J. J. MERRILL.

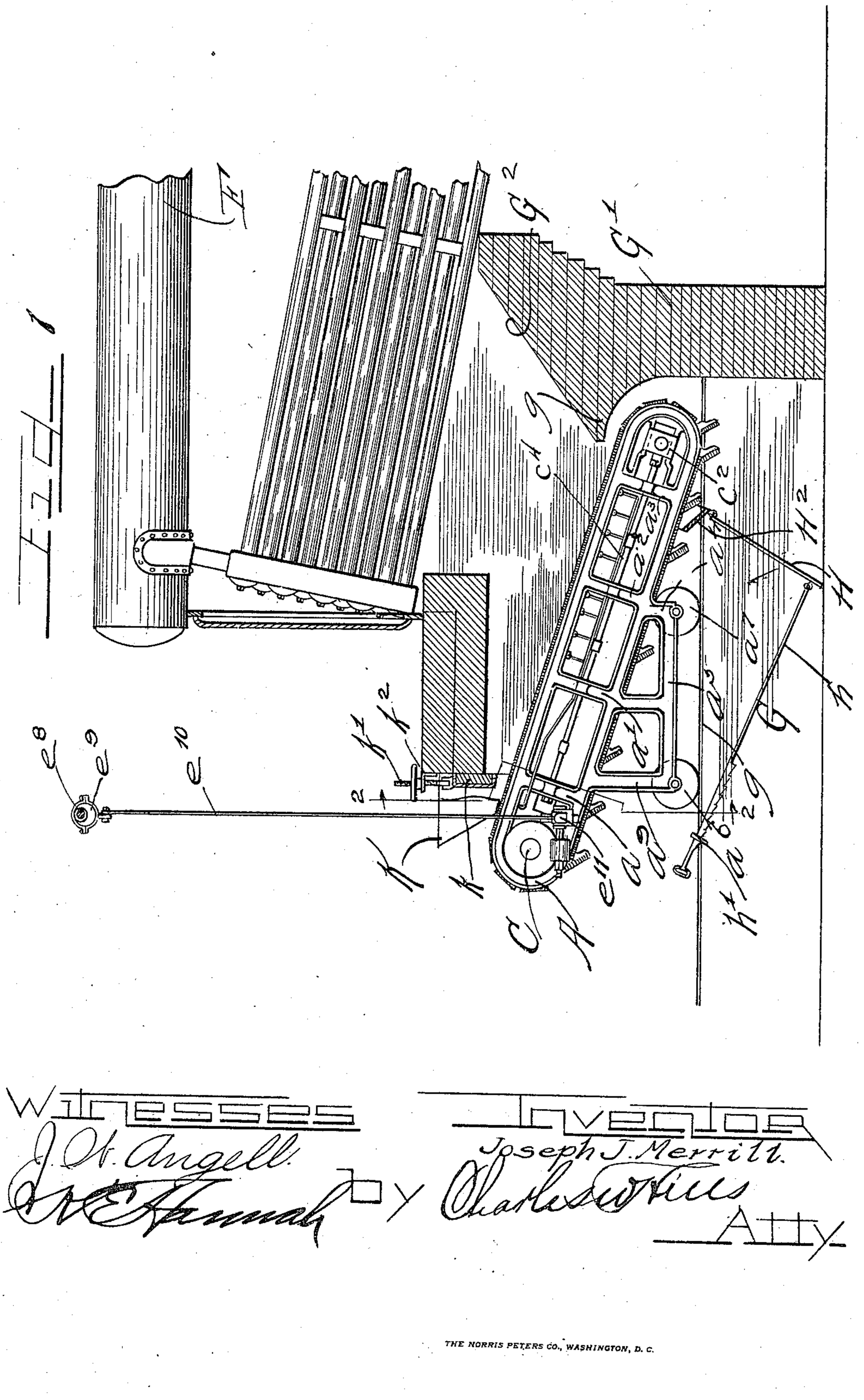
FURNACE GRATE.

APPLICATION FILED FEB. 10, 1909.

974,902.

Patented Nov. 8, 1910.

5 SHEETS—SHEET 1.



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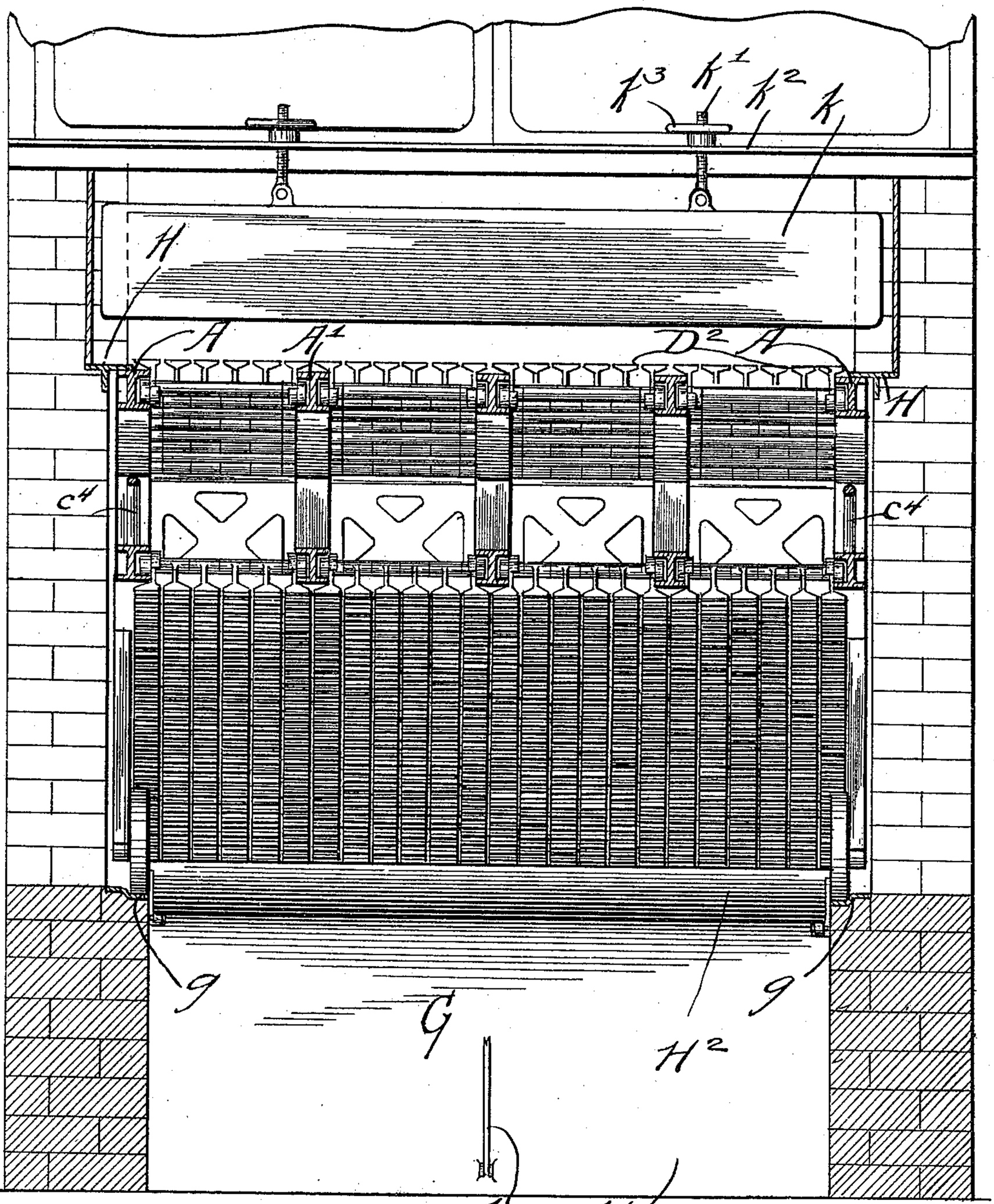
5 SHEETS—SHEET 2.

