

W. S. BELLOWS.
WEB DRYING APPARATUS.
APPLICATION FILED JULY 12, 1902.

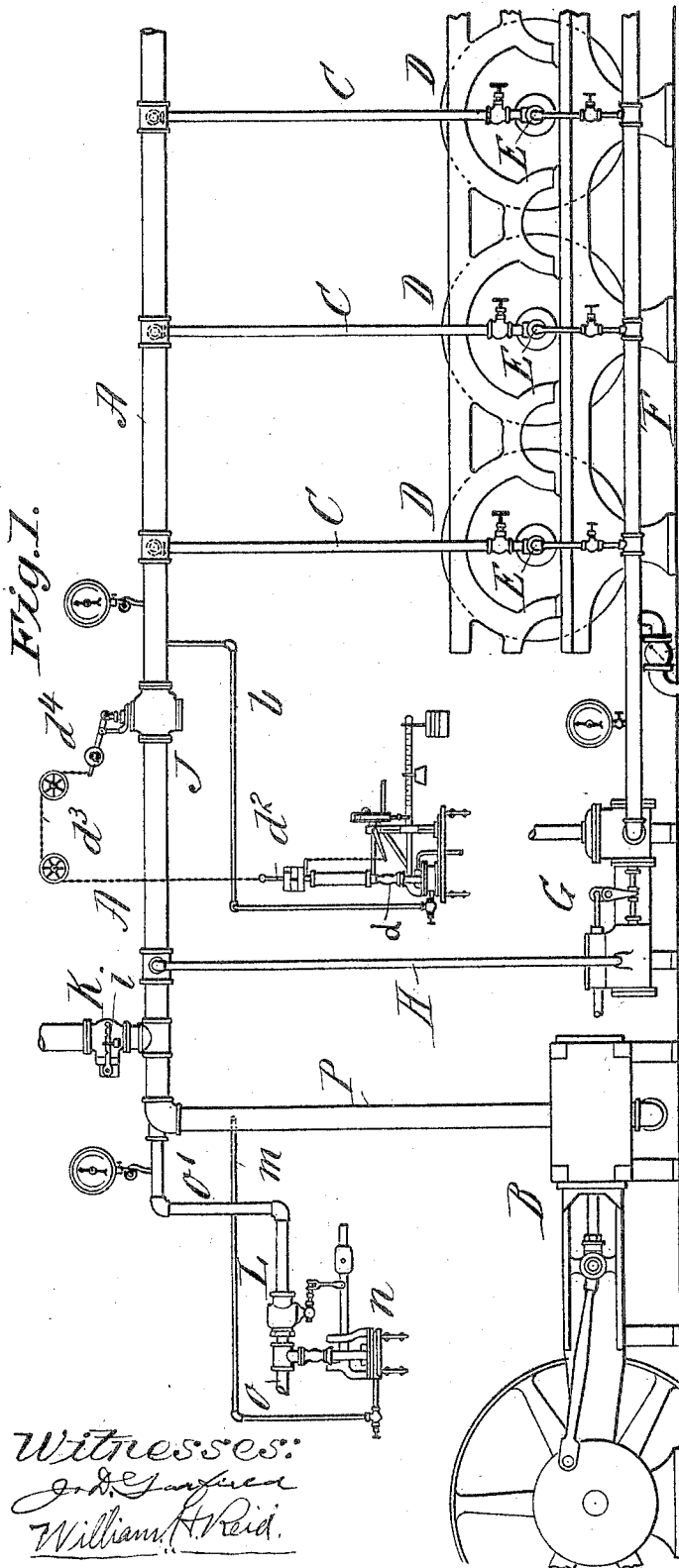
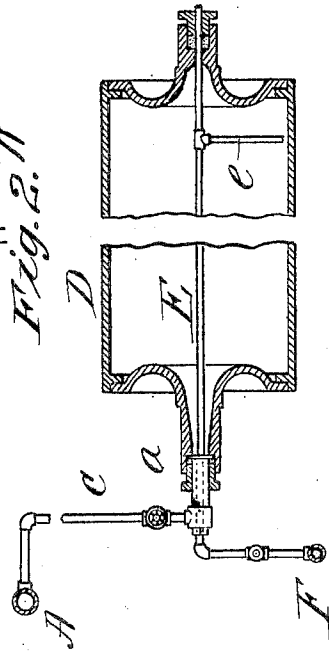


Fig. 1.

