

No. 638,659.

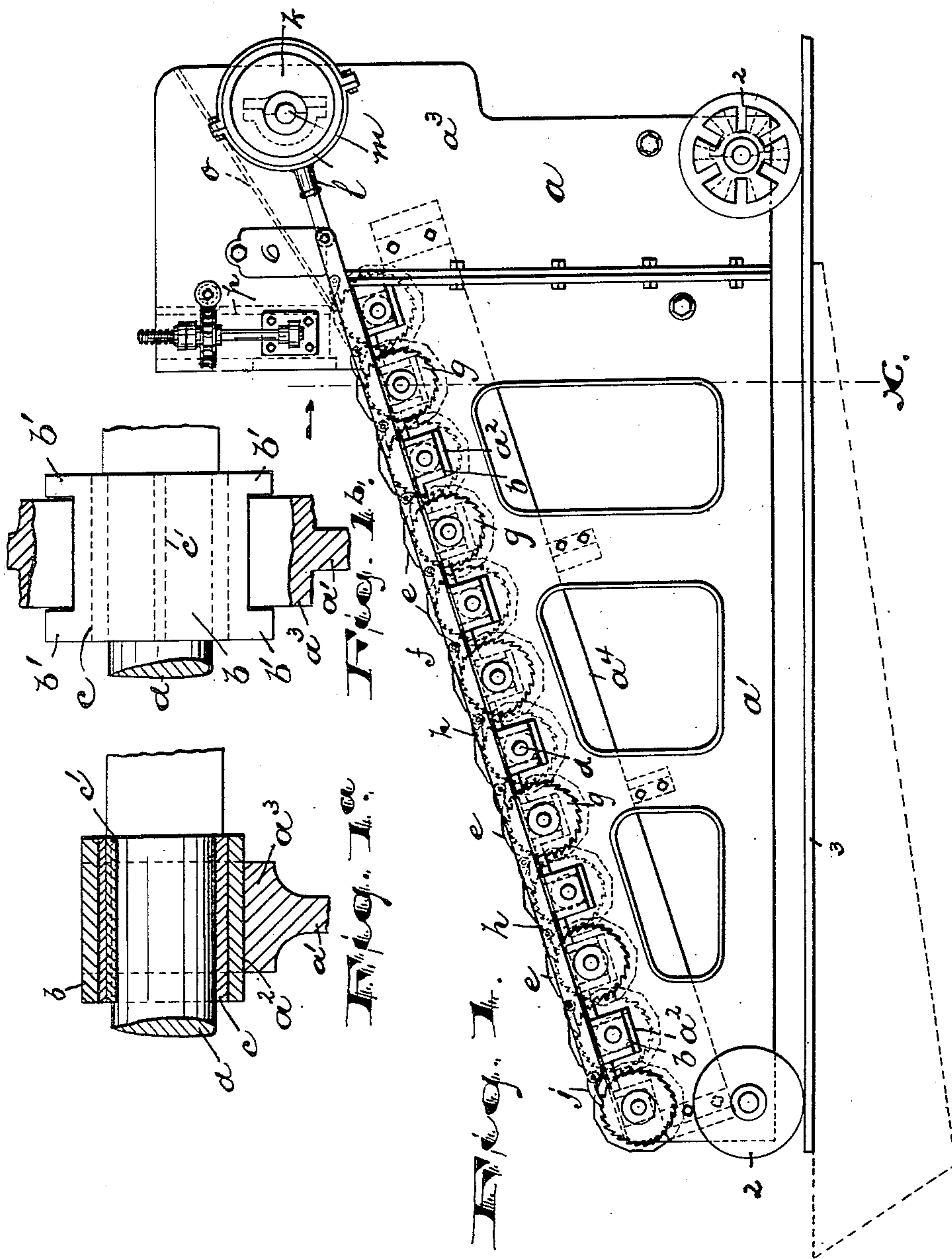
Patented Dec. 5, 1899.

H. BENTON.
STOKING GRATE.

(Application filed Mar. 4, 1899.)

