A. McDONALD.
Shaking-Grate.

No. 208,109. **Patented Sept. 17, 1878.**

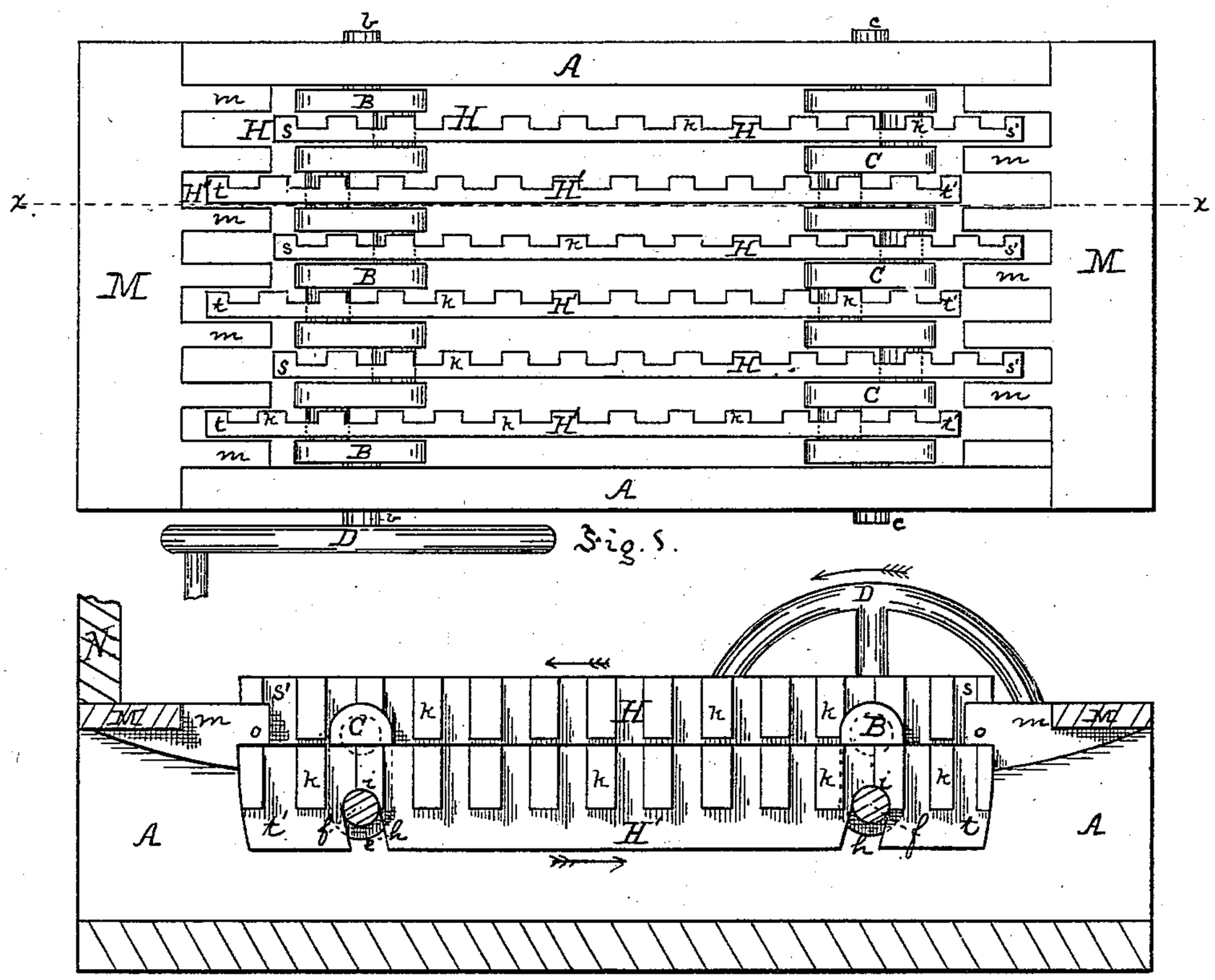

Fig. 1.

Fig. 2.

