(No Model.) 2 Sheets—Sheet 1.

J. DUNN.

FURNACE.

No. 561,097. Patented June 2, 1896.

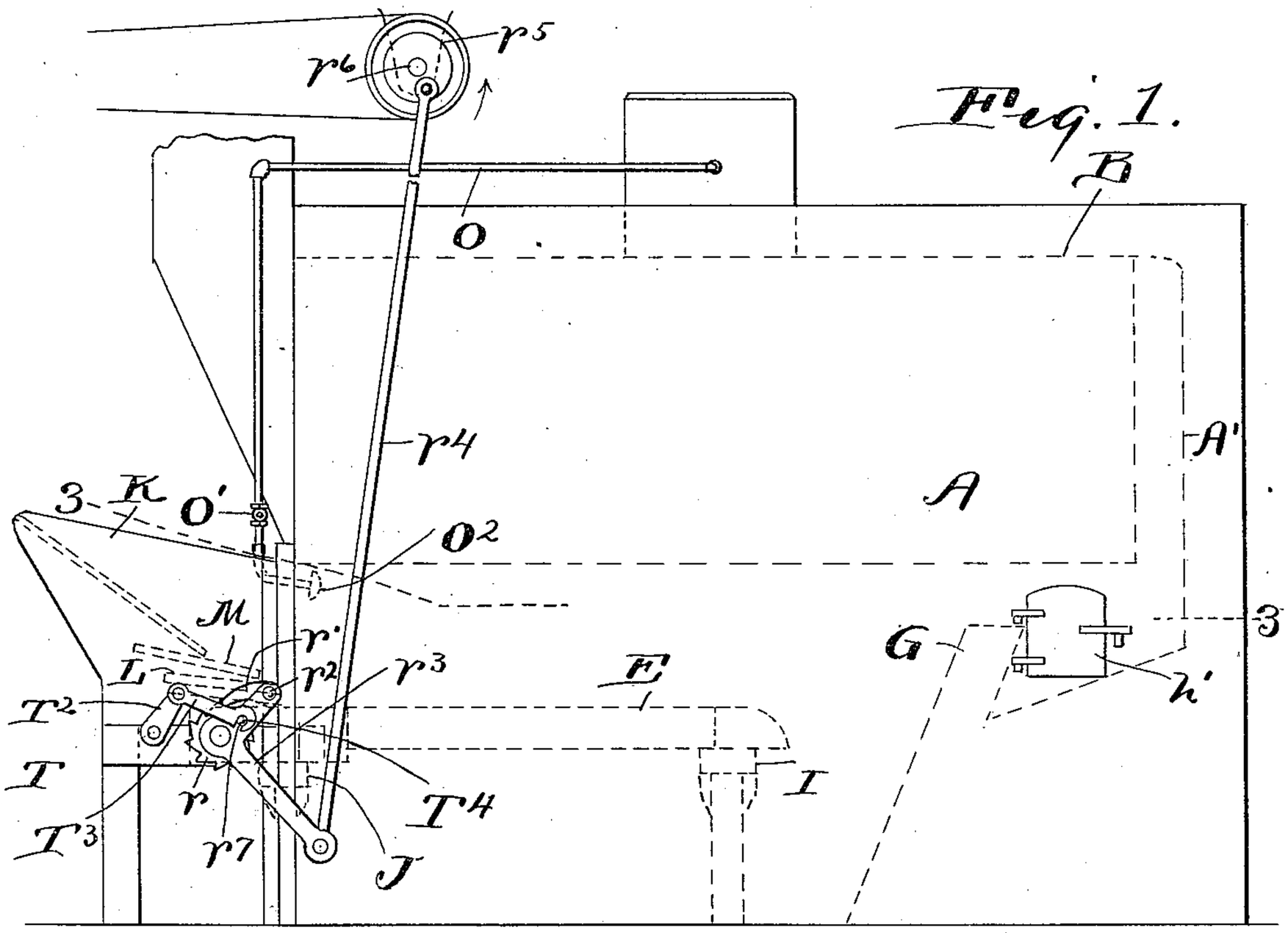

Fig. 1.

