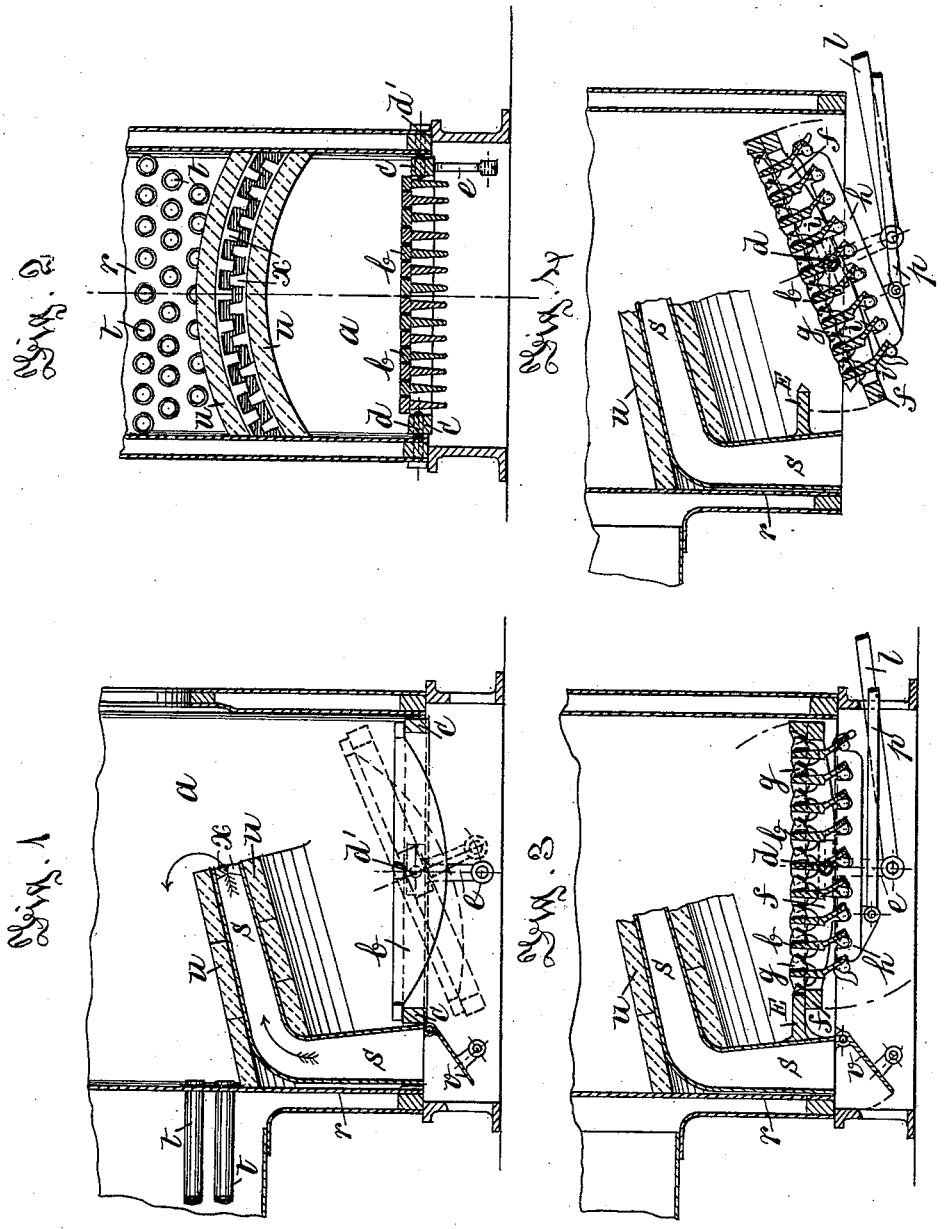
(No Model.)

2 Sheets—Sheet 1.

E. F. PADDON.

COMBUSTION APPARATUS.

No. 523,233. Patented July 17, 1894.



Witnesses:-
John A. Wilson.
Percy C. Bowen.