(No Model.)

5 Sheets—Sheet 1.



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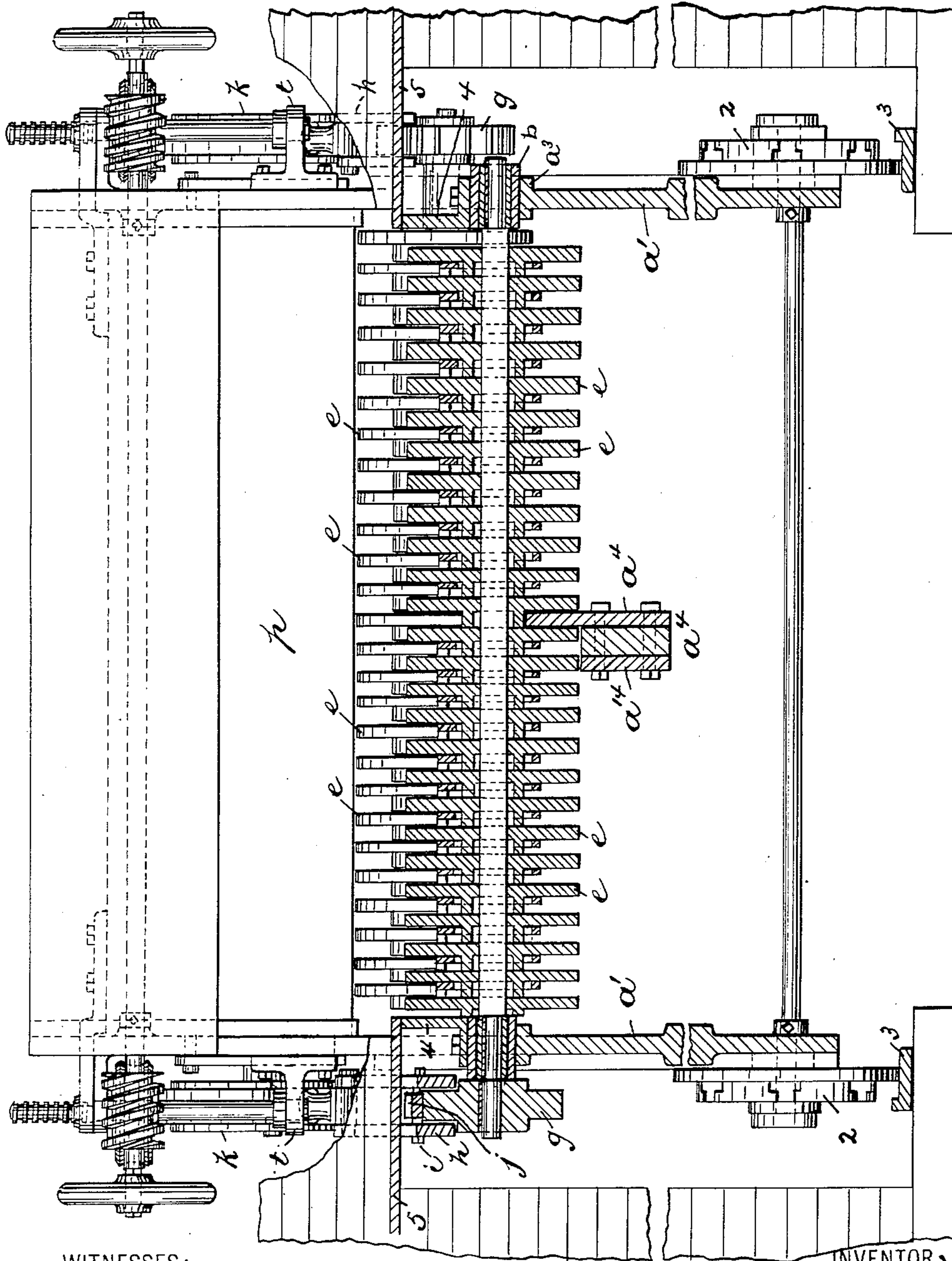
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Fig. 2.

