

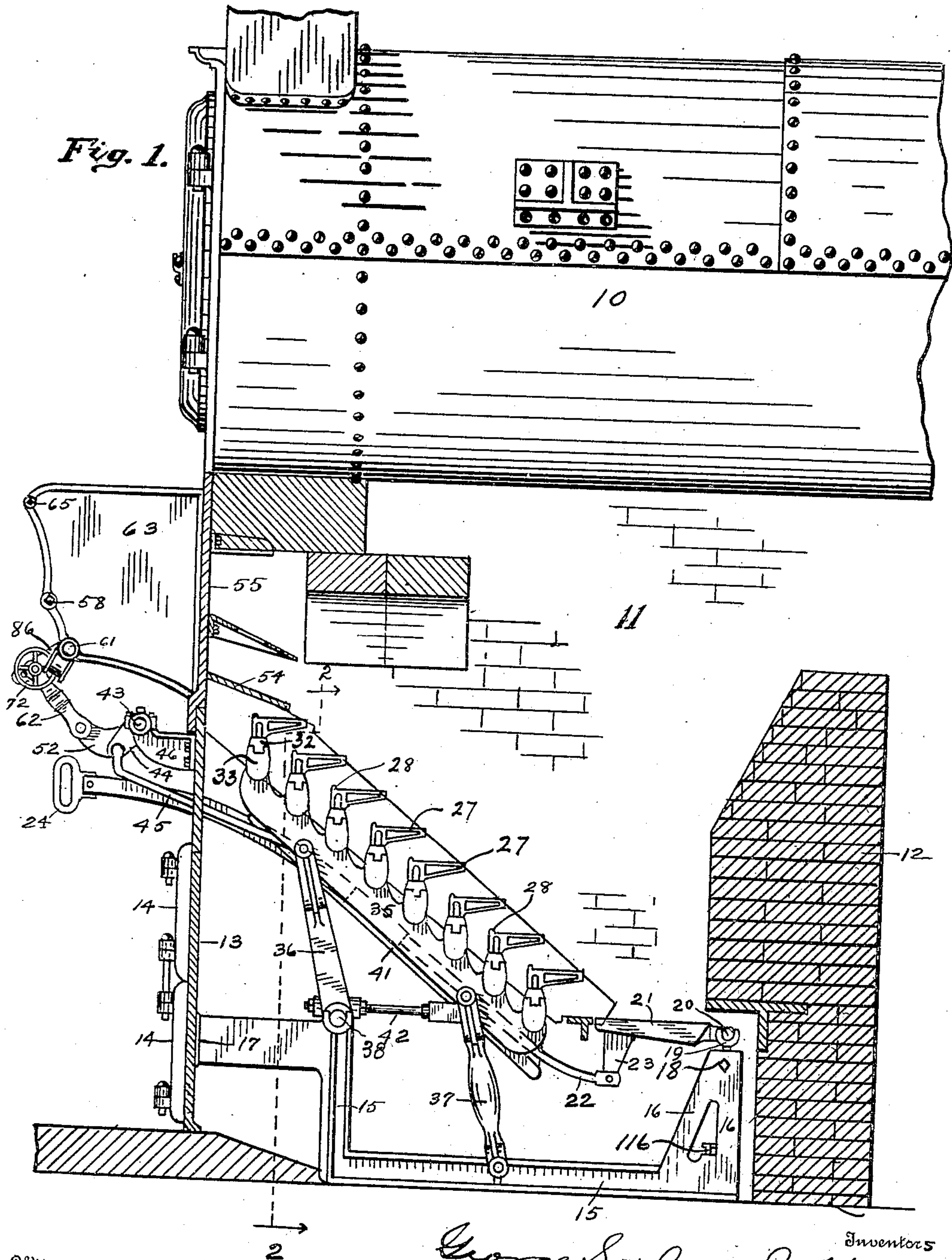
No. 829,921.

PATENTED AUG. 28, 1906.

G. S. & J. J. HUFF.  
FURNACE GRATE.

APPLICATION FILED OCT. 12, 1903.