Inventor:-
Edwin F. Paddon
by Whitman & Wilkinson,
Attys

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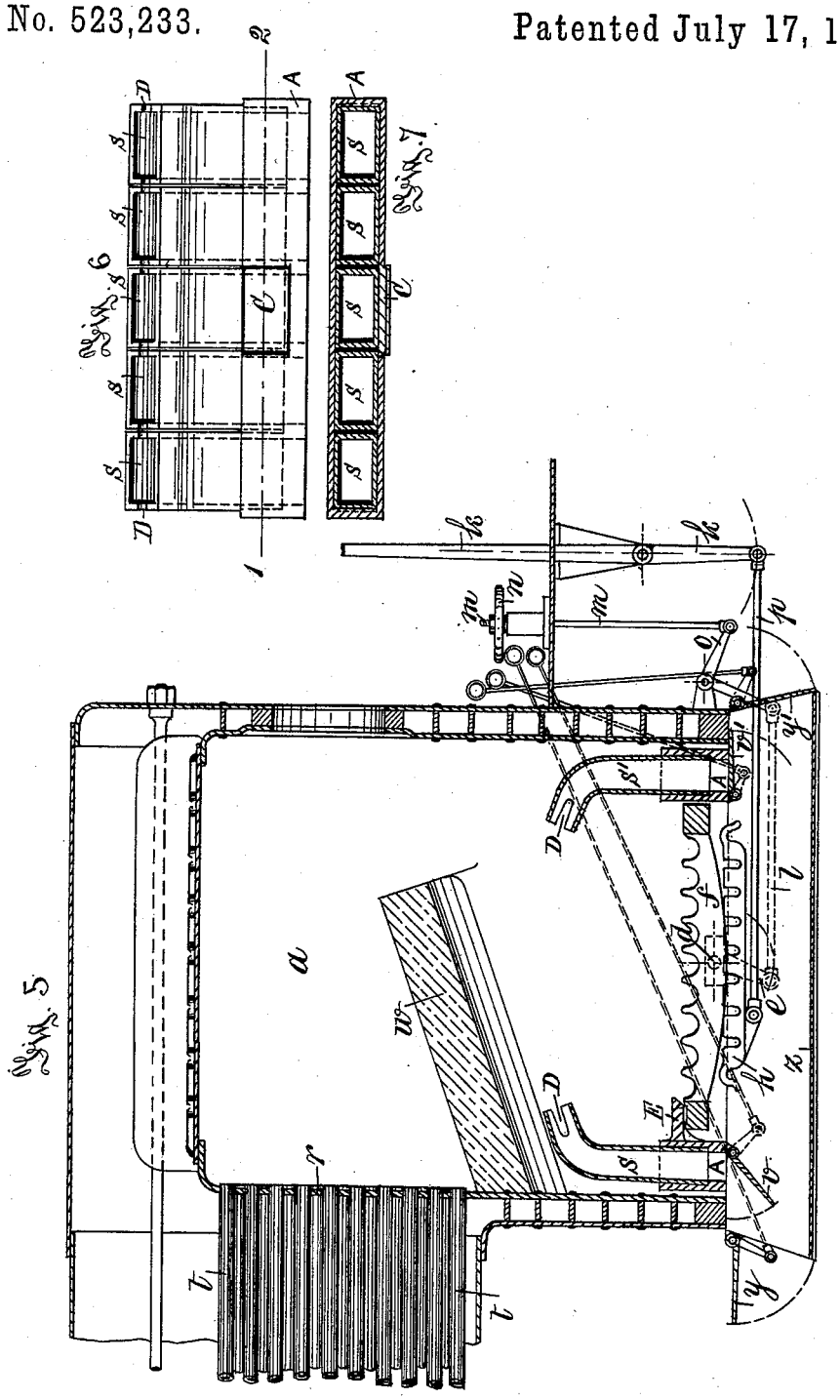

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UNITED STATES PATENT OFFICE.

EDWIN FAULKNER PADDON, OF LONDON, ENGLAND.

COMBUSTION APPARATUS.

SPECIFICATION forming part of Letters Patent No. 523,233, dated July 17, 1894.