Fig 2



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5 SHEETS—SHEET 3.

Fig. 3

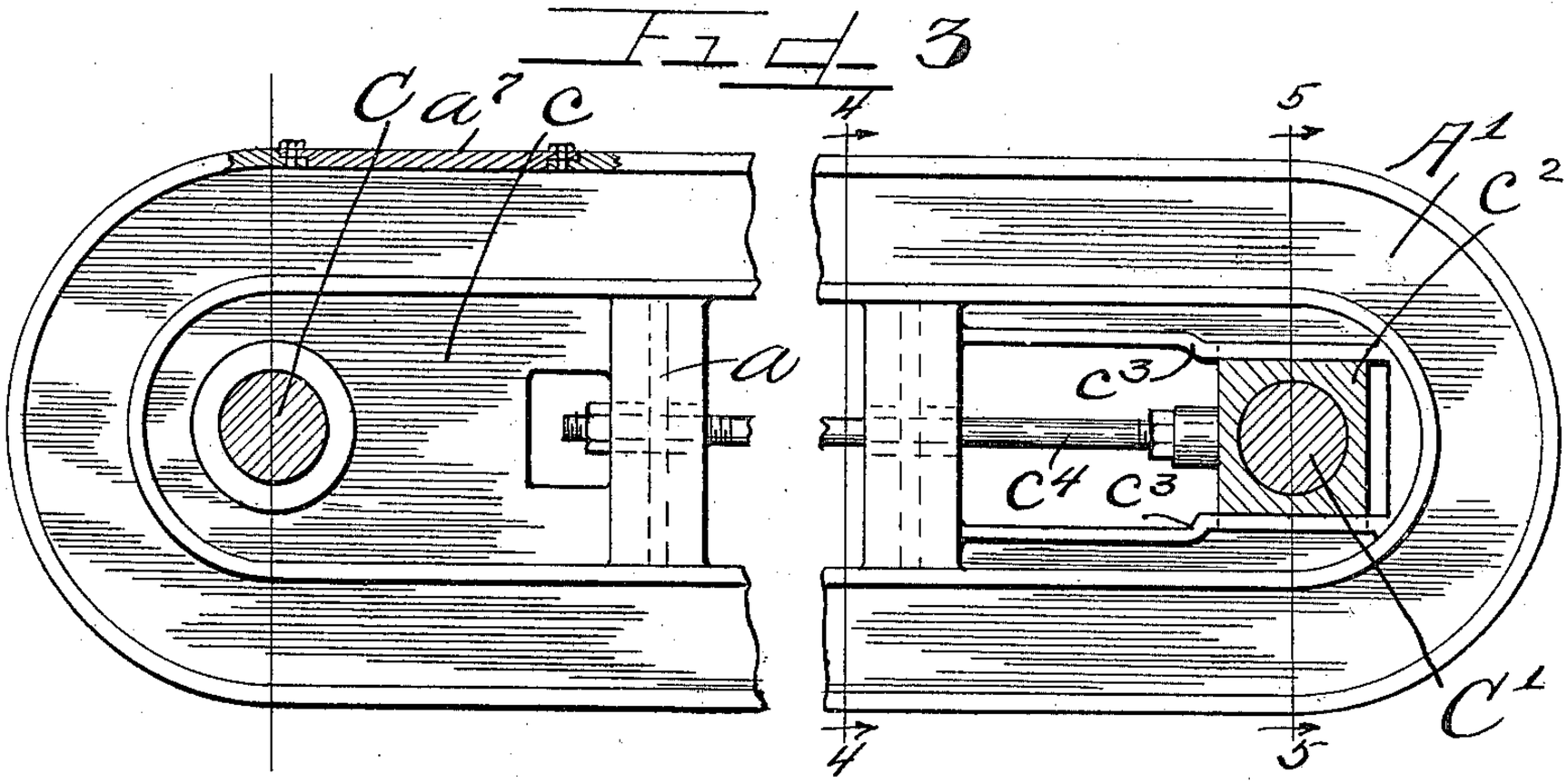


Fig. 4