4 SHEETS—SHEET 1.



Witnesses  
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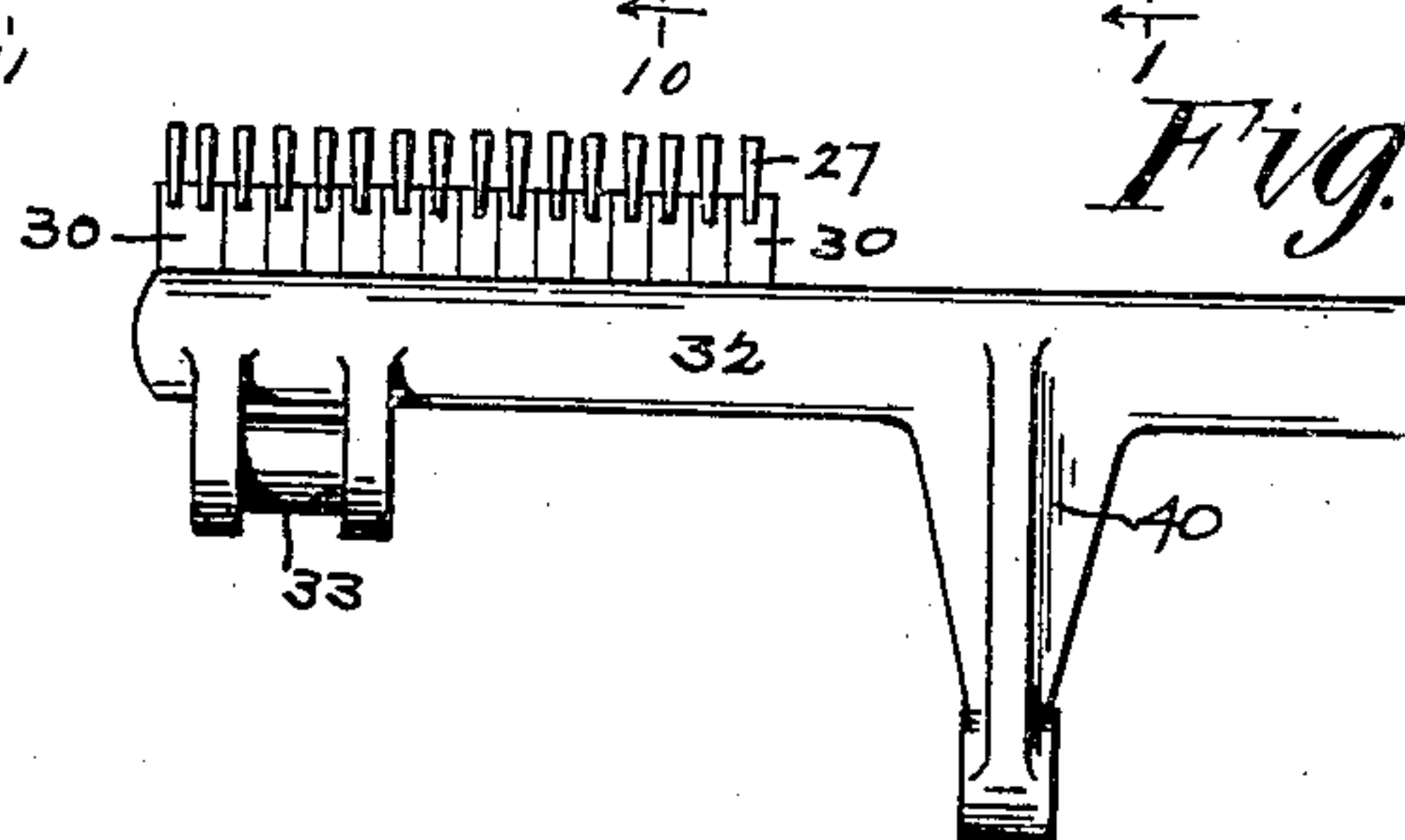
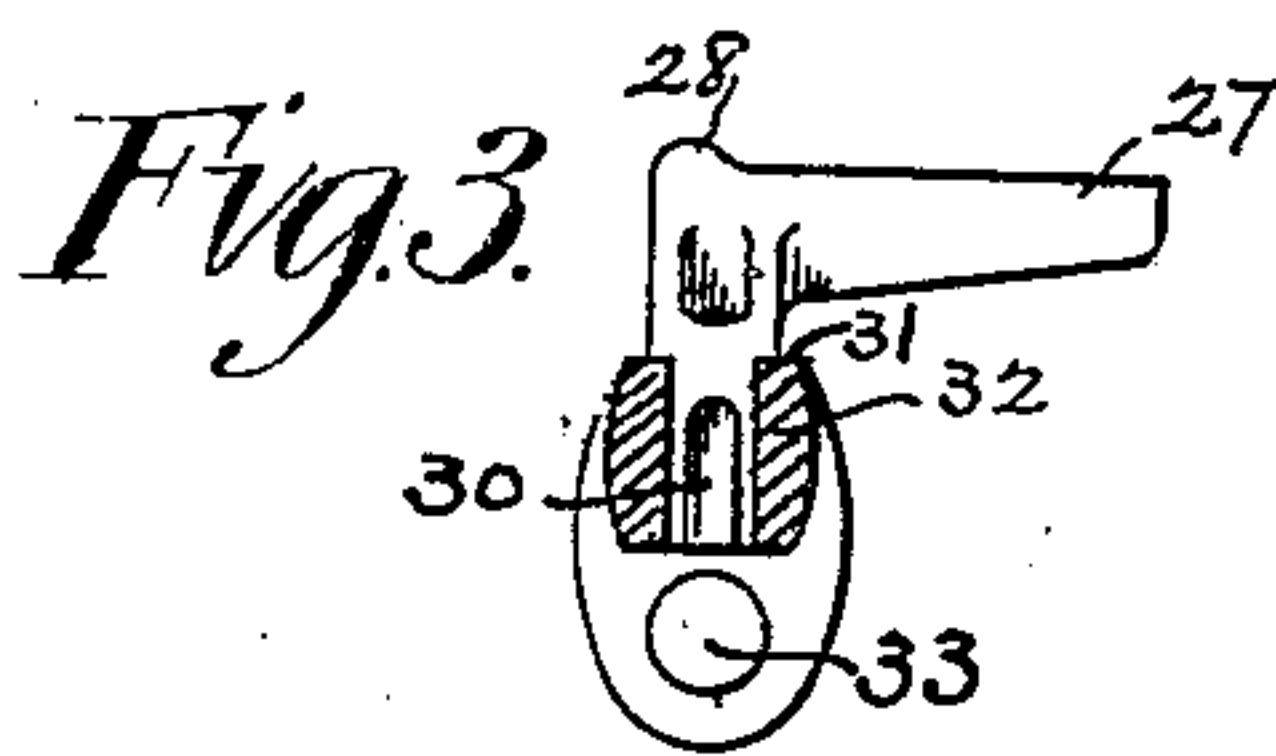