Application filed February 7, 1894. Serial No. 499,405. (No model.)

To all whom it may concern:

Be it known that I, EDWIN FAULKNER PADDON, a subject of the Queen of Great Britain, residing at London, in the county of Middlesex, England, have invented an Improved Apparatus for Insuring Perfect Combustion in the Furnaces of Boilers, of which the following is a specification.

My invention relates to furnaces, and more especially to the furnaces or fireboxes of boilers of the well-known locomotive type, and it has for its objects novel methods of construction hereinafter described and claimed.

The accompanying drawings are in illustration of my invention.

Figure 1 is a longitudinal section through the firebox of a boiler of the ordinary locomotive type fitted with firebars of the usual kind, and Fig. 2 is a transverse section through the same. Fig. 3 is a longitudinal section through a similar firebox fitted with oscillating or rocking firebars, and Fig. 4 is a similar section showing the frame carrying the firebars tilted or inclined upon its pivots. Fig. 5 is a longitudinal section through the firebox of the boiler of a locomotive engine, and Figs. 6 and 7 are detailed views showing the air passages separately.

The same letters of reference indicate the same parts in the several figures.

Assuming that my invention is to be applied (as illustrated in Figs. 1 and 2) to an ordinary locomotive boiler having a square firebox *a* at the open bottom of which firebars *b* of the ordinary kind are arranged, I fit these bars in a rectangular frame *c* of sufficient strength, which frame is capable of oscillating upon pivots *d*, *d'*, in or carried by the sides of the firebox near its lower edge. This frame *c* together with the firebars *b* carried by it, is shown oscillated or canted, in dotted lines in Fig. 1, for which purpose a lever *e* is attached to the frame *c* and is operated by means of a lever, or by a screw and wheel or equivalent means, situated in a convenient position to be worked by an attendant.

Instead of the ordinary bars *b*, as shown in Figs. 1 and 2, I prefer however to use firebars of the kind described in the specification of Letters Patent to Galley, No. 270,582, dated January 16, 1883, as illustrated in Figs. 3 and 4 in which the firebars *b* are arranged transversely across the firebox and are provided with pivots at their ends capable of oscillating or turning in notches or bearings in the sides of the frames *f*, each bar being provided with projections *g* entering freely into the spaces or recesses between the projections of the adjoining bars, and all the bars being connected by a link or links *h* by which they can be made to oscillate upon their centers, angled plates or feathers *i* being moreover formed upon or attached to the lower side of the bars by which the air space between the latter is more or less opened or closed and regulated when the bars are made to oscillate by means of a suitable lever or handle, (as shown at *k* in Fig. 5).

By my present invention I make the frame in which the ends or pivots of the bars oscillate as described capable itself of oscillating upon transverse pivots *d* at or near the center of its length from back to front, these pivots turning in bearings or recesses in fixed supports carried by and attached to the lower edge of the firebox. This oscillating frame carrying the firebars is provided with a lever *e* and connecting link *l* which may be actuated in any convenient way in order to oscillate or tilt the frame *f* as shown in Fig. 4. For instance (as illustrated in Fig. 5) by a screwed bar *m* passing through a nut in a hand wheel *n* turning in suitable bearings arranged in a convenient position near the firedoor of the furnace, the lower end of the screwed bar being jointed to one arm of a bell crank *o* turning upon a fixed center and having its outer arm jointed to the connecting link which actuates the oscillating frame *f*. The bars themselves are made to oscillate or turn simultaneously upon their several centers as already described (in the way described in the specification of the said Letters Patent already referred to) by means of a lever *k* situated in a convenient position which lever operates the bars by means of a connecting link *p*. The movement of the frame *f* carrying the bars will not injuriously interfere with the simultaneous rocking if desired of the firebars upon their several centers, in the said frame.