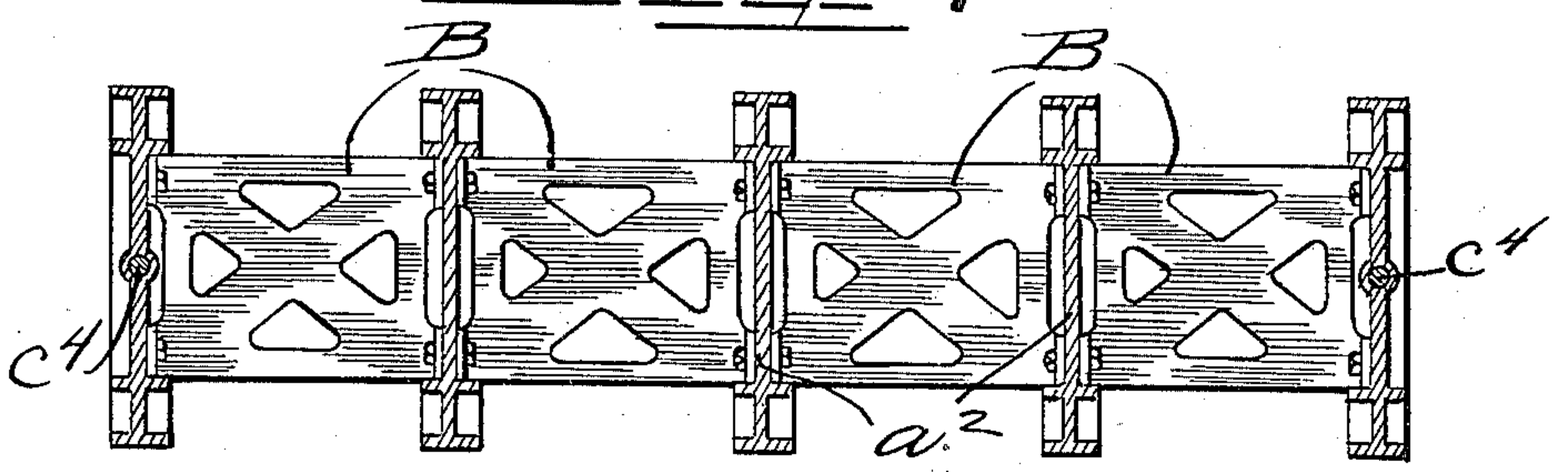
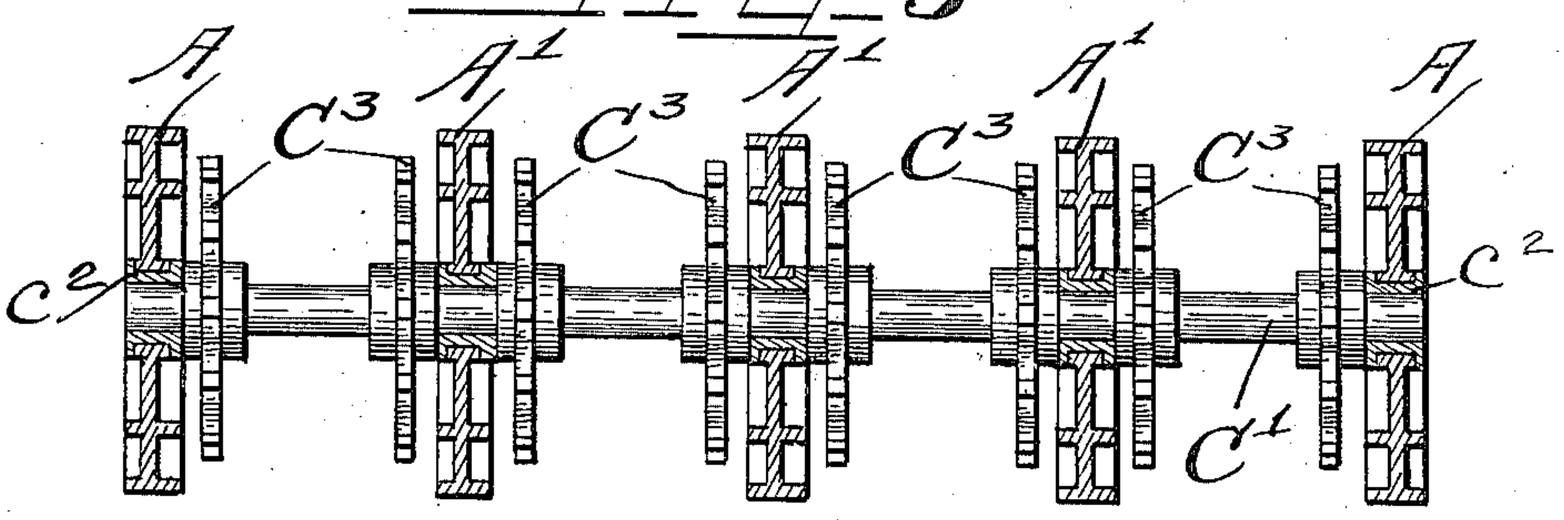


Fig. 5



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5 SHEETS—SHEET 4.