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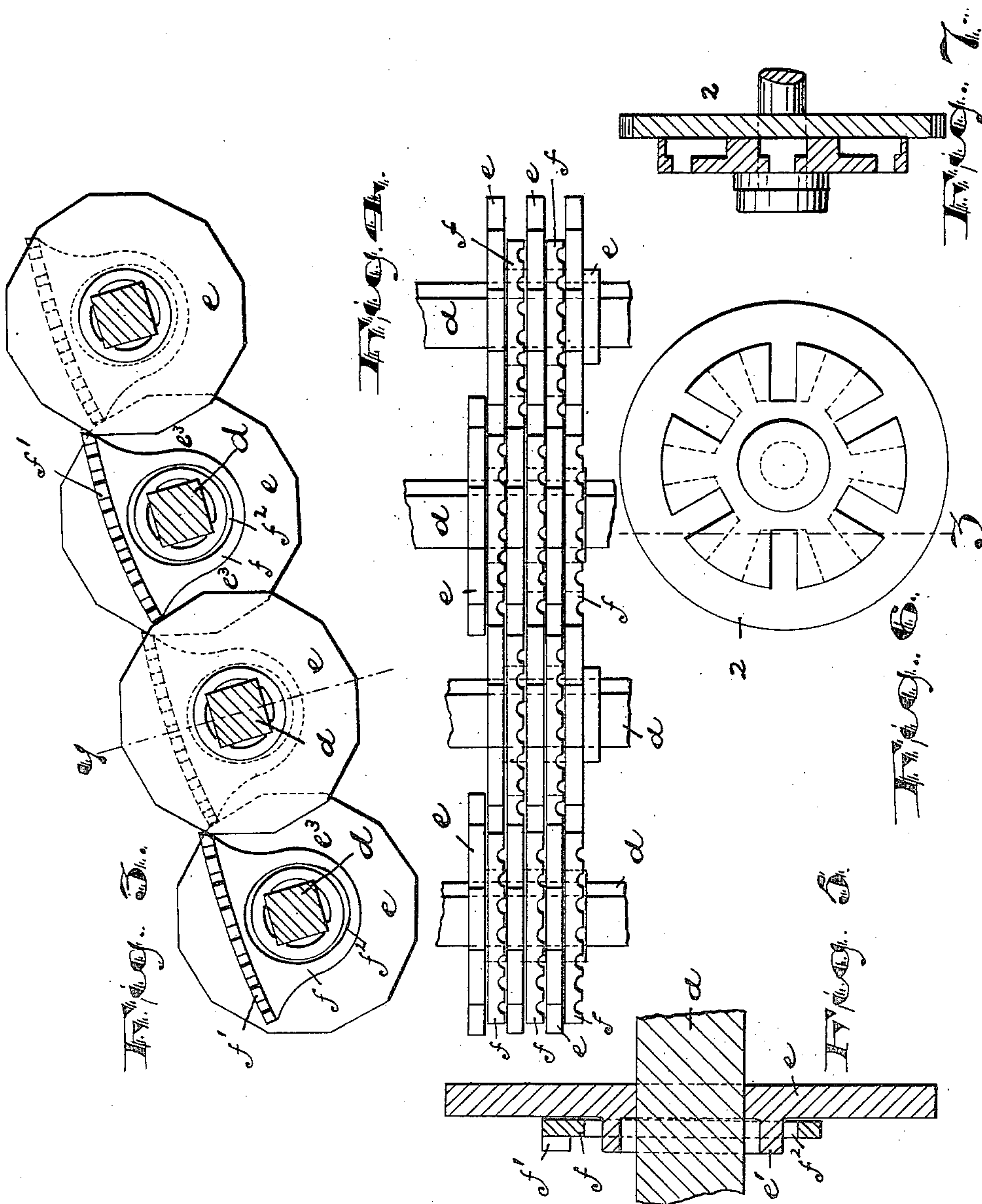
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