When it is desired to clear the firebars and to break up the clinker upon them, or to regulate the air space between the angled

plates below them, the lever *k* is moved backward and forward so as to oscillate the bars upon their centers. When it is required to remove and discharge the clinker from the firegrate or bars or to draw and discharge the fire, the frame *f* carrying the bars is made to turn or cant upon its side pivots *d*, (as shown in Fig. 4,) its front end being lowered and the fuel being discharged into the ash pan or pit below. Simultaneously with this, the lever *k* may be worked to oscillate the bars upon their several pivots and so facilitate the discharge and the proper cleaning of the firegrate, which can then be returned to its normal position. E is a stop which determines the proper position of the frame *f* when raised.

It is evident that the oscillating frame may be made to carry any other kind of rocking bars instead of those described and shown.

In order to provide for admission of air above the fuel, so as to insure perfect combustion and to prevent smoke, I leave a space between the forward end of the frame which carries the bars and the inner or tube plate end *r* of the firebox, and in this space I arrange and fix a vertical passage *s* open below, preferably of cast iron, which after rising above the top of the fire is curved over and directed backward (or away from the tube plate as shown in the several figures). The outer end of this passage *s* is directed preferably slightly upward and for a sufficient distance over the fire, so that it forms a kind of firebridge (which may be curved or arched as shown in Fig. 2) round and over which the flames and products of combustion have to pass on their way to the tubes *t*, meeting as they pass round its open end, a current of air which rises up through the open lower end of the passage *s* and after being heated as it passes is discharged through the front open end above the fire. The passage described may be coated with fireclay at *u* or other material sufficiently refractory to heat, and may be made tapering in cross section as shown, its upper open end being of less sectional area than its lower open end, which is provided with a movable door or damper *v* by which the admission of the air can be regulated and adjusted, and by which a part of the air entering the ash-pit is deflected into the lower open end of the chamber *s*.

The passage *s* may be made in the form of a series of pipes arranged side by side across the firebox (as shown separately in Fig. 6) and these pipes may be circular, elliptical, rectangular, or of other desired shape in cross section. They may be either wholly or in part inclosed in fireclay, as already described, or they may be used in combination with the firebrick arch used in locomotive fireboxes as shown at *w* in Fig. 5.

The inner or discharge end of the passage or pipes may be serrated or toothed as shown at *x* in Figs. 1 and 2, to facilitate the more perfect distribution and mixing of the issuing air with the products of combustion.

As illustrated in Fig. 5, which shows the boiler of a locomotive engine, air chambers *s*, *s'*, of the kind described may be used both at the front and back ends of the firebox *a*, that *s'* being used when the engine is running backward. The arrangement of the oscillating firebars and of the tilting frame which carries them is similar to that already described, and movable doors or dampers *v*, *v'*, are used for closing or regulating the admission of air to the bottom open ends of the passages *s*, *s'*, and for directing the air into the latter, while similar movable doors or dampers *y*, *y'*, are fitted to the open front and back of the ashpan *z*, and are regulated and adjusted by connecting rods and handles in the usual way as illustrated. When the engine is running forward, the doors *v* and *y* are opened and *v'* and *y'* closed, while when it is running backward the doors *v* and *y* are closed and *v'* and *y'* opened.

In Figs. 6 and 7 the passages *s* are shown made in several parts, arranged side by side and fitting into a lower chest or support A which is fixed in the bottom of the firebox. By this method of arrangement any of the separate passages *s* can be easily removed or replaced when necessary, to facilitate which the center of the front of the chest A may also be made removable at C and when removed either of the passages *s* can be easily removed by drawing it forward.

The edges of the discharge openings for the air are shown notched at D, to facilitate the lateral distribution of the air.

I do not confine myself to the exact details of construction or of the forms and proportions of the several parts, which may be varied more or less as may be found advisable, and to suit different circumstances.

What I claim, and desire to secure by Letters Patent, is—

In a locomotive furnace the combination with a grate, and means for admitting air beneath said grate from either end thereof; of a pair of curved air passages, situated at the two ends of said grate and curved toward the center of said grate, and opening above the same; and pivoted doors in each passage, adapted to close the same, whereby the one air passage may be closed while the other is open, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two witnesses.

EDWIN FAULKNER PADDON.

Witnesses:

JOHN HAM,

ARTHUR E. EDWARDS.