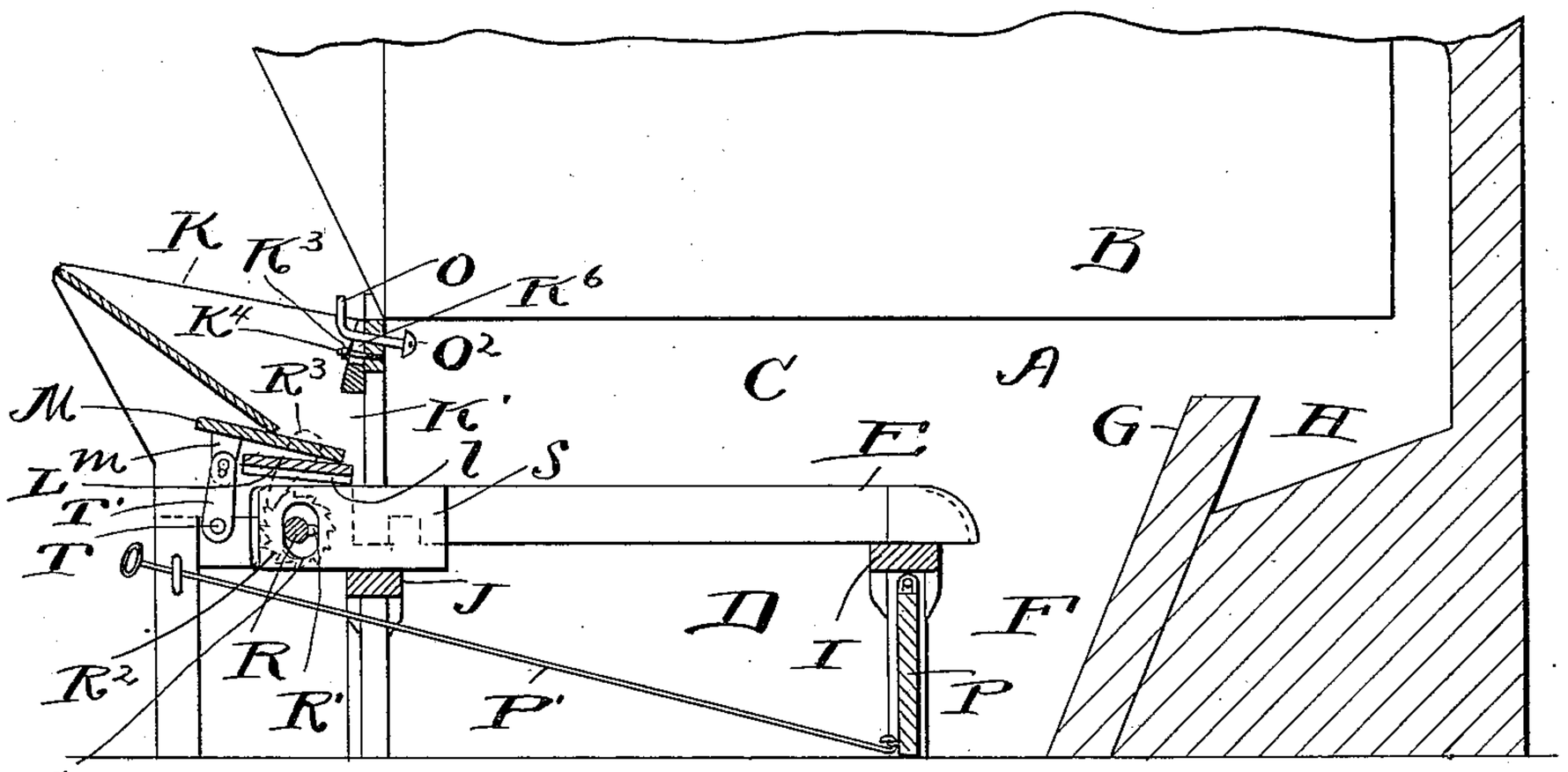

Fig. 2.

Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

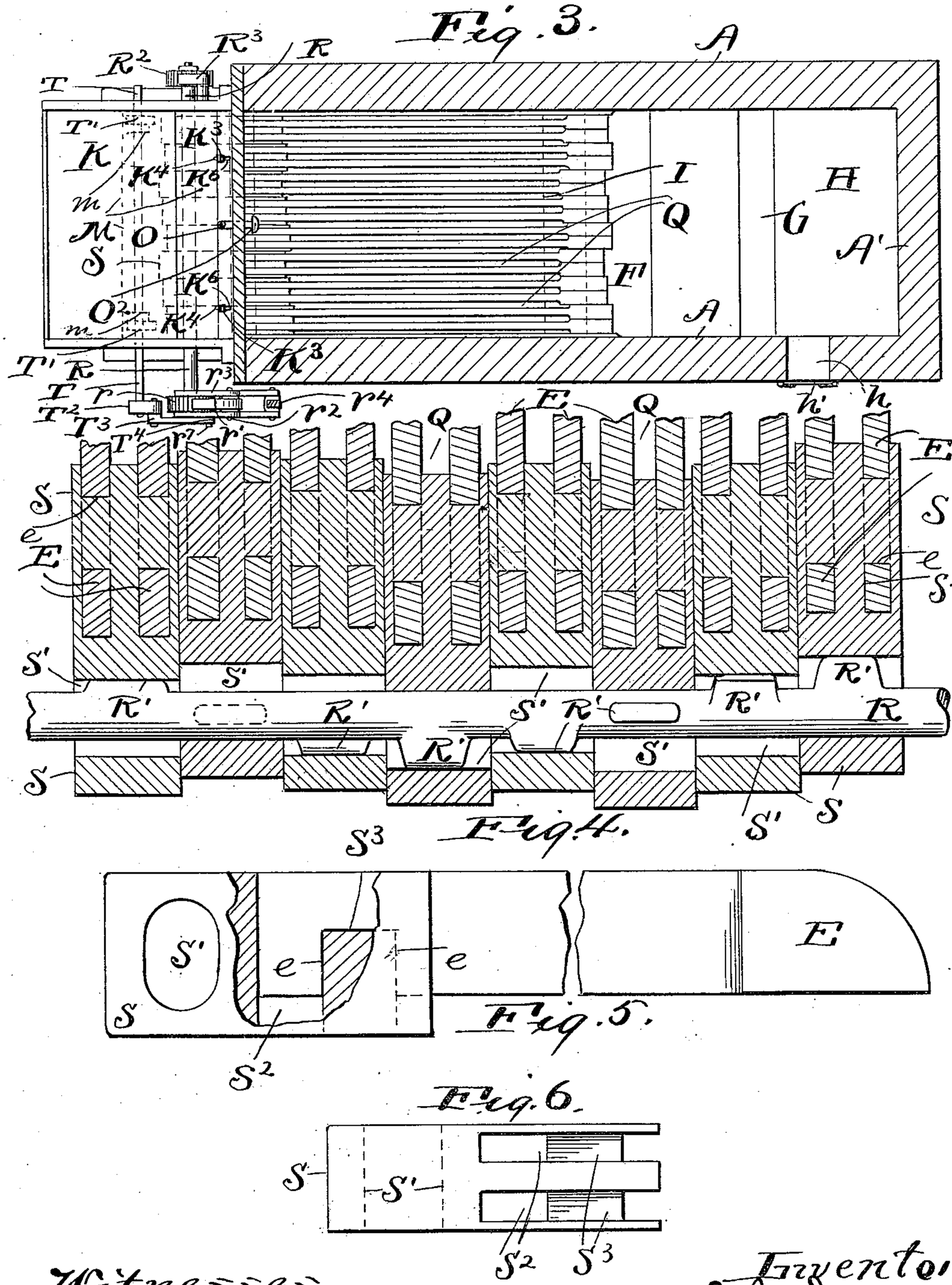

Fig. 4.