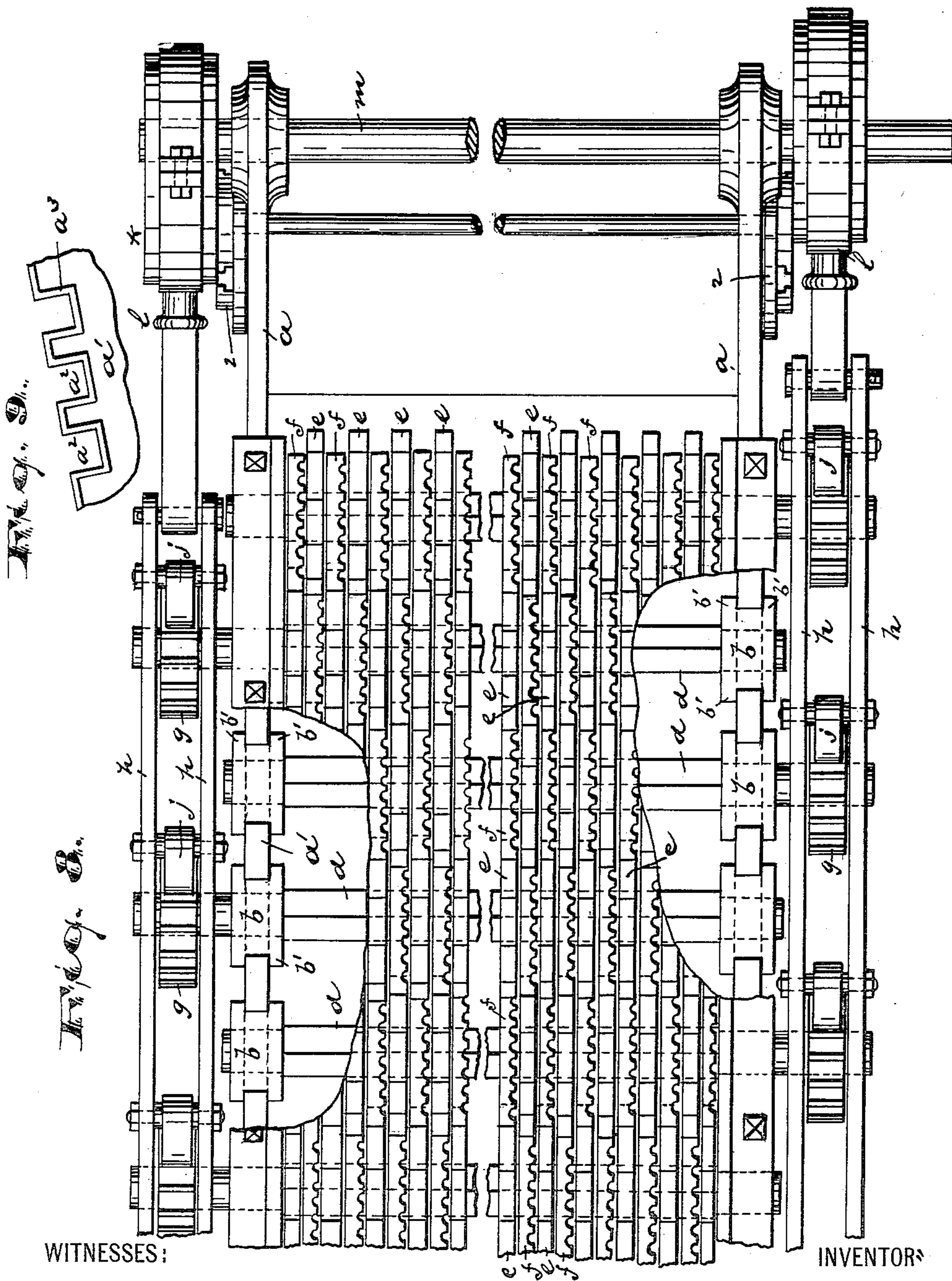
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5 Sheets—Sheet 4.