Fig. 2.



Witnesses:
J. D. G. [unclear]
William H. Reid.

Inventor:
W. S. Bellows

UNITED STATES PATENT OFFICE.

WILLIAM S. BELLOWS, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR
TO THE CALORIC TRANSFER COMPANY, OF SPRINGFIELD, MASSACHU-
SETTS, A CORPORATION OF MASSACHUSETTS.

WEB-DRYING APPARATUS.

No. 802,441.

Specification of Letters Patent.

Patented Oct. 24, 1905.

Application filed July 12, 1902. Serial No. 115,263.

To all whom it may concern.

Be it known that I, WILLIAM S. BELLOWS, a citizen of the United States of America, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Web-Drying Apparatus, of which the following is a full, clear, and exact description.

This invention relates to apparatus used in combination with the web-drying cylinders of paper-machines.

The object of the invention is to provide means whereby the drier-drums may be kept at any desired temperature by maintaining therein any pressure as may be predetermined to correspond to the kind of paper being dried, whether the pressure be one below atmospheric pressure in some cases and more or less above atmospheric pressure in others, and whereby steam from high and low pressure sources may be available to maintain an adequate maximum pressure automatically at one end or portion of the steam feed-pipe for the driers, and whereby in the portion of the feed-pipe connected to the driers the pressure of steam being supplied thereto will be automatically and uniformly maintained at the more or less lowered pressure, and also whereby at the same time water of condensation from the steam introduced into the cylinders will be withdrawn; and the invention consists in the combinations and arrangements of parts and appliances in the apparatus, all substantially as hereinafter described, and set forth in the claims.

In the drawings, Figure 1 is an elevation of an apparatus embodying my invention. Fig. 2 is a vertical section taken axially through one of the cylinders and showing the connecting-pipes.

Like characters of reference indicate the same parts in both views.

A steam-main A, provided with low-pressure steam from a suitable source, preferably from the exhaust-ports of the steam-engine B, is connected with a series of drying-cylinders D D by pipes C C, respectively. The pipes C connect with the cylinders axially, as indicated at *a* in Fig. 2, leading into the interior of the cylinders.

Each of the cylinders has an outlet-pipe E, all of such pipes being connected with a return-main F. Each pipe E has a dependent

leg *e*, whose free end is located a short distance from the bottom of the cylinder, which pipe serves as an outlet for the water of condensation in the cylinders. The construction and arrangement of the cylinders with their inlet and outlet pipes form the basis of another application filed by me July 12, 1902, and bearing Serial No. 115,265.

I provide a suitable suction apparatus, such as a vacuum steam-pump G, for the exhausting of water of condensation from the cylinders through the pipe F. The steam-pump may be driven by steam from the same source that supplies the engine B. The exhaust from the steam-pump is conducted by the pipe H to the feed-pipe A and serves to assist the exhaust from the engine B in heating the cylinders.

There is a valve J, located in the feed-pipe A, herein termed the "automatic feed-valve," the same being in practice a reducing-valve of any of the well-known constructions of reducing-valves having an automatic regulator or controller *d* therefor, which comprises a diaphragm in a case, to which case is connected a pipe *b*, which extends thereto from connection with the feed-pipe A at a portion thereof forward of the automatic feed-valve J—that is, at a point between the feed-valve and the drying-cylinders. The diaphragm-rod *d*², through the chain *d*³ and lever *d*⁴, serves to open the feed-valve J when the pressure in the feed-pipe A falls below a certain predetermined limit, and when the pressure exceeds this limit the diaphragm will cause the feed-valve J to close either partially or completely until the excess of pressure is removed. This diaphragm-controller may be of any suitable or preferred form and is preferably made adjustable by weights or otherwise, so that different pressures may be obtained in the feed-pipe A. Inasmuch as under some conditions the pressure of the exhaust-steam in the feed-pipe is insufficient to properly heat the cylinders, provision is made for introducing steam under a higher pressure—for instance, from the boiler or source of steam that operates the engine B. For this purpose I provide a valve L, which may be connected by the pipe O' with high-pressure steam and by the pipe O with the feed-pipe A. Any desired form of controlling-valve, such as a diaphragm-valve *n*, connected with the exhaust-steam pipe P