Fig. 6

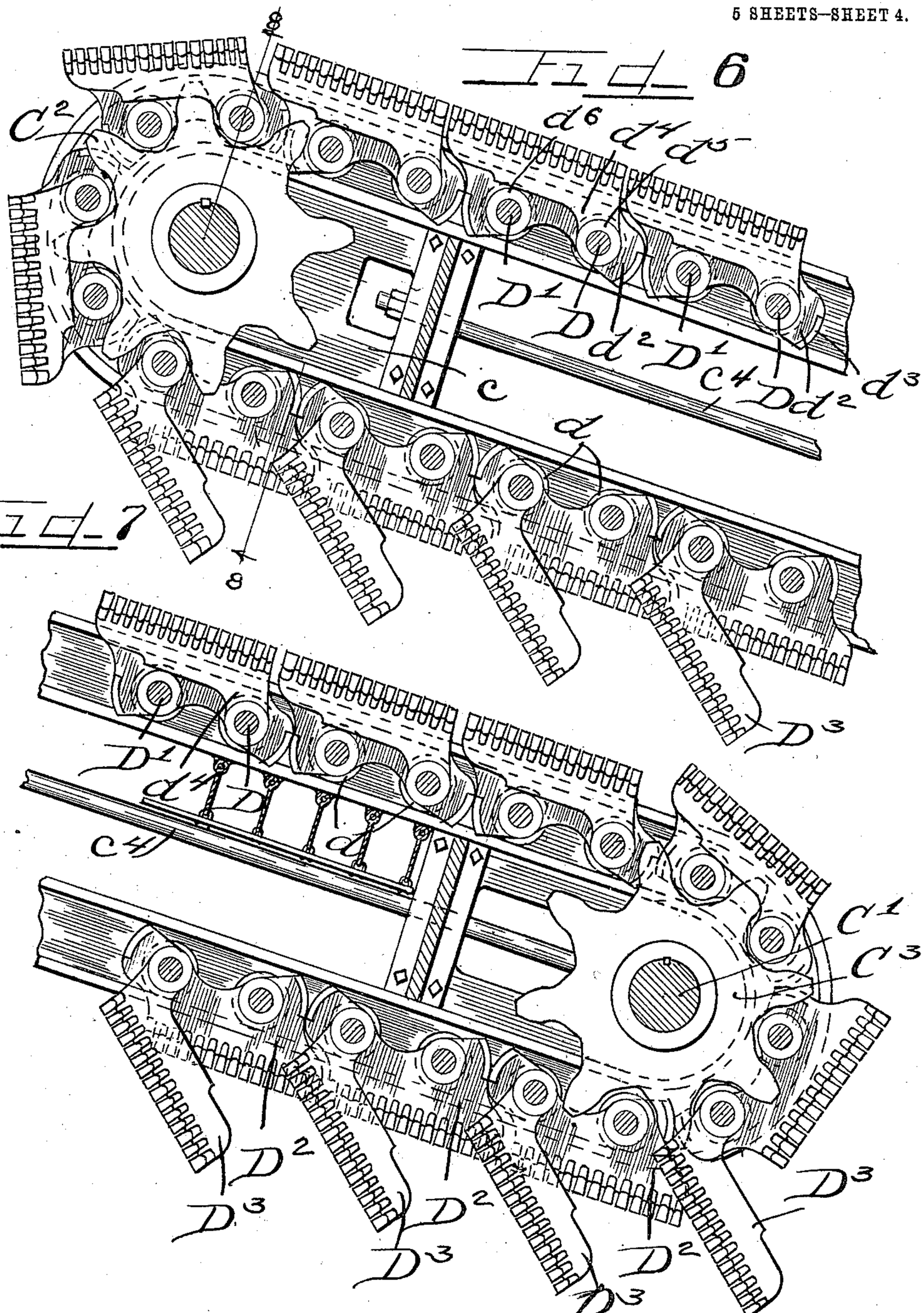

Fig. 7

Witnesses

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5 SHEETS—SHEET 5.

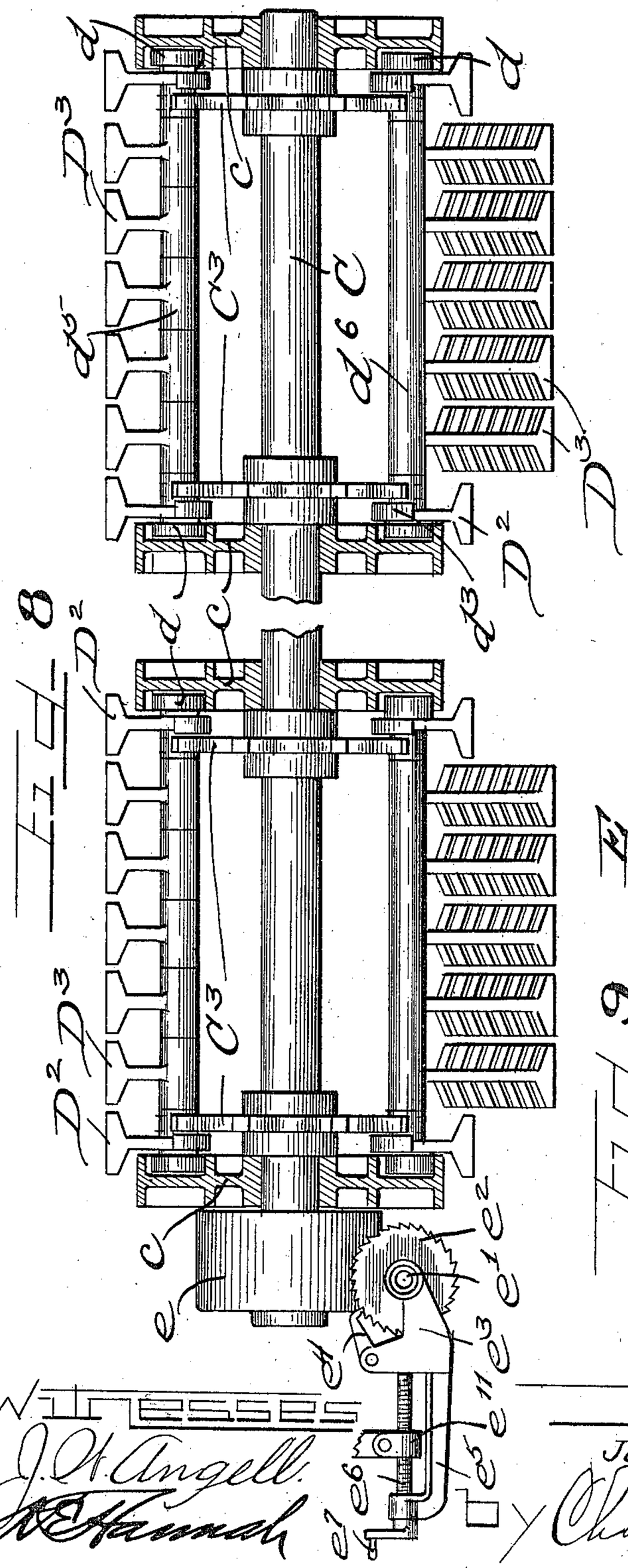

Fig. 8

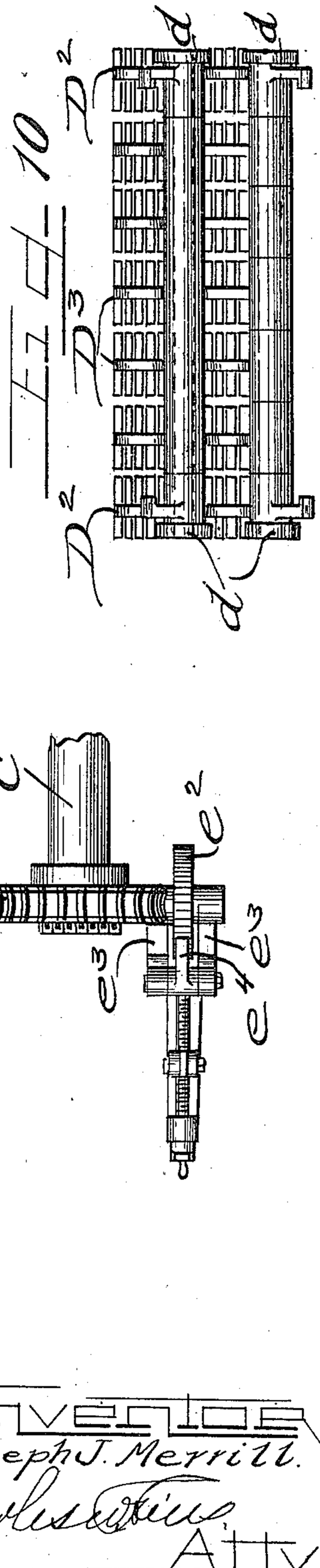

Fig. 10

Fig. 9

Witnesses

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UNITED STATES PATENT OFFICE.

