

UNITED STATES PATENT OFFICE.

CYRUS S. DEAN, OF CROWLAND, CANADA.

IMPROVEMENT IN TUBES AND FLUES FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 172,302, dated January 18, 1876; application filed July 1, 1875.

To all whom it may concern:

Be it known that I, CYRUS S. DEAN, of Crowland, in the county of Welland, Province of Ontario, in the Dominion of Canada, have invented certain new and useful Improvements in Tubes and Flues for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification.

In steam-boilers where the products of combustion pass through tubular flues surrounded by water, the products of combustion following the draft, whether in horizontal or vertical boilers, decrease or taper toward their exit, so that those portions of the tubular pipes remote from the fire-chamber are not sufficiently heated, and hence an unequal boiling takes place, the portions of the tubular pipes next to the fire-chamber being the hottest, and in very long boilers the exit extremities of the flues are of very little use. I remedy this defect by combining in the tubular pipes or flues a series of cylindrical stops at suitable distances apart, and of a diameter only sufficiently less than that of the tubular flues to permit the flames to pass over them. These stops are strung upon a pipe extending from the front one of the series, in which it is embedded through the smoke-stack box into the open air or an air-chamber, where it receives air or heated air, which passes into the flue through perforations therein immediately in rear of each stop, and unites with the flame, and aids the combustion. The cylindrical stops being of less diameter than the flues are supported therein by wings either upon the surface of the stops or upon the rod or tube. The products of combustion pass from the fire-chamber into the flues, and striking the conical front of the first stop are crowded into the annular space between said stop and the inner walls of the tubular flue; thence diving and receiving additional fuel from the heated air of the central pipe they are in a measure held back by the front end of the next stop, and whirl in the flue between the stops, and

thus pass over all the stops of the series, being, as it were, retarded and replenished between between each stop of the series, yet the flame is continuous. Thus it is that the products of combustion are forced to impinge alike upon the whole interior surface of the flues, while the stops serves also as radiators of the heat, and in their double function utilize to the fullest extent the heat passing through the flues.

In the accompanying drawings, Figure 1 represents a section of a horizontal tubular boiler embracing my invention; Fig. 2, a longitudinal section through one of the tubular flue-pipes of the series; Fig. 3, a detail view, in perspective, of one of the stops strung upon the carrying stem or rod; and Fig. 4, a cross-section through Fig. 2, the three latter views being on enlarged scales.

In the tubular flue-pipes *a* of the boiler I pass a central pipe or hollow stem, *b*, which carries, at intervals, which experience may approve, (preferably about twenty-two inches,) a series of fire-stops or arresters, *c*, which may be of cast-iron, fire-brick clay, or any fire-proof material. These stops *c* are cylindrical in form, and have their fronts or ends *c'* facing the onset of the flames of conical form, so as to permit of its refraction upward and over their peripheries. Said stops are of a diameter sufficiently less than the diameter of the tubular flues *a*, which inclose them to permit of the passage of the flames between their peripheries and the inner walls of said flues, and to admit of free draft. They arrest the flame, and cause it to dive and whirl in the free space between each, and thus to impinge upon the whole inner surface of the tubular flues, and insure a perfect and uniform heating of the water in the boiler, in pursuance of which the stops also serve as radiators of the heat. They are supported in the flues by the stem or pipe *b*, upon which they are strung, and by wings *d* cast with them or placed upon the pipe, and by which they are kept at an even distance from the inner walls of the flues, so as to secure an annular space for the passage of the products of combustion over the stops. The first one of the tubular stops is placed a little back of the tubular flue entrance, so as to permit of the ingress of full flame. The hollow

stem or pipe *b*, upon which the stops *c* are strung, extends from the first stop, in which it is embedded, on through the series of stops and the boiler-flue through the smoke-stack box to the open air, or into an air-chamber, from whence it receives air or heated air, which passes into the flues through openings *e* in said hollow stem immediately in the rear of each stop, and adds fuel to the products of combustion. Thus the flames, passing over and around the first stop from the fire-chamber, dive and receive additional fuel from the heated air passing through the hollow stem, which is consumed, and, whirling and impinging upon all sides of the inner flue within the space between this stop and the next, pass over and around the next stop, and so on throughout the series. In serving as stops for the heat within the flues said stops also become highly heated, and act as radiators, and thereby utilize, to the fullest extent, the heat passing through the flues. These stops may be made conical at both ends, thus giving increased facility for cleaning the flues by steam-jets at either or both ends.

The stops may be strung upon a rod and used without the central air-passage, if desired, and the supporting-wings *d* may be secured like spokes upon the rod, as their only function is to sustain the stops in their central position. The stops and their rod or tube may be removed together from the flues, when desired, for any purpose.

I claim—

1. The combination, with the tubes or flues

a of a tubular boiler, of a series of fire-stops, *c*, of less diameter than the inside of the tubes, and intermediate spaces thereby formed, whereby the flame and products of combustion are held or retarded in their passage through the flues within said spaces and between the stops, for the purpose of equalizing the heat throughout the flues, and constituting radiators within said flues.

2. A series of fire-stops, *c*, strung upon a pipe or stem, *b*, centrally within the tubes or flues *a* of a tubular boiler, to receive and arrest by turns the impingement of the body of the heat and flame while permitting of a continuous passage thereof through said flues.

3. The combination, with the fire-stops *c* and the intervening spaces, of the perforated hollow tubes *b e*, upon which the stops *c* are secured, for conducting air from the outer side directly within the flues, and within the spaces between the fire-stops for supplying oxygen to increase and continue the combustion within the flues.

4. The fire-stop *c*, provided with double conical ends to facilitate the cleaning of the tubes by steam-jets from either or both ends of the flues.

In testimony that I claim the foregoing I have affixed my signature in presence of two witnesses.

CYRUS S. DEAN.

Witnesses:

A. E. H. JOHNSON,

J. W. HAMILTON JOHNSON.