by a pipe *m*, may be arranged to open the valve L when the pressure of steam in the pipe P falls below a predetermined limit and which will close the valve L when the desired pressure is restored in the exhaust-steam pipe P. In the feed-pipe A, between the said reducing feed-valve J and the place of admission of live steam through the pipe O', is a relief-valve or safety-valve K, in order that when the pressure of steam in the pipe A exceeds a certain predetermined amount the valve K will open and permit steam to escape until the desired pressure is restored. The valve K is preferably located between the connection of the feed-pipe A with the exhaust-pipe H and the connection of the high-pressure-steam pipe O' with the feed-pipe.

If the pipe *m* were to have operating connection with the diaphragm-case *n* from the point in the steam-main A, at the right hand or forward of the automatic feed-valve J instead of at the left thereof, the ingress of the boiler-steam into that portion of the exhaust-steam main with which the conduit B, which governs the proper action of the feed-valve, has its connection, will be such as to defeat the proper automatic controlling and operation of such feed-valve primarily from the pressure conditions forward of the feed-valve in the main.

As an example of the practical operation of this apparatus the automatic feed-valve and its controlling appliances may be adjusted for the maintenance normally of one pound of steam-pressure in the main A forward of the feed-valve. The back pressure or release valve will be adjusted for the egress of steam from the valve K at the higher pressure of, say, five pounds pressure in the main A back of the feed-valve J, it being understood that by reason of the restricted way through said valve the pressure forward thereof is lowered to about the ratio indicated—that is, five to one—and the automatic valves K and L are to be relatively adjusted in such manner that the one, L, will open at a little lower pressure—say one pound less—than required back of the feed-valve J to cause the opening of the relief-valve K.

I provide in a branch of the vacuum-main F, located between the drying-cylinders and the steam vacuum-pump G, a check-valve W, so arranged that normally and during the operation of the vacuum-pump the partial vacuum created by the pump will operate to keep the valve W closed, such valve being operative in case anything should happen to render the steam-pump non-effective to open by the exercise of any suction at the lower end of the branch, which suction might in case of emergency be accomplished by a temporarily-connected suction-pump or otherwise.

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

1. In a web-drying apparatus of the class described, the combination with one or more rotary drying-cylinders, of a feed-pipe passing through a journal of each cylinder, a steam-supply pipe with which the feed-pipes are connected, a return-pipe having a separate connection with each drying-cylinder, a vacuum steam-pump connected with the return-pipe, a feed-valve located in the steam-supply pipe at a point between the connection of the steam-pump exhaust and the feed-pipe for the cylinders, and an automatic controller for said feed-valve, said controller being pipe-connected with the steam-supply at a point between the feed-valve and the cylinder feed-pipe.

2. In a drying apparatus of the character described, the combination with one or more rotary drying-cylinders, of a feed-pipe passing through a journal of each cylinder, a steam-supply pipe with which the feed-pipes are connected, a return-pipe having a separate connection with a journal of each drying-cylinder, a vacuum steam-pump connected with the return-pipe, and having the exhaust thereof pipe-connected with the steam-supply, a feed-valve located in the steam-supply pipe at a point between the connection of the steam-pump exhaust and the feed-pipe for the cylinders, and an automatic controller for said feed-valve, said controller being pipe-connected with the steam-supply at a point between the feed-valve and the cylinder feed-pipe.