JOSEPH J. MERRILL, OF CHICAGO, ILLINOIS.

FURNACE-GRATE.

974,902. Specification of Letters Patent. Patented Nov. 8, 1910.

Application filed February 10, 1909. Serial No. 477,199.

To all whom it may concern:

Be it known that I, JOSEPH J. MERRILL, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnace-Grates; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of furnace grates set forth in my prior patent issued on the 5th day of December, 1905, No. 806,422, and known as traveling grates, and in which the fuel delivered upon the grate surface is fed inwardly by the travel of the grate, thus automatically stoking the furnace.

The object of this invention is to afford in a grate of the class described a construction which insures adequate support for the fuel and which insures the entire clearance of clinkers or other refuse from the grates at the inward limit of travel.

It is also an object of the invention to afford adequate draft to support the combustion by opening the grates on the lower or upward run.

It is also an object of the invention to afford a construction in which the grate sections may be lifted bodily from the guides, should it be desired, and to afford a hinged construction for part of the grate bars in each section.

It is also an object of the invention to afford grate sections, a part of which may be considered as connecting members and the remainder of which may be considered as hinged sections whereby the major portion of the grate section is adapted to swing downwardly to open the grate to clear the same and to facilitate draft.

It is a very important object of the invention to afford a standardized construction by the use of which grates of any desired size may be constructed by connecting in parallel relation units which extend longitudinally into the furnace and when rigidly secured to duplicate units afford a practically continuous grate for the full width of the furnace.

The invention consists in the matters hereinafter described and more fully pointed out and defined in the appended claims.

In the drawings: Figure 1 is a central, longitudinal, fragmentary section of a grate and furnace embodying my invention and installed beneath a water tube boiler. Fig. 2 is an enlarged, fragmentary section taken on line 2—2 of Fig. 1. Fig. 3 is an enlarged, fragmentary side elevation partly in section of one of the frame sections showing the shafts and bearings therefor in section. Fig. 4 is a reduced section taken on line 4—4 of Fig. 3. Fig. 5 is a similar section taken on line 5—5 of Fig. 3. Fig. 6 is an enlarged, fragmentary, longitudinal section of the upper end of the grate. Fig. 7 is a similar view of the lower end thereof. Fig. 8 is a fragmentary section on line 8—8 of Fig. 6. Fig. 9 is an enlarged, fragmentary top plan view illustrating the driving means for the grate. Fig. 10 is a bottom plan view of one of the grate sections.

As shown in the drawings: Said grate is constructed of one or more standard units rigidly secured together side by side, each unit comprising parallel guides between which are movable duplicate interchangeable standard units or grate sections which afford the grate surface. As shown, the outer frame units or members comprise parallel, channeled frame bars A, connected at the ends by outwardly curving, integral channels, said frame members being conveniently constructed integrally by casting, and, as shown, said frame bars are connected transversely by integral webs a—a' a^2—a^3, at such distances apart as may be necessary to afford the requisite strength. Also integrally connected with the lower frame bar of each of said outer frame members are downwardly extending legs a^9—a^4, which may be connected by a bar or web member a^5, as shown in Fig. 1. On each of said legs a^9—a^4, is journaled a truck or wheel a^6—a^7, on which the grate as a whole is supported and is movable, said truck wheels being so disposed beneath the grate as to properly balance the same longitudinally. If the grate consists of but a single unit in width, two of said side frame members are rigidly secured together in parallel relation. If, however, as more frequently occurs the grate is to be constructed of a width requiring a plurality of units, the outer frame

members A, are constructed as before described and intermediate frame members are arranged parallel thereto and equal distances apart. Said intermediate frame members A′, comprise connected parallel frame bars such as before described, and as shown in Figs. 2 and 3, afford continuous channels on both sides thereof.

As shown, the frame members are rigidly connected in parallel relation by means of cast or other suitable sectional girders B, which may be of any suitable length and width, and are rigidly bolted to the respective frame members through transverse webs a^2, thereon, as shown in Fig. 4. For this purpose, as shown, said sections are cast in approximately rectangular form and flanged at the ends to receive the bolts whereby the same are held in place between adjacent frame members. Of course, said frame members may be connected at any desired number of points transversely. At each end thereof, as shown, is journaled a sprocket shaft C and C′, whereby the grate is operated. The upper shaft C, is journaled in bearings formed in the integral webs c, in each of the frame members, as shown in Fig. 8, and the lower shaft C′, is journaled in bearings c^2, slidable between parallel guides or ways c^3, cast integral on the inner side of each of the frame members, and extending longitudinally of the outer frame members A, and through the webs a—a'—a^2—a^3, are adjusting rods c^4, which adjustably engage each of the lower bearings or boxes c^2, as shown in Figs. 1 and 3, and are provided at their upper ends with nuts bearing against the transverse webs or struts a, and whereby said shafts are held in parallel relation and the lower may be adjusted from or toward the upper, as required. Rigidly secured on each of said shafts on the inner side of the outer frame members A, and one each side of each intermediate frame member A′, are sprocket wheels C^3, as shown in Fig. 5, whereby the grate sections are actuated. A portion of the upper flange of each of said frame members for each of its channels is removable, as shown in Fig. 3, to enable the grate sections to be inserted or removed. For this purpose, a recess is provided in the top of each of said frame members to receive the plates a^7, which project continuously with the upper flanges of each frame member and are securely bolted in place.

Each grate unit comprises, as shown, parallel cylindric shafts D—D′, on each end of each of which is a roller or wheel d, adapted to track in the channels of each pair of frame members, as shown in Figs. 6, 7, and 8. Connecting said shafts at their ends adjacent said rollers and adapted to mesh with the sprocket wheels C^3, between each pair of adjacent frame members, are connecting grate bar sections D^2, through the ends of which said shafts extend. These are shaped at the top to afford a grate surface, as shown more plainly in Figs. 6, 7, and 10, and as shown, said grate sections D^2, are extended laterally at the top sufficiently to cover approximately half the width of the corresponding frame member at the top. Said grate bars D^2, are curved upwardly between said shafts D—D′, to facilitate passing about the turns at the ends of the frame members, and as shown, the front end of the grate surface of each of said sections terminates approximately above the forward shaft D, while the shaft D′, is positioned approximately beneath the middle of said grate surface. As shown also, the forward extremities d^2, of said grate bars extend considerably in advance of the shaft D, and in alinement with the channel or track and are rounded to bear against the complementally curved rear end of the corresponding grate bar in advance thereof, as shown in Fig. 6. The bearing ends are each provided with a flange d^3, which increases the bearing surface to lessen wear. Said shafts are arranged a distance apart to correspond with the teeth on the sprocket wheel C^3, and the lower extended portions of each of said sections are of a length, as shown in Fig. 6, to space the adjacent shafts of adjacent grate units a distance apart equal to the distance between the shafts of the same unit.