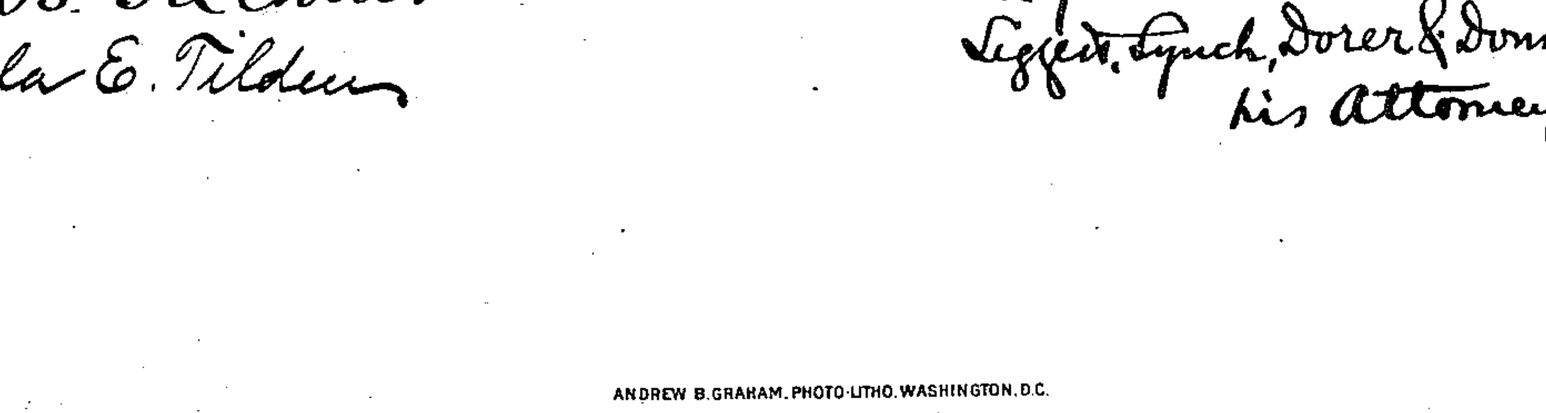

Fig. 5.

Fig. 6.

Witnesses,
E. B. Gilchrist
Ella E. Tilden

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UNITED STATES PATENT OFFICE.

JOHN DUNN, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO EDWARD SMITH, OF SAME PLACE.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 561,097, dated June 2, 1896.

Application filed February 3, 1896. Serial No. 577,779. (No model.)

To all whom it may concern:

Be it known that I, JOHN DUNN, of Cleveland, Cuyahoga county, Ohio, have invented certain new and useful Improvements in Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in furnaces, the object being to provide a furnace that will burn fuel economically, avoid the formation of smoke, require little attention on the part of the engineer or attendant, whose grate-bars can be conveniently renewed when required, and whose construction throughout is exceedingly simple and durable.

With this object in view my invention consists in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a boiler-furnace embodying my invention. Fig. 2 is a side elevation of the furnace, mostly in central vertical longitudinal section. Fig. 3 is a top plan in section on line 3 3, Fig. 1. Fig. 4 is a top plan of a portion of the grate-bars in horizontal section and shows the shaft for reciprocating said bars longitudinally. Fig. 5 is a side elevation of a grate-bar and the coupling instrumental in connecting together two grate-bars. Fig. 6 is a top plan of one of the grate-bar couplings. Figs. 4, 5, and 6 show the parts therein exhibited on a larger scale than they are shown in the remaining figures, and in Fig. 5 portions are broken away to reduce the size of the figure and to more clearly show the construction.

Referring to the drawings, A A designate the side walls of the furnace-setting; A′, the rear end wall of the setting; B, the boiler, supported from the setting in the usual manner; C, the fire or combustion chamber; D, the ash-pit; E, the horizontally-arranged or approximately horizontally-arranged grate-bars between the ash-pit and combustion-chamber; F, the clinker-pit at the rear of the ash-pit and grate-bars; G, the bridge-wall at the rear of the clinker-pit and a suitable distance forward of the rear end of the boiler; H, a soot or dirt collecting chamber formed at the rear of the bridge-wall; *h*, a doorway leading to said chamber H; *h*′, a door for closing said doorway; I, a stationary bearing for the rear ends of the grate-bars; J, a cross-bar or stationary bearing for the grate-bar couplings at the forward ends of the grate-bars; *k*, a hopper for holding a quantity of fuel at the forward ends of and above the grate-bars; L, a stationary dead-plate at the lower end of the hopper, above the grate-bar couplings, and declining, preferably, toward the combustion-chamber; *l*, a narrow air-space between dead-plate L and the grate-bar couplings, in open relation with the external atmosphere and lower portion of the combustion-chamber at the upper surface of the grate-bars; K′, the hopper's discharge-opening communicating with the forward end of the combustion-chamber; K², the vertically-adjustable rear wall of the hopper; M, the feeding-plate or feeder arranged above plate L and designed to feed fuel from hopper K to the combustion-chamber and declining, preferably, in the direction of the combustion-chamber; O, a steam-pipe connected with the steam-space of the boiler and provided with a valve O′ for controlling the passage of steam therethrough from the steam-space of the boiler and provided at its discharging end with a nozzle O², arranged within the upper and forward portion of the combustion-chamber and adapted to discharge a steam-blast upon or over the fuel in the combustion-chamber; P, a damper between the ash-pit and clinker-pit and hinged at its upper end to any stationary object, and adapted when open to admit air into the rear end of the combustion-chamber from the ash-pit through the clinker-pit, as required to check the combustion after the fire has been banked for the night, and P′ a rod or suitable device operatively connected with the lower end of the check-damper and extending forwardly through the ash-pit to within convenient reach of the attendant.