3. In a drying apparatus of the character described, the combination with one or more rotary drying-cylinders, of a feed-pipe passing through a journal of each cylinder, a source of low-pressure steam with which the feed-pipes are connected, a return-pipe having a separate connection with a journal of each cylinder, a vacuum steam-pump connected with the return-pipe, a regulating feed-valve for controlling the flow of steam to the feed-pipes, an automatic controller for said valve, said controller being pipe-connected with the low-pressure-steam supply at a point between the feed-valve and feed-pipes, a source of high-pressure steam connected with the low-pressure-steam supply in rear of the said feed-valve, and a regulating-valve for controlling the admission of high-pressure steam, said latter valve being controlled by the low-pressure-steam supply.

4. In a drying apparatus of the character described, the combination with one or more rotary drying-cylinders, of a feed-pipe passing through a journal of each cylinder, a source of low-pressure steam with which the feed-pipes are connected, a return-pipe having a separate connection with a journal of each cylinder, a vacuum steam-pump connected with the return-pipe, and having the exhaust thereof pipe-connected with the source of low-pressure steam, a regulating feed-valve for controlling the flow of steam to the feed-pipes, an automatic controller for said valve, said

controller being pipe-connected with the low-pressure-steam supply at a point between the feed-valve and feed-pipes, a source of high-pressure-steam supply in rear of the said feed-valve, and a regulating-valve for controlling the admission of high-pressure steam, said latter valve being controlled by the low-pressure-steam supply.

5. In a drying apparatus of the character described, the combination of one or more rotary drying-cylinders each having a hollow journal, a feed-pipe communicating with said journals, a source of low-pressure steam connected with said feed-pipe, a source of high-pressure steam connected with said low-pressure-steam pipe, a return-pipe connected with the journals of the drying-cylinders, a vacuum steam-pump connected with said return-pipe, a valve located in said high-pressure-steam pipe, an automatic controller for said valve, pipe-connected with the low-pressure-steam pipe and operable to admit high-pressure steam into said low-pressure-steam pipe when the pressure in the latter falls below a predetermined amount, a pipe connecting the exhaust from said vacuum-pump with said cylinder feed-pipe between the admission to the latter of the high-pressure steam and said cylinders, and a feed-valve located in said feed-pipe between said cylinders and the place of admission into the feed-pipe of the exhaust from said vacuum-pump.

6. In a drying apparatus of the character described, the combination of one or more rotary drying-cylinders each having a hollow journal, a feed-pipe opening into a journal of each cylinder, a source of low-pressure steam connected with said feed-pipe, a source of high-pressure steam connected with said low-pressure-steam pipe, a return-pipe connected with the journals of the drying-cylinders, a vacuum steam-pump connected with said return-pipe,

an automatic valve located in said high-pressure-steam pipe and arranged to admit high-pressure steam into said low-pressure-steam pipe when the pressure in the latter falls below a predetermined amount, a pipe connecting the exhaust from said vacuum-pump with said cylinder feed-pipe between the admission therein of the high-pressure steam and said cylinders, a feed-valve located in said feed-pipe between said cylinders and the point of admission into the feed-pipe of the exhaust from said vacuum-pump, an automatic controller for said feed-valve, pipe-connected with a portion of the feed-pipe forward of such feed-valve, and an automatic relief-valve located in said feed-pipe between the admission therein of the high-pressure steam and the admission into the feed-pipe of the exhaust from said vacuum-pump.

7. In a drying apparatus of the character described, the combination with one or more drying rotary cylinders each having a hollow journal, a steam-feed pipe for the steam opening into a journal of each cylinder, a return-pipe connected with the said journals of the cylinders, a vacuum steam-pump connected with the return-pipe, a pipe connecting the exhaust from said pump with the feed-pipe, a branch pipe having connection with the return-pipe between the drier-cylinders and the pump and having a check-valve therein adapted normally to be held closed by the suction action of the vacuum-pump and operable to open upon a predetermined reduction of the vacuum in the return-pipe.

Signed by me at Springfield, Massachusetts, in presence of two subscribing witnesses.

WILLIAM S. BELLOWS:

Witnesses:

ANNIE V. LEAHY,
WILLIAM H. REID.