The grate bars intermediate the outer grate bars D^2, on each grate section D^3, are shaped on the top to correspond with the grate surface afforded by the grate bars D^2, and are provided at the forward end with a downwardly extending arm d^4, provided at its lower end with a transverse sleeve d^5, through which the shaft D, extends, said sleeves being of a length to space said grate bars suitable distances apart. The rear end of each of the grate bars D^3, is supported on the shaft D′, on which, as shown, is secured a sleeve d^6, which is of a thickness to support said intermediate grate bars at the same height or in the same plane with the upper surface of the grate bars D^2. This construction insures the grate as a whole affording a uniform fuel surface at the upper run of the grate, but permits the intermediate grate bars to swing over, as shown in Fig. 7, to dump the ashes and cinders in passing the sprocket wheel C^3, and further opens the entire lower run of the grate to allow free and unobstructed access of the air both to rapidly cool the depending grate sections and also to afford a better draft to support the combustion.

Automatic means may be provided for driving the grate and for this purpose any convenient mechanism may be employed. Conveniently, however, the outer end of the shaft C, is provided with a worm gear E, inclosed in a suitable housing e, to protect

the same from dust and dirt and extending transversely below the same on a shaft e', is a worm adapted to mesh with the worm gear E, to drive the same. A ratchet wheel e^2, is secured on said shaft e', and pivotally engaged on the shaft by means of brackets e^3, is a pawl e^4, positioned to engage the teeth of said ratchet wheel.

Extending outwardly from the bracket e^3, is an arm e^5, in which and said bracket is journaled a threaded shaft e^6, provided at its outer end with a crank e^7, for actuating the same. A shaft e^8, suitably journaled with reference to said outer end of the grate (conveniently above the same, as shown in Fig. 1), is provided with an eccentric e^9, or crank or any suitable means for affording sufficient throw, and connected thereon is a rod e^{10}, provided at its lower end with a nut e^{11}, engaged on said threaded shaft, and which, of course, dependent upon the distance of the nut from the pawl e^4, is capable of varying the throw of the ratchet wheel due to each rotation of the shaft e^8, thus permitting the rate of rotation of the shaft C, to be varied at will.

As shown, the grate is installed in a suitable furnace beneath a water tube boiler F, though, of course, it is adaptable for use in furnaces of any kind and for any purpose. Said furnace, as shown, is constructed with lateral walls affording an ash pit G, and lateral tracks g, at a suitable height above the same, and on which the track wheels a^6—a^7, of the grate travel when moving the grate into or out of the furnace. Set into the side walls of the furnace at a height slightly above the top of the lateral frame members, are T bars or other structural steel bars H, the flange of which is directed downwardly approximately flush with the face of the wall and the web of which on one side of the flange extends outwardly over the side frame member A, at approximately the same inclination and fitting closely thereto protects the same from accumulations of ashes or coal, and, as shown, the brick work of the arch or furnace may be extended outwardly to coincide with the outer edge of said extended web, thus affording a slight overhang in the wall of the furnace for the purpose specified.

The arch or top of the furnace inclines downwardly and inwardly substantially parallel with the top of the grate, as shown in Fig. 1, to a point within the header for the boiler, if used with a boiler furnace, and thence extends upwardly to the boiler. At the inner end of the grate is a bridge wall G', the face of which adjacent the inner end of the grate extends upwardly and curves forwardly and upwardly over the lower end of the grate, as shown in Fig. 1, sufficiently to prevent cold air passing around the end of the grate and upwardly without passing through the fire surface. From said forward extension of the bridge wall the face thereof slopes upwardly and rearwardly at a suitable angle to afford the most effective draft, as shown in Fig. 1.

As shown, supported on the furnace front above the grate is a hopper K, having an open bottom and adapted to contain the fuel to be fed to the grate, and slidably supported on the furnace front is a gate for regulating the feed of the fuel to the grate and comprising, as shown, a vertically adjustable bar or plate k, supported on the furnace front by means of threaded shafts k', pivotally engaging said gate k, and extending through a flange k^2, in a structural bar secured on the front of the furnace, and as shown, provided with hand wheels k^3, whereby the gate may be elevated or lowered to regulate the supply to the grate.

Pivoted in the ash pit is a draft regulating damper H, to the lower end of which is pivotally connected an adjusting bar h, which at its outer end is provided with teeth to engage the catch h', to secure the damper in any adjustment. Secured in the furnace to close the space between the depending rows of grate bars to prevent air circulating over the damper is a deflector H^2, which is inclined toward the front of the furnace and is adapted to jar each row of grate bars to loosen any clinkers which otherwise might adhere to the grate.

The operation is as follows: The grate may be constructed in all respects of standard interchangeable units. Each pair of connected frame members comprising longitudinally extended units of standard width by the use of which a grate of approximately any desired width may be constructed by connecting together side by side the required number of units, in which case, owing to the overhang of the side wall of the furnace supported on the structural steel bar H, a variation of a number of inches may be provided in the width of the furnace to compensate for any lack in width of the sections when united, though, of course, the sections, if desired, may be standardized in several widths, and by combining several sections of different widths almost any desired total width of grate may be secured without additional expense for construction even though the furnace width be quite unusual. In the same manner the grate units for each width of section are interchangeable and each duplicates of the others.

