of separators than separating-calorimeters alone, and I do not limit myself to the use of such perforated cup in separating-calorimeters alone.

Having thus completely described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a calorimeter, the combination, with a steam-separator, means for collecting the moisture separated, and an orifice through which the dry steam escapes, of a pressure-gage connected with the calorimeter and adapted to indicate the quantity of dry steam flowing through said orifice, substantially as described.

2. In a calorimeter, the combination, with a steam-separator, means for collecting the moisture separated, a steam-jacket surrounding said separator and arranged to receive the dry steam therefrom, and an orifice in said jacket through which the dry steam may escape, of a pressure-gage connected with said jacket, and adapted to indicate the quantity of steam flowing therefrom, substantially as described.

3. In a steam-separator, the combination, with a separating-chamber, open at one end, and a steam-pipe projecting into the open end of said chamber, of a cup fitting into the end of said chamber and inclosing the end of said steam-pipe, having perforations through which moisture may pass into the separating-



chamber, and having in its sides projecting burs arranged to catch the moisture thrown to the outside of the current of steam, substantially as described.

5 4. In a steam-separator, the combination, with a separating-chamber, open at the top, and a steam-pipe projecting downwardly into said chamber, of a cup suspended from the sides of said chamber and surrounding the  
10 end of said steam-pipe, having perforations through which moisture may pass into the

separating-chamber, and having on its sides projecting burs arranged to catch the moisture thrown to the outside of the ascending current of steam, substantially as described. 15

In testimony whereof I affix my signature in presence of two witnesses.

ROLLA C. CARPENTER.

Witnesses:

S. E. BANKS,

WM. HAZLITT SMITH.