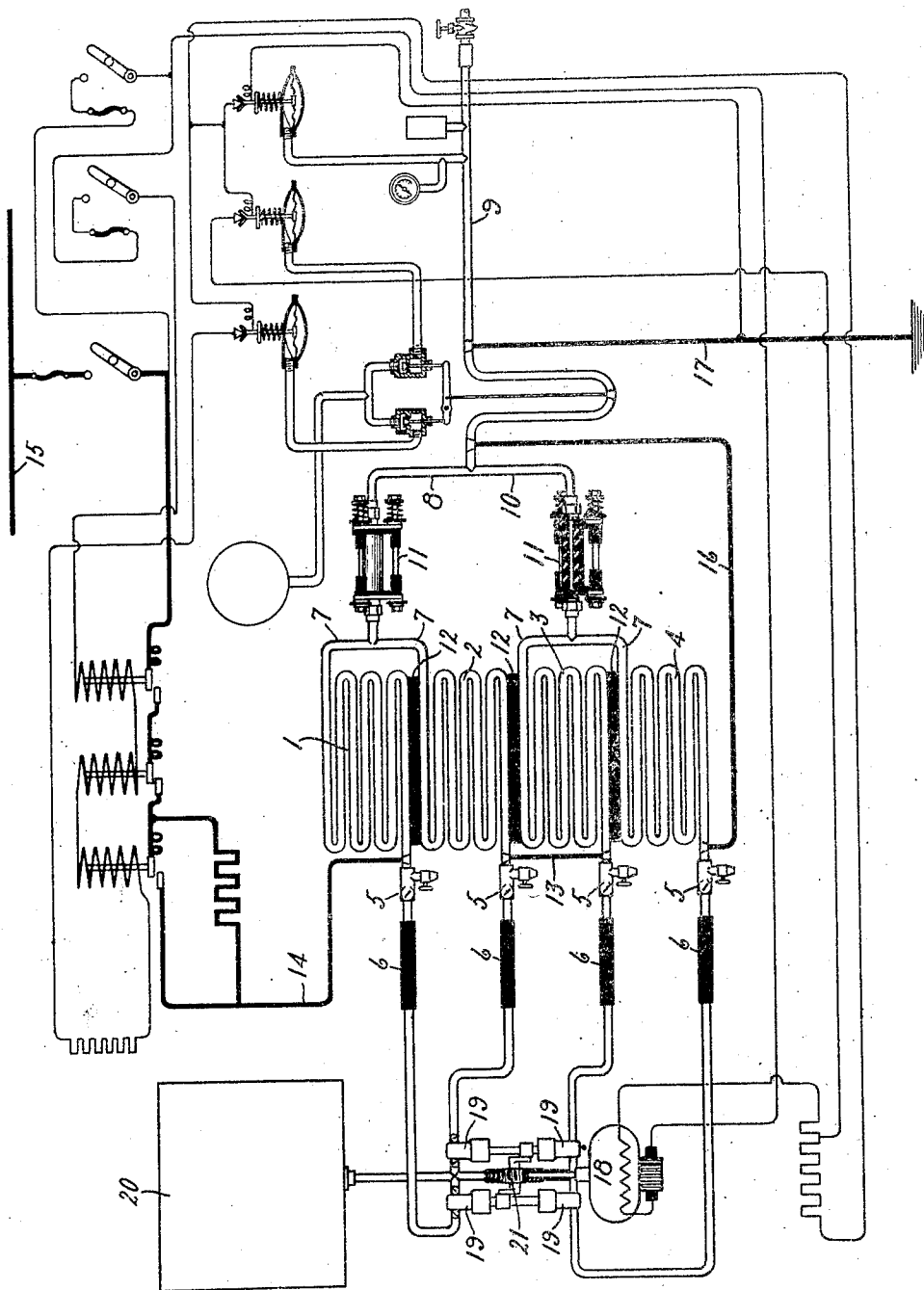


A. F. BATCHELDER.
ELECTRIC STEAM HEATING SYSTEM.
APPLICATION FILED SEPT. 28, 1908.

1,019,413.

Patented Mar. 5, 1912.



Witnesses:

George W. Tilden
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Asa F. Batchelder,
by *Allen B. Davis*
Att'y.

UNITED STATES PATENT OFFICE.

ASA F. BATCHELDER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC STEAM-HEATING SYSTEM.

1,019,413.

Specification of Letters Patent.

Patented Mar. 5, 1912.

Application filed September 28, 1908. Serial No. 455,164.