In operation, the frame having been erected and the sprocket shafts with the sprockets thereon having been installed in the same, the plates a^7, on each frame member are removed and the grate units are successively dropped into place with the rollers or wheels d, on the shafts D—D', fitting in the channels, and with the shaft D, on

which the intermediate sections are journaled in advance of the shaft D′. As the grate units are dropped into place each affords an independent truck for the carriage of fuel, and each rolls downwardly and may be easily pushed around the frame until the frame section is full, the last grate unit when dropped into place fills the frame and affords in connection with the other grate units a succession of independent fuel carrying trucks, each comprising parallel shafts connected at the ends by the grate sections D^2, and thereby spaced equal distances from each other and from the next succeeding shafts of the adjacent carriages or grate units. Should the sprocket shafts not be properly positioned with reference to each other to permit the grate units to drop readily into place or should it be necessary to adjust the same to compensate for wear, this may be easily accomplished by releasing or setting up the nut on the adjusting rods c^4, thus spacing the shafts the desired distance apart and in parallel relation. The grate having now been rolled into the furnace in the proper position, as shown in Figs. 1 and 2, the hopper K, is filled and the gate k, is adjusted to the required height to spread the fuel uniformly in the desired thickness upon the surface of the grate. Rotation of the shaft e^8, now actuates the sprocket shaft C, by successively raising and lowering the bracket arm e^5, and thereby rotating the shaft e', and thence through the worm and worm gear of said shaft C, and the fuel is thus carried inwardly, evenly distributed over the grate surface, the draft being supplied from beneath and through the grate sections, and the upper run of the grate.

Owing to the overhang in the sides of the furnace wall supported upon the structural steel bar or beam H, the fuel cannot lodge upon the side frame members, and in consequence, the side frame members are protected from injury while the intermediate frame members over which the grate sections D^2, extend are thereby protected from injury and also being exposed to the draft from below or at all times kept comparatively cool.

As each grate unit travels inwardly carrying its fuel exposed for combustion, the heat of the combustion is carried downwardly along the inclined faces of the arch and thence directed upwardly and rearwardly to the boiler or other device to be heated, the draft naturally passing upwardly along the rearwardly inclined surface G^2, of the bridge wall. As each grate unit leaves the turn at the lower end of the frame, as shown in Fig. 7, and passes around the sprocket C^3, the intermediate grate sections swing over, throwing the ashes, cinders and other residue of the combustion into the ashpit, this downward swing being sufficiently violent to entirely clear the grate from any adhering material and said intermediate grate sections so depending, exposed for their entire extent to the inflowing draft of air to the furnace, are very quickly and completely cooled, thereby, and in consequence are protected from injury. Obviously, also, said intermediate grate sections being suspended on the shaft D, only during the upward travel of the grate unit, very free access of the air is thus permitted to the fire surface to support the combustion and also to keep all the upper portions of the grate comparatively cool, thus insuring durability as well as efficient and satisfactory combustion. As the grate units arrive at the upper sprocket wheels C^2, and are carried upwardly thereby around the ends of the frame members, the rear ends of said intermediate grate sections fall by gravity against the sleeve d^6, on shaft D′, as before described practically without noise and each of said grate units thus again passes over its sprockets and beneath the hopper to receive its quota of fuel to continue the operation.

Should it be desired to vary the inward feed of the grate, this can be accomplished by turning the screw shaft e^6, by means of the crank e^7, to adjust the end of the connecting rod e^{10}, farther from the pawl e^4, thus giving a less amplitude to the throw of the pawl and producing consequent less speed of travel for the surface. Should greater speed be desired, the end of the adjusting rod is adjusted closer to the pawl, thus affording a greater amplitude of travel for the pawl and proportionately increasing the feed. The supply of fuel may, of course, be regulated by the gate, as before described.

Should it be desired to remove the grate as a whole from the furnace it is only necessary to disconnect the connecting rod e^{10}, from the screw shaft e^6, and to roll the grate on its track out of the furnace.

Of course, for small furnaces, a single section in width may be all that will be used. In others, two or more such sections either of the same or of different standard widths may be used, and, should the standard widths of the units be insufficient to fit exactly in the furnace, this may be compensated by affording a greater overhang of the furnace walls above the beam or bar H.

Of course, numerous details of the construction may be varied, and where I have described a construction of cast metal, of course, other structural material of suitable cross sectional forms may be employed, should it be desired. I therefore do not purpose limiting this application for patent otherwise than necessitated by the prior art.

I claim as my invention:

1. A furnace grate comprising inclined

parallel ways, curved ways connecting the respective parallel ways and independent grate units movable in said ways, each comprising a pair of shafts, grate bars connecting the shafts adapted to lie parallel with the inclined ways on both the upper and lower run and grate bars pivoted to one of the shafts adapted to lie parallel with the inclined ways on the upper run and to swing at an angle with the ways on the lower run to admit air through the grate.

2. In a grate of the class described individual grate units each separate from the others and each comprising parallel shafts, grate sections connecting the same at the ends thereof and intermediate grate sections journaled on one of said shafts and loosely supported on the other and adapted to operate by gravity to dump the ashes therefrom when combustion is completed.

3. In a grate of the class described a plurality of longitudinally extended, laterally arranged frame sections rigidly secured each to each in parallel relation and affording on the inner adjacent faces thereof continuous channels to afford in each a circuit, a plurality of independent, interchangeable duplicate grate units each comprising an individual truck or carriage supported in the channels between adjacent frame members and each consisting of two parallel shafts, end grate sections connecting the same, intermediate grate sections pivoted on one and resting on the other, and said grate sections being so proportioned as to insure uniform distances between the shafts of each unit and the adjacent shafts of adjacent units, and sprocket wheels journaled at the ends of the frame members to propel said grate units.

4. In a grate of the class described duplicate interchangeable grate units each comprising a carriage or truck consisting of parallel shafts mounted on rollers, grate sections connecting said shafts at the ends, intermediate grate sections pivotally supported on one of said shafts and resting on the other and adapted to swing over by gravity in dumping and to hang from one of said shafts only during the return travel of the unit.

5. A furnace grate comprising frame members each having oppositely facing channels at the sides thereof, means rigidly connecting the frame members, a plurality of independent grate units loosely mounted on said frame members, each consisting of a plurality of shafts, grate bars journaled at each end to said shafts and grate bars pivoted at one end to one of the shafts and loosely resting on the other shaft.

6. A furnace grate comprising frame members each having oppositely facing channels at the sides thereof, means rigidly connecting the frame members, a plurality of independent grate units loosely mounted on said frame members, each consisting of a plurality of shafts, grate bars secured at opposite ends to said shafts, grate bars pivoted on one of the shafts and loosely resting on the other shaft, said end grate bars having curved extensions and flanges curved complementally therewith adapting each grate unit at its ends to turn on the adjacent units.