The grate-bars at their rear ends are preferably arranged close together, so as to avoid spaces between them, as shown in Fig. 3, and at said ends are somewhat thicker than their

main or remaining portion, so as to form air-conducting and ash-conducting spaces Q between the grate-bars. The grate-bars are slowly reciprocated longitudinally, as will hereinafter appear, to feed the fuel received thereby and subject to combustion thereon slowly toward the rear ends of the bars, not only to prevent the accumulation of clinkers upon the bars, but to feed any clinkers that may be formed thereon gradually toward the bars' rear ends and there discharge the same into the clinker-receiving pit F, whence the clinkers are removed in any approved manner. The grate-bars are preferably not moved in unison, and I have devised means whereby some of the bars are moved forwardly, while others are moved rearwardly, or in the opposite direction, and while others are not moved at all, so that liability of formation and accumulation of clinkers during the combustion of the fuel is reduced to a minimum, and a very desirable construction is illustrated more clearly in Fig. 4, and comprises a suitably-supported and horizontal shaft R, arranged at the forward ends of the grate-bars and transversely of the furnace, and provided upon its periphery with lugs R′, arranged at suitable intervals lengthwise of the shaft, and also arranged at suitable intervals, preferably in a spiral path, circumferentially of the shaft. Any suitable number of grate-bars E (and two bars in the case illustrated) are connected together by means of a suitably-constructed coupling S, that is mounted upon one of the lug-bearing portions of shaft R, and the grate-bar couplings S are preferably mounted closed together upon the shaft—that is, each grate-bar coupling S is provided with a suitably sized and shaped hole S′ therethrough, and shaft R extends through this hole, and the arrangement of parts, and shape, and size of holes S′ in the grate-bar couplings are such, relative to the size and arrangement of the lug-bearing portions of the shaft, that some of the grate-bars will be moved longitudinally in the one direction, while other bars are moved longitudinally in the other direction, and while other bars are not moving at all, and there will be a time when each grate-bar coupling of the construction shown will move in a direction opposite to the adjacent grate-bar coupling or couplings, or remain stationary while the adjacent grate-bar coupling or couplings are in motion. Motion is transmitted to shaft R through the medium of a ratchet-wheel r, operatively mounted upon one end of said shaft outside of the furnace-setting, a pawl r' engaging said ratchet-wheel and pivoted horizontally at r^2 to the outer end of one arm of a bell-crank lever r^3, that is loosely mounted or fulcrumed upon shaft R, and has its other arm operatively connected, by means of a link r^4, with the wrist of a crank-wheel r^5 of a suitably-actuated shaft r^6, as shown in Fig. 1, by which construction shaft R is intermittently rotated and the connected grate-bars are moved longitudinally at suitable intervals of time in the manner hereinbefore described. Shaft R is of course rotated in one direction only, and means for preventing rotation of said shaft in the opposite direction is preferably provided, and consists, preferably, of a ratchet-wheel R^2, operatively mounted upon the shaft at any suitable point and engaged by a suitably-supported pawl R^3.

The fuel-feeder is preferably operatively connected with the grate-bar-actuating shaft, and, with this end in view, said feeder is provided with any suitable number of depending arms m, (see Figs. 2 and 3,) that are operatively connected with upright arms T′ of an oscillating shaft T, that is suitably supported and arranged horizontally a suitable distance forward of the grate-bar-actuating shaft, and has an arm T^2 operatively connected at its outer end by means of a link T^3 (see Fig. 1) with the pawl-bearing arm of bell-crank lever r^3, and the connection of link T^3 with said arm of the bell-crank lever is removable, and consists, preferably, in a hook T^4, formed upon link T^3 and removably engaging a pin or lug r^7, formed upon said arm of the bell-crank lever, whereby the operation of the fuel-feeder can be quickly interrupted, if desired, by unhooking link T^3 from the shaft-actuating bell-crank lever.