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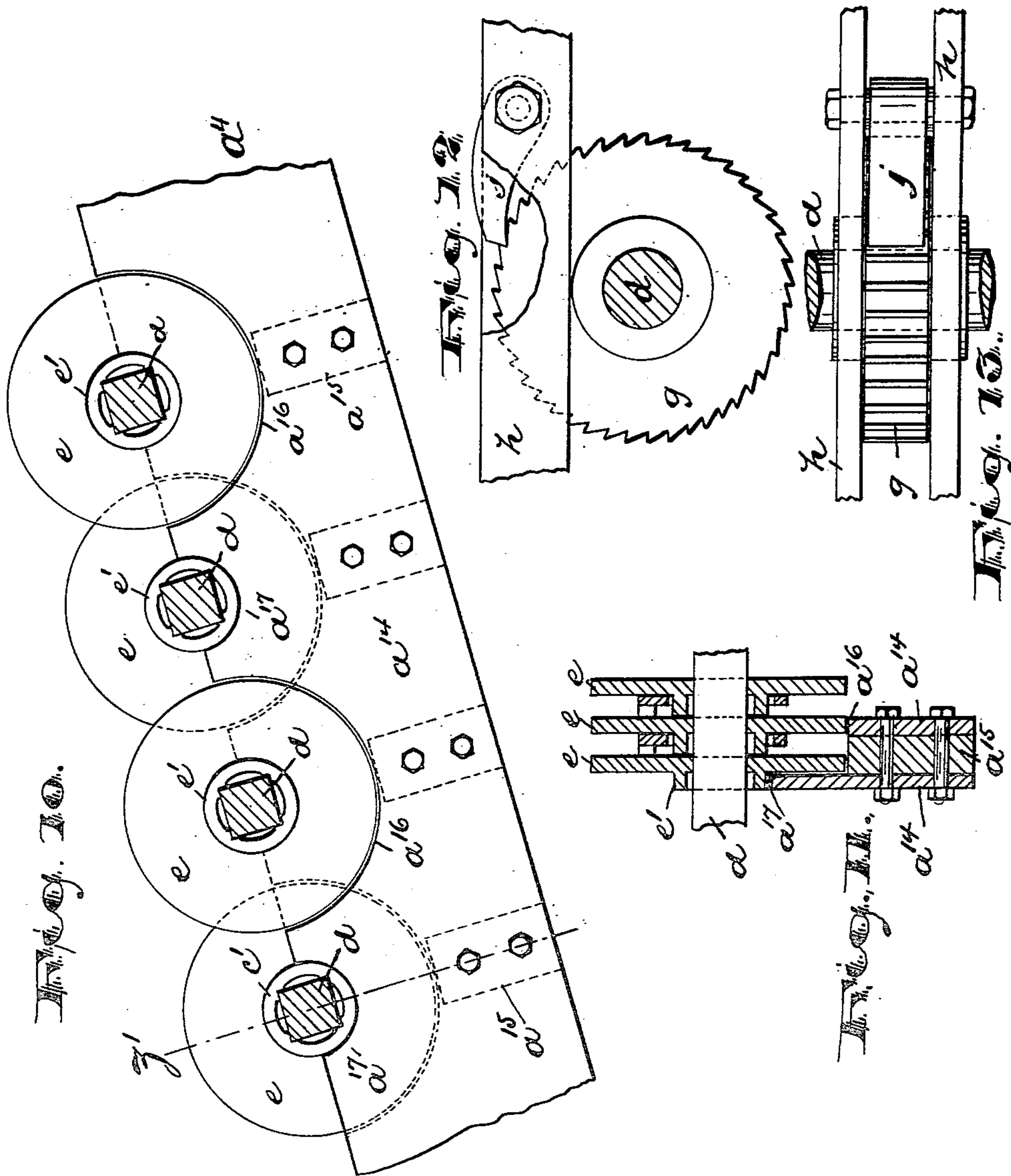
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5 Sheets—Sheet 5.