7. In a device of the class described duplicate frame members, means for rigidly connecting the same, shafts journaled in the frame members, sprocket wheels thereon, shafts provided with rollers at the ends thereof, grate bars connecting the shafts in pairs, part of the same resting loosely at one end on one of the shafts, a drive shaft connected to actuate one of the sprocket shafts and a timing mechanism embracing an eccentric, a rod reciprocated thereby, a pawl actuated by reciprocation of the rod to actuate the drive shaft and a shaft having threaded connection with the rod adapted to adjust the same to vary the rate of feed.

8. In a device of the class described frame members, flanges integral with each providing channels, shafts having rollers on the ends thereof to engage in the channels, a removable plate adapted to admit the rollers into the channels, grate bars connecting the shafts in pairs together, said grate bars having curved extensions, flanges complementally curved with the extensions affording broad bearing surfaces for the adjacent grate bars and grate bars secured to each pair of shafts to swing downwardly to dump the ashes.

9. A conveyer embracing parallel ways affording a circuit, and independent grate trucks or carriages movable therein and affording during the upper run of the circuit a substantially uniform carrying surface and during the lower run of the circuit affording a large opening therethrough.

10. A conveyer embracing parallel ways affording a continuous circuit and a plurality of disconnected, independent duplicate grate carriages or trucks movable between said ways and affording at one portion of the travel a supporting surface and parts of said grate carriages adapted to automatically swing out of normal supporting position after passing dumping position to afford a large opening through the carriages when the carriages are traveling from dumping position to supporting position.

11. A conveyer of the class described embracing parallel ways affording a continuous circuit embracing an upper and a lower run, independent grate sections therein, part of each grate section affording a continuous supporting surface on the upper run of the circuit and adapted to swing to dumping position at the inner limit of travel and to afford unobstructed draft through the lower

run of the circuit and part of said grate sections affording a continuous surface on both the upper and lower run.

12. In a device of the class described two or more parallel inclined frame members each affording a continuous channeled circuit on the adjacent faces thereof, duplicate interchangeable carriages filling said channeled circuits, grate bars supported on said carriages and affording the fuel carrying surface for a part of the travel and adapted at the inner limit of travel to swing to dump the grate section, and to return to near starting position suspended from one end the carriage, actuating means for said carriages, and coacting draft dampers arranged beneath the fuel surface, one adapted also to jar part of the grate sections and means for actuating the same to regulate the draft.

13. In a device of the class described parallel frame members affording on their inner faces continuous duplicate circuits, a plurality of duplicate interchangeable independent carriages or trucks movable in said circuit, each embracing parallel shafts, truck wheels thereon at the ends, grate bar sections affording the fuel surface for the truck, part of said sections connecting the parallel shafts, and the remainder of the grate sections connected to one and supported on the other and adapted to be suspended from said shafts during the return movement of the carriages to the fuel receiving position.

14. In a device of the class described independent duplicate grate sections each embracing parallel shafts, wheels thereon, grate bars secured thereon transversely of the shafts, some of which are secured to each shaft, the remaining grate bars being secured to one shaft and supported on the other whereby the last named grate bars are suspended by one end when returning to loading position, the supporting surfaces of said bars having a width to overlap and overhang the ends of the shafts and the wheels therefor when in carrying position.

15. A traveling grate comprising independent units, each consisting of two shafts, a grate section at each end of each pair of shafts connecting the shafts, and intermediate grate sections journaled to one of the shafts with one extremity of the section above the shaft and said intermediate sections adapted to rest on the other shaft at approximately the middle thereof.

16. In a device of the class described duplicate sections having ways therein, duplicate interchangeable guides connecting each pair of sections, independent grate units, each comprising shafts adapted to travel in said ways, grate sections pivoted to one of the shafts and adapted to rest on the other shaft and grate sections forming the sides of the grate units connecting the shafts and spacing the shafts the required distance apart for the pivoted grate sections to rest thereon.

17. The combination with a furnace having an inwardly and downwardly facing abutment or overhang in the side walls thereof and extending from the outer end to near the inner end of the furnace, of a stoker embracing lateral parallel frame members inclined downwardly at their top and complementally with the inclination of said overhang and adapted to fit therebeneath, corresponding channeled circuits in the inner faces of said frame members, and a traveling grate movable in said channeled circuit, the lateral edges of said grate projecting above and in proximity with the overhang of the furnace wall, parts of said grate being adapted to swing downwardly to open the lower run thereof to afford unrestricted draft to the fire surface, and coacting dampers supported below the lower run of said grate, one adapted for adjustment to regulate the draft therethrough and the other rigidly supported to jar the parts of the grate that swing downwardly.

18. A traveling furnace grate comprising independent grate units each consisting of a pair of shafts, grate bars pivoted to both shafts and covering the same on the upper and lower runs and grate bars pivoted to one of said shafts adapted to cover both shafts on the upper run to provide a fuel bed and adapted to swing away from one of the shafts on the lower run to admit air to aid combustion.

19. A furnace of the class described embracing parallel frame or guide members, sectional girders spacing the same appropriately apart and rigidly engaging the same in parallel relation, and independent duplicate rolling grate sections each comprising a plurality of grate bars extending between and longitudinally of the frame members, some thereof maintaining parallel relation with the frame members, others adapted to swing downwardly to dump the products of combustion and to hang from one end beneath the frame during the returning run of said grate sections.

20. A device of the class described embracing parallel frame members, independent fuel carrying trucks or carriages movable thereon, each comprising a plurality of shafts, a plurality of grate bars connecting the shafts and a plurality of grate bars pivoted to one shaft and adapted to rest on another shaft or to hang downwardly dependent upon the position of the carriages in the circuit, means for actuating the carriages, and removable sections in said frame members adapted to permit said trucks or carriages to be lifted bodily therefrom.

21. In a device of the class described independent grate units, each comprising a plurality of grate sections pivoted at one

end with the opposite end loose, and a plurality of sections pivoted at both ends.

22. In a device of the class described independent duplicate fuel conveying carriages each comprising parallel shafts, grate bars secured thereon longitudinally of the travel of the grate, said grate bars being of approximately a standard width to permit variation of the width of the carriages by the insertion or removal of the grate bar sections, and the use of a shaft of corresponding length, two of said grate bars on each carriage being shaped to mesh with sprocket wheels, the remaining grate bars of each section being pivotally engaged on one shaft and supported on the other, and wheels on each shaft to support the same upon the track.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

JOSEPH J. MERRILL.

Witnesses:
K. E. HANNAH,
LAWRENCE REIBSTEIN.