Another important feature of my invention resides in the peculiar manner of removably attaching the grate-bars, that are connected together by a grate-bar coupling, to said couplings, and the connection between the grate-bar coupling and the connected bars is more clearly illustrated in Figs. 4, 5, and 6. A grate-bar coupling is shown detached in Fig. 6, and is provided with a vertically-arranged pocket S^2 for each bar of the connected bars for receiving the forward end of the respective bar, and is furthermore provided within each bar-receiving pocket, a suitable distance from the forward end of the pocket, with a seat or saddle S^3, adapted to engage a recess e, formed in the under side of the forward end of the respective bar, as shown in Fig. 4. The side walls of pockets S^2 prevent lateral displacement of the grate-bars connected together by the grate-bar coupling, and the engagement of saddles or seats S^3, formed within said pockets with recesses e in the under sides of the connected grate-bars, prevents longitudinal displacement of the bars; but it will be observed that the construction that thus prevents lateral and longitudinal displacement of the bars does not interfere with the removal of the bars from the supporting grate-bar coupling upwardly out of the grate-bar-receiving pockets of said coupling, and the attendant at the furnace can quickly remove the bar for repairs or renewal when required.

By the admission of air to the bottom of the body of fuel upon the grate-bars in the operation of the furnace a conjunction with the discharge of a blast upon the fuel from above,

a combustion that practically avoids the formation of smoke, obtains.

The rear wall K^2 of the fuel-hopper is preferably adjustable vertically, so that the discharge-opening of the hopper can be enlarged or reduced at pleasure, and said wall is secured in the desired adjustment (see Figs. 2 and 3) by nuts K^3, mounted upon studs K^4, rigidly secured to stationary wall K^5, and the holes K^6 in the hopper-wall, through which the studs extend, are elongated to accommodate said adjustment.

What I claim is—

1. In a furnace, the combination with the grate-bars and bearings for the grate-bars, a horizontally-arranged oscillating shaft operatively connected with the forward ends of the grate-bars, means for communicating a reciprocatory motion to the grate-bars from, and during an intermittent rotation of, said shaft, the ratchet-wheel r operatively mounted upon the shaft, bell-crank lever r^3 fulcrumed upon the shaft and having one of its arms provided with a laterally-projecting lug or pin, pawl r' borne by one arm of said lever and engaging the ratchet-wheel, and the suitably-reciprocated link or rod r^4 operatively connected with the other arm of the bell-crank lever, of the fuel-feeder M, horizontally-arranged shaft T having any suitable number of upright arms operatively connected with said feeder and having another upright arm T^2, and the link T^3 operatively connecting said arm T^2 with the bell-crank lever and connected with said lever by means of a hook formed upon the link and engaging the aforesaid pin or lug of the bell-crank lever, substantially as shown and described.

2. In a furnace, the combination with the longitudinally-reciprocating grate-bars, a bearing for the rear ends of the grate-bars, couplings S connecting together the forward ends of any suitable number of bars, the suitably-actuated oscillating shaft R provided, upon its periphery, with laterally-projecting lugs arranged at suitable intervals lengthwise of the shaft, and the grate-bar couplings being mounted upon the lug-bearing portions of the shaft and having holes through which the shaft extends, a bearing for said couplings, and the size and arrangement of said holes relative to the arrangement of the lugs upon the shaft being such that the grate-bar couplings and connected grate-bars are reciprocated intermittently during the rotation of the aforesaid shaft, substantially as set forth.

3. In a furnace, the combination with the longitudinally-reciprocating grate-bars, a bearing for the rear end of the grate-bars, couplings S connecting together the forward ends of any suitable number of bars, the suitably-actuated oscillating shaft R provided, upon its periphery, with laterally-projecting lugs arranged at suitable intervals lengthwise of the shaft, and also at suitable intervals circumferentially of the shaft, and the grate-bar couplings being mounted upon the lug-bearing portions of the shaft and having holes through which the shaft extends, and bearing for said couplings, and the size and arrangement of said holes, relative to the arrangement of the lugs upon the shaft being such that the grate-bar couplings and connected grate-bars, are reciprocated intermittently during the rotation of the aforesaid shaft, and some of the grate-bars will be moved longitudinally in the one direction while other grate-bars are moved in an opposite direction, and while other grate-bars are at a standstill, substantially as set forth.

4. In a furnace, grate-bar couplings having pockets for receiving the forward ends of grate-bars, and provided, within said pockets, with seats for engaging the bars, substantially as shown, for the purpose specified.

In testimony whereof I sign this specification, in the presence of two witnesses, this 3d day of January, 1896.

JOHN DUNN.

Witnesses:
C. H. DORER,
ELLA E. TILDEN.