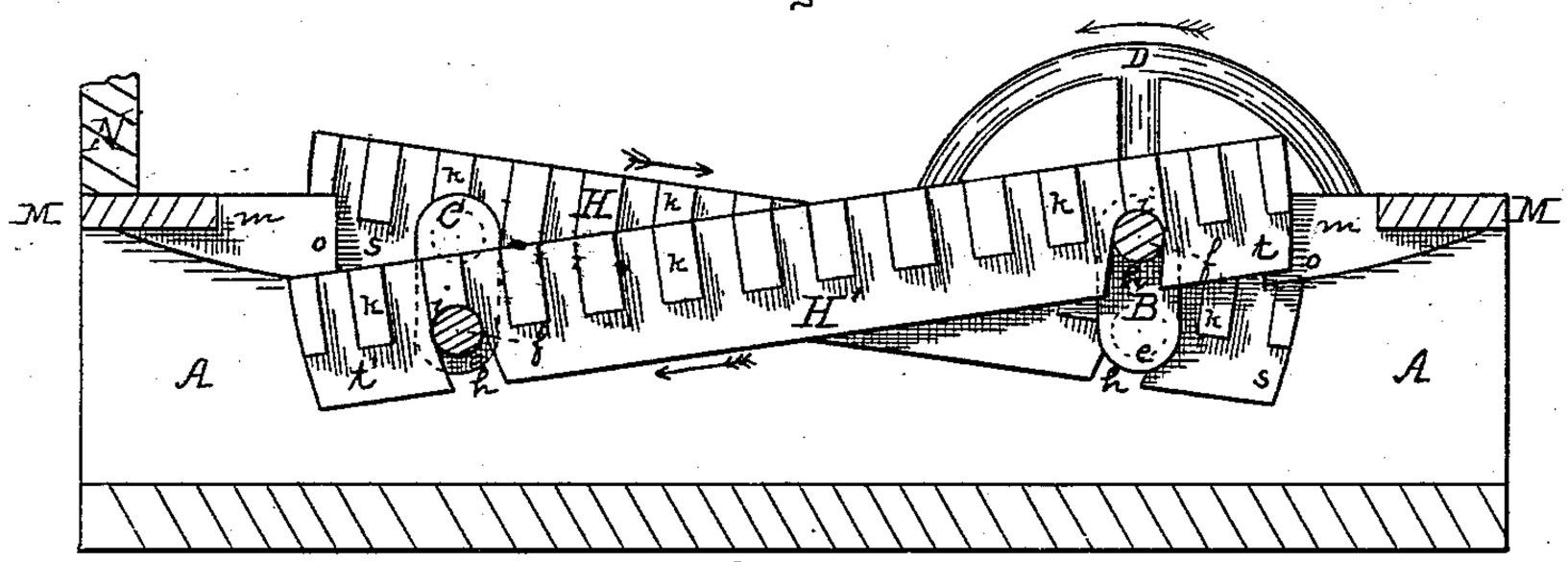

Fig. 3.

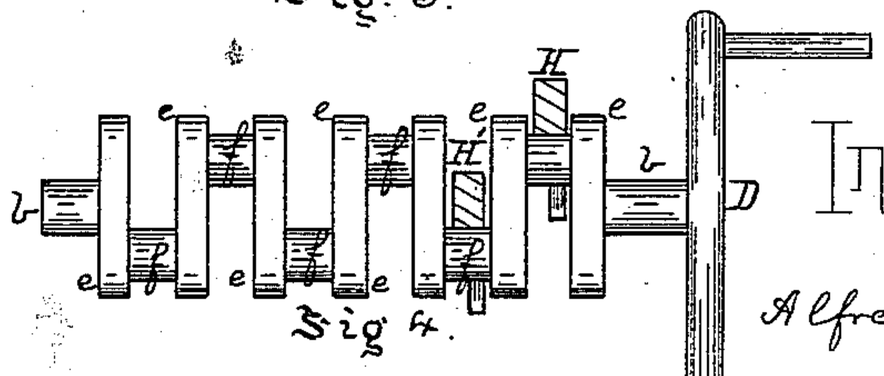

Fig 4.