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UNITED STATES PATENT OFFICE.

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TO CHARLES B. RING, OF LORRAINE, NEW JERSEY.

STOKING-GRATE.

SPECIFICATION forming part of Letters Patent No. 638,659, dated December 5, 1899.

Application filed March 4, 1899. Serial No. 707,701. (No model.)

To all whom it may concern:

Be it known that I, HENRY BENTON, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Stoking-Grates; 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters and numerals of reference marked thereon, which form a part of this specification.

The objects of this invention are to provide a grate which will constantly change its upper surface in contact with the fire, so as to prevent the said surface from becoming unduly heated and melted or burned at its point of contact with the fire, to prevent the grate from warping due to excessive heating, to keep the bed of coals in a continuous state of movement, whereby the said bed will not become clogged with ashes or the draft obstructed by clinkers, to provide simple and efficient means for producing a substantially continuous movement, to enable the ashes to be deposited in the ash-pit automatically, and to secure other advantages and results, some of which may be referred to hereinafter in connection with the description of the working parts.

The invention consists in the improved stoker and grate for furnaces, &c., and in the arrangements and combinations of parts of the same, all substantially as will be hereinafter set forth, and finally embraced in the clauses of the claim.

Referring to the accompanying drawings, in which like letters and numerals of reference indicate corresponding parts in each of the several views, Figure 1 is a side elevation of the stoker or grate adapted to be wheeled into position in the furnace or removed therefrom for purposes of repair or for other purposes. Fig. 1^a is a vertical longitudinal section, on an enlarged scale, of one of a series of boxes providing bearings for the grate-bars. Fig. 1^b is a plan view of the same. Fig. 2 is a section of the stoker or grate, taken at line *x* in Fig. 1, portions of the walls of the furnace

being shown. Fig. 3 is a detail section of the grate, showing, on an enlarged scale, certain rotary plates and guards interposed between the same. Fig. 4 is a plan of the parts shown in Fig. 3. Fig. 5 is a section on line *y*, Fig. 3, the scale being still further enlarged to show the arrangement of guards more clearly. Fig. 6 is a side elevation of a certain jack-wheel upon which the stoker-frame is carried; and Fig. 7 is a section of the same, taken at line *z*. Fig. 8 is a plan of a portion of the stoker or grate, showing the relative arrangement of the grate-bars and operating parts more clearly. Fig. 9 is a detail side view of the upper edge of one of the side plates of the frame. Fig. 10 is an enlarged sectional view of a portion of the grate, showing a certain center-support more clearly in its relations to the grate. Fig. 11 is a cross-section of the same on line *z'*, Fig. 10. Fig. 12 is an enlarged side view of a certain pawl and ratchet for rotating the grate-bars; and Fig. 13 is a plan of the same, all said parts thus briefly mentioned being hereinafter more fully described in detail.

As shown in the drawings, my improved grate consists of a fire-bed formed of circular, approximately circular, or polygonal plates arranged vertically edgewise and sufficiently close together to prevent the coals dropping through any spaces between said plates. The plates are fixed in parallel series upon transversely-extending shafts, those of a series on one shaft being separate from one another sufficiently to allow the plates of the series upon the adjacent shafts on either side to extend in between the plates of the first-mentioned series. The said shafts are rotated by appropriate mechanism, hereinafter more fully described, so as to cause the disks or plates thereon to rotate all in one direction, and this produces an agitation at the bottom of the fire which removes the ashes and clinkers and secures an always clean fire, the amount of agitation being controlled by varying the speed of rotation of the shafts and plates.

In the drawings, *a* indicates a frame upon which the grate-bars have their bearings. Said frame consists, preferably, of side plates *a'*, of cast metal, the upper edges of which are formed on an incline corresponding more or

less closely to the incline of the tubes of the boiler arranged above the grate. The said upper edge of each side plate is preferably provided with a series of angular recesses a^2 , adapted to receive square boxes b , said boxes being provided at their sides with flanges b' , adapted to overlap the sides of the frame, and thus hold the boxes in proper relative position with respect thereto. At the said notched upper edge the side plate a' is thickened or provided with a strengthening-rib a^3 , Figs. 1 and 1^a, which follows the outline of said upper edge and provides a more firm seat for the boxes b . Said boxes are perforated to receive sleeves or bushings c , which latter are arranged upon the axial ends of the square or angular shafts d and held thereto by keys c' , the said bushings thus taking the wear due to rotation which would otherwise come on the shaft.