To all whom it may concern:

Be it known that I, ASA F. BATCHELDER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Steam-Heating Systems, of which the following is a specification.

This invention relates to appliances for generating low pressure steam for heating purposes. Since the heating agent is an electric current transmitted along the coiled pipe constituting the steam generator, the invention is especially applicable to the heating of electric railway cars.

In order to produce sufficient resistance to the passage of the electric current, the pipe must be of considerable length. But this involves, on the other hand, a high pressure to force the water through the generator, owing to the hydraulic friction to be overcome, which is proportional to the length of the pipe and the square of the velocity. In order to avoid this, I divide the pipe into sections and connect them in parallel, so that the water will be pumped through each section independently of the others, each having its own inlet and delivery connections. The several delivery pipes are all connected to one steam distributing main. The sections of the generator are, however, all connected in series electrically, so that the heating effect is the same as though they constituted one continuous pipe, although the frictional resistance to the flow of the water is very much less.

The accompanying drawing is a diagrammatic illustration of a steam heating system embodying my invention.

For the sake of perspicuity, I have illustrated more than the mere generator, in order that its place in the system may be clearly understood. The control circuits and devices are substantially the same as are set forth in the patent of Hermann Lemp, No. 919,366.

My improved steam generator is composed of a plurality of sections of tubing, preferably bent or coiled into compact form. For convenience, I have shown four sections 1, 2, 3, 4, arranged in a tier and each containing the same length of tubing coiled in the same manner. Each section has its own supply pipe 5 in which is an insulating length or joint 6. The delivery pipes 7 of

the sections 1 and 2 are connected to a pipe 8 which delivers steam to the steam main 9. Sections 3 and 4 are similarly connected by a pipe 10 with the steam main 9, which is preferably of the same size of pipe as the sections. In each of the pipes 8, 10 is an insulating joint 11, which forms the subject of a separate application for patent. The sections are separated from each other by interposed insulating material 12. Thus the generator as a whole is electrically insulated from the rest of the system by the lengths of insulating pipe 6 on one side, and the insulating joints 11 on the other side. On the other hand, the tubing composing the sections is all in series electrically, the supply pipes of sections 2 and 3 being connected by a conductor 13. A conductor 14 is brought from a supply main 15 and connected to the inlet of section 1, the circuit being completed through a conductor 16 running to the steam main and a ground connection 17 therefrom. The heating current will thus traverse the sections in series, and the electrical resistance of the entire length of tubing in said sections is available for heating the tubing and its contents.

Water is supplied to the generator by a pump driven by a motor 18. I prefer to use a multiple-cylinder pump, having one cylinder 19 for each section of the generator, each cylinder drawing water from a tank 20. The pump plungers may all be driven by a double crank-shaft 21 geared to the motor. Each cylinder delivers one quarter of the total quantity required by the generator. If all the water had to be forced through the entire length of the pipe it would flow through a conduit having four times the length of that provided by my arrangement. The velocity would, therefore, have to be four times as great in order to deliver a given quantity of water in a given time. The friction of water flowing in a full pipe of a given unit of length is proportional to the square of the velocity. Therefore, in my parallel-pipe system the friction in any given unit of length is but one-sixteenth of that in a single pipe; and since each pipe is but one-fourth the length of the single pipe the pressure required in my system is but one-sixty-fourth of that required in a continuous pipe generator of the same size.

The temperature of the steam at the delivery end of the generator is the same in

both systems, because the low velocity in each section exactly compensates for the shorter length.

It has been found in practice that my multiple-section generator gives the same output of steam as a continuous-pipe generator, but requires a much less expenditure of power to force the water through it, so that it is a far more efficient piece of apparatus.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is—

1. The combination with a plurality of sections of piping each having a separate inlet, of a common main into which said sections deliver, a separate pumping device

connected with each inlet, and means for sending an electric current through said sections in series.

2. The combination with a plurality of sections of piping each having a separate inlet, of a common main, of the same sized piping, into which said sections deliver, pumping mechanism connected with said inlets, insulating joints separating said sections from the pumping mechanism and the delivery main, and an electric circuit in which said sections are connected in series.

3. The combination with a plurality of sections of piping, all of the same size, length and number of bends, of a multiple-cylinder pump having its cylinders connected respectively with said sections, and an electric circuit including said sections in series.

In witness whereof, I have hereunto set my hand this 26th day of September, 1908.

ASA F. BATCHELDER

Witnesses:

BENJAMIN B. HULL,

MARGARET E. WOOLLEY.