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ALFRED McDONALD, OF ALLEGHENY, PENNSYLVANIA.

IMPROVEMENT IN SHAKING-GRATES.

Specification forming part of Letters Patent No. **208,109**, dated September 17, 1878; application filed July 23, 1878.

To all whom it may concern:

Be it known that I, ALFRED McDONALD, of Allegheny city, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Shaking-Grates; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, forming a part of this specification, in which—

Figure 1 is a top view of my improved grate. Fig. 2 is a longitudinal vertical section on the line *x x*, Fig. 1, showing the position of the grate after one-quarter revolution of the crank. Fig. 3 is a similar view, showing the position of the grate after a three-quarter revolution of the crank; and Fig. 4 is a side elevation of the revolving crank, showing, in section, two of the grate-bars resting thereon.

Like letters of reference indicate like parts in each.

My invention relates to that class of grates for furnaces, boilers, stoves, and fire-places termed "shaking-grates," in which the ashes are sifted from the grate, and in some cases the ignited fuel stirred automatically by the movement of the grate-bars upon which the fuel rests. It consists in pivoting or hanging the grate-bars upon two compound cranks, which are journaled in the fire-walls or grate-frame, one of which is adapted to revolve and the other to oscillate, and, by the revolution and oscillation of the cranks, imparting to the grate-bars a rising and falling raking motion, by means of which the ashes are shaken out of the grate and the fuel stirred up and carried to the center of the grate.

To enable others skilled in the art to make and use my invention, I will describe its construction and operation.

In the drawing, A A represent the fire-walls or grate-frame of the furnace or fire-place. In the grate-frame A are formed suitable housings, in which the revolving crank B and oscillating crank C are journaled by means of the bearings *b c*, the crank B being journaled near the front of the grate-frame, and the crank C near the rear. One bearing of the crank B extends through the grate-frame, and is provided with a wheel or crank-arm, D, by means of which the crank B is revolved. The cranks B and C are cast or forged, and are composed of different bends or angles *e*, forming the alternating cranks, one on each side of the central bearings, thus forming the compound cranks. At each bend is formed the cylindrical bearing *f*, upon which the grate-bars rest. The number of crank-bearings *f* corresponds to the number of grate-bars used.

The grate-bars H H′ are cast in the usual way, being made of iron or steel, as desired. Each bar is provided with two bearings, *i i*, at a distance from each other corresponding to the distance between the rotating and oscillating cranks, formed in slots *h* extending up from the base of the grate-bar. The bearings *i i* fit over and rest upon the bearings *f* on the bars B C, each grate-bar being thus hung or pivoted on the cranks. The bars H are hung on one side of the cranks, and the alternating bars H′ on the other, so that by the rotation of B each alternating bar will be raised or lowered and drawn forward or back. The slots *h* in the grate-bars are inclined or formed at a slight departure from a right angle, so that when the cranks are at the same inclination the grate-bars cannot be removed, it being necessary to move one of the cranks to lift off the grate-bars.

The grate-bar is thus locked onto the cranks, so that it cannot be thrown off by the movement of the cranks or any clinker which may get between the bars.

The grate-bars are provided on one or both sides with a series of lugs, *k*, which extend part way down the sides of the bars, far enough to prevent the fuel from falling between the bars when one is raised above the other by the revolution of the crank.

The grate-bars are all of the same form and the bearings formed therein of the same depth, so that any bar of the required size will fit any one of the crank-bearings, and when the faces of the cranks are horizontal the upper faces of the grate-bars will be on the same horizontal plane, as illustrated in Fig. 1.

As the rotation of the crank and the movement of the grate-bars past each other would leave a large opening for the escape of the fuel at the ends of the grate-bars, I place at both ends of the grate-frame a guard-plate, M, of cast metal, from which the guard-projec-

tions *m* extend longitudinally between the ends of the grate-bars, and between which projections the grate-bars work when operated by the cranks. The guard-plates with their projections are on the same horizontal plane with the grate-bars, and uphold the fuel when the grate-bars are drawn from under it. As the projections extend between the grate-bars they fill up the space through which the fuel would otherwise drop. The projections *m* extend under the guard-plates, and gradually increase in depth until the ends *o* extending between the bars are of sufficient thickness that the tops of the bars are never brought below the lowest point of the projections in the movement. This form strengthens the projections so that they will not break off when a clinker is caught between them and the bars, and also prevents the escape of the fuel when the bars are drawn below the level of the guard-plate. One of these guard-plates M forms the feeding-plate to the furnace, and as it is level with the bars it will not obstruct the feeding of the fuel or raking of the bars, when necessary. The other plate at the rear may be built into the furnace and form the foundation for the bridge-wall N.

The operation of my improved grate is as follows: In Fig. 1 the faces of the cranks B C are horizontal, thus holding the grate-bars level, or nearly so. The crank B is revolved in the direction indicated by the arrow, and when turned one-quarter way round the forward ends, *s*, of the bars H are raised and thrown backward by its revolution, while the forward ends, *t*, of the bars H′ are lowered and drawn forward, the oscillating crank moving in the same direction and imparting the same motion to the other ends, *s′ t′*, of the bars. This motion is shown in Fig. 2. Upon the half-revolution of the crank the grate-bars are drawn even, or nearly so. Upon the three-quarter revolution of the crank (illustrated in Fig. 3) the front ends, *s*, of the bars H are lowered and drawn forward, and their rear ends, *s′*, are raised and drawn forward by the oscillation of the crank C.

At the same time the forward ends, *t*, of the bars H′ are raised and thrown back by the revolution of the crank B, and their rear ends lowered and thrown back by the oscillation of the crank C, so that the bars H H′ are thrown out of a horizontal line and pass each other at an angle inclined toward each other. When one revolution has been completed the faces of the bars are again brought even, or nearly so, and upon the further revolution of the crank the operation above described will be repeated.

The revolution of the crank A and oscillation of the crank B thus impart to the grate-bars hung thereon an alternately rising and falling motion forward and backward past each other, by means of which the mass of fuel on the grate is thoroughly stirred and the ashes sifted therefrom.

The motion of the raised bars at the front of the grate is always backward, either in a horizontal or inclined plane, and the motion of the raised bars at the rear of the grate is backward when horizontal, and forward when inclined. The advantage of this peculiar motion is, that the fuel fed at the front is always carried to the center of the grate by the raised bars in front, while the forward movement of the inclined bars will preclude its being carried against the bridge-walls, and the backward horizontal movement will feed it slightly back, so that the fuel will be held between the center and rear of the furnace, the best point for its combustion.

The lugs *k* on the sides of the grate-bars prevent the falling of any large unconsumed fuel from between the grate-bars, so that nothing but the ashes will escape. The front ends of the bars are carried down and forward by the revolution of the crank, so that they will rise through the guard-plates M and lift any fuel resting on the projections and gradually feed it back to the fire. The grate can readily be cleared of clinkers or the fuel removed therefrom by simply revolving the crank in the other direction, when the grate-bars will carry all the fuel, &c., to the front of the furnace.

It is evident that but a slight alteration is necessary to adapt the grate to fire-places and different styles of stoves, such as fixing a basket front before the grate and hanging the bars lengthwise of the grate.

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

1. The combination of the revolving crank B, the oscillating crank C, and a series of grate-bars pivoted or hung upon said cranks, substantially as and for the purposes set forth.

2. The oscillating grate-bar H, provided with the bearings *i*, formed in the inclined slots *h*, extending up from the base of the bar, substantially as and for the purposes set forth.

3. The guard-plate M, attached to the grate-frame, and having the projections *m*, extending under the guard-plate and gradually increasing in thickness to their outer ends, substantially as and for the purposes set forth.

4. The combination of the revolving crank B, oscillating crank C, a series of grate-bars hung on said cranks, and the guard-plates M, attached at the end of the grate-frame on the same plane with the bars, and provided with projections *m*, between and through which the bars work, substantially as and for the purposes set forth.

In testimony whereof I, the said ALFRED MCDONALD, have hereunto set my hand.

ALFRED MCDONALD.

Witnesses:

W. P. WOOD,

JAMES I. KAY.