The shafts d are in an inclined series and extend from side plate to side plate, and on the same are arranged in series the angular plates e , said angular plates being octagonal, dodecagonal, or polygonal. These plates are angular, so as to produce something of a lifting movement as each angle is brought vertically beneath the bed of coals. The said plates e are preferably provided with hubs e' , each of about one-eighth of an inch, more or less, greater length than the thickness of the plate on which it is formed and so when the said plates are arranged upon the shaft in series spaces will be formed between the plates. Each of said spaces is little greater in width than the thickness of a plate, and thus the outer peripheral portion of a plate on one shaft may enter the space formed between the corresponding parts of two plates on another shaft to effect a free movement of the plates without friction. The square or angular shafts d are arranged a distance apart sufficient to cause an overlapping of the plates, as indicated in Figs. 3 and 4. The plates upon one shaft do not extend up to the hubs of the plates upon the shafts next in series; but openings are formed between the hubs and the peripheral edges of the plates, as at e^3 , through which the air may pass upward to supply oxygen to the furnace-coals. When I employ very fine fuel—such as coal-dust, buckwheat, or soft coal of very small size—I partly close the said openings e^3 by means of guards loosely arranged upon the hubs of the plates, as indicated in Figs. 3 and 4. The said guards comprises slotted ears f , at the upper edges of which are formed notched flanges f' , the notched flanges extending across the spaces formed between the plates and the notches in said flanges being small to prevent the gravitation of very fine dust and yet permitting a sufficient passage of air to the burning coals. The slot f^2 in the ear f of the guard permits a limited vertical movement of the flange f' , preventing the plates e from being damaged and obstructed in their movements by the flanges f' .

The hubs of the said plates e are fitted upon the shafts, being provided with perforations corresponding more or less perfectly in shape with the shape of the shaft in cross-section, and the said plates e are thus caused to turn positively with the said shaft to effect the desired movement of the bed of coals resting upon the upper edges of the said plates. The said plates and shafts are provided with motive devices, by means of which the same are caused to turn simultaneously and together in one given direction, the direction being toward the lower end of the grate, so that the coals will be caused to move downward, not only by gravity, but by the positive action of the said plates. The movements of the said plates and shafts are preferably effected by ratchet-wheel and pawl devices; but any other suitable means may be employed.

The method of moving the shafts and plates which I prefer is shown in Figs. 1 and 2, where g g g indicate the ratchet-wheels, secured upon the ends of the shafts alternately, the wheels being at one end of one shaft and at the opposite end of the shaft next adjacent in the series, as indicated in Fig. 1. Near the top of the frame are arranged sliding bars h h in pairs over each side plate, the bars of each pair lying at opposite sides of the ratchet-wheels g and resting on the hubs thereof, as indicated in Fig. 2. Said bars of each pair are joined together by bolts i , upon which are arranged pawls j , disposed between the bars of each pair. The said bars, arranged as described, are suitably held on their bearings by the weight thereof and are given reciprocal movements by means of an eccentric k and its strap l , suitably attached to the forward end of the said bars. The said eccentric k is arranged upon the shaft m , having its bearings in the forward cheek-pieces a^3 of the frame a , one eccentric being on each side of the frame and so timed that when one pair of bars h is moving in one direction the other pair is making a return movement in the opposite direction. By this arrangement the series of plates e upon one shaft is making a movement while the series upon the adjacent shafts at each side are stationary, as will be understood.

While I have referred to the movement of the plates e as substantially continuous, as a matter of fact when the ratchet-and-pawl mechanism is employed the movement is actually intermittent. It is evident that should I employ sprocket wheels and chains instead of the ratchet-and-pawl mechanism the said movement would then be really continuous; but for purposes of this invention the action of the ratchet and pawl is preferable.

I prefer to employ between the side plates a' an inclined center-support a^4 , (shown in Figs. 1, 2, 10, and 11,) adapted to support the center of the grate bars or shafts and their plates to prevent the grate as a whole from sagging at the center. Said support comprises two parallel plates or strips a^{14} a^{14} , held

apart by blocks a^{15} , bolted between, so as to bring the strips in line with two longitudinal rows or lines of plates e . Both the peripheries of the plates in said rows and their hubs are circular, and recesses a^{16} a^{17} are cut therefor in the upper edges of the strips a^{11} a^{14} . One strip therefore supports, at its hub, every other one of that line of plates, the recesses a^{17} for the peripheries of intermediate plates being deep enough to give room for their turning without friction at their peripheries. The other strips similarly sustains, at its hub, plates upon the alternate shafts unsupported by the first-described strip and is recessed for the peripheries of intermediate plates or disks. In this way I secure a longitudinal central support for the shafts, so as to prevent any depression or sagging in wide grates. In practice I prefer to employ such a support in all grates six feet and over in width. It will be understood that said support extends from end to end of the furnace, where its ends are firmly secured in any suitable manner. Furthermore, the blocks a^{15} , holding the strips a^{14} a^{14} at a proper distance apart, are no wider in the direction of the length of the support than is necessary, and thus ashes and cinders are permitted to fall between said strips a^{14} a^{14} to the ash-pit.

At the front of the frame, between the cheek-pieces a^3 thereof, is arranged an inclined plate o , Fig. 1, which forms, with a certain sliding door p , a hopper for the reception of fuel, a space or opening being formed at the bottom of the hopper, through which the fuel gravitates onto the upper faces of the grate. An aperture with swinging cover 6 is provided for convenience in observing the interior of the hopper.

The frame a is arranged upon wheels 2 , the forward pair of which are jack-wheels or wheels having thereon means to receive crow-bars or like instruments, whereby the said wheels may be turned, and thus the frame, together with its grate bars and plates, may be drawn out from the furnace for purposes of cleaning, repair, or the like. The wheels are preferably arranged on tracks 3 to facilitate movement, and to prevent the fuel from being wasted at the side and to provide against escape of heat I have provided at the top of the frame a vertical guard-plate 4 , which extends from the top of the frame a to or near to the walls of the furnace, or a horizontal plate 5 of said furnace. The said guard

serves also to protect the ratchet-and-pawl mechanism from the heat and from the coals, which might tend to clog their movements.

It is evident that various modifications of the exact construction shown may be made without departing from the spirit or scope of my invention, and I do not wish, therefore, to be understood as limiting myself by the positive descriptive terms employed, excepting as the state of the art may require.

Having thus described the invention, what I claim as new is—

1. In a furnace, the combination with parallel shafts and vertical plates arranged in parallel series, of guards arranged in the vertical planes of the longitudinal rows of plates and partially closing the flaring spaces between the peripheries of said plates, substantially as set forth.

2. The combination in a grate, with vertical plates arranged in longitudinal rows upon transverse shafts, of guards lying between adjacent plates in longitudinal line therewith and partially closing the space between the peripheries of said plates, substantially as set forth.

3. The combination in a furnace-grate, of transverse shafts, vertical plates arranged on said shafts in parallel series and having hubs, the plates on one shaft alternating in position with those on the adjacent shafts and projecting therebetween, and guards arranged between the parallel plates and above the hubs on a shaft and occupying the space between the peripheries of the plates on the two adjacent shafts, substantially as set forth.

4. In a furnace-grate, the combination with the parallel plates pivoted on transverse shafts and having hubs, of guards having ears perforated to receive the hub of the plate and having a top flange lying at the side of the plate, substantially as set forth.

5. The combination with the plates e , having hubs e' , at one side, of guards having ears provided with elongated slots to receive said hubs and having perforated flanges at the top adapted to lie between parallel plates on the same shaft, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 20th day of February, 1899.

HENRY BENTON.

Witnesses:

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RUSSELL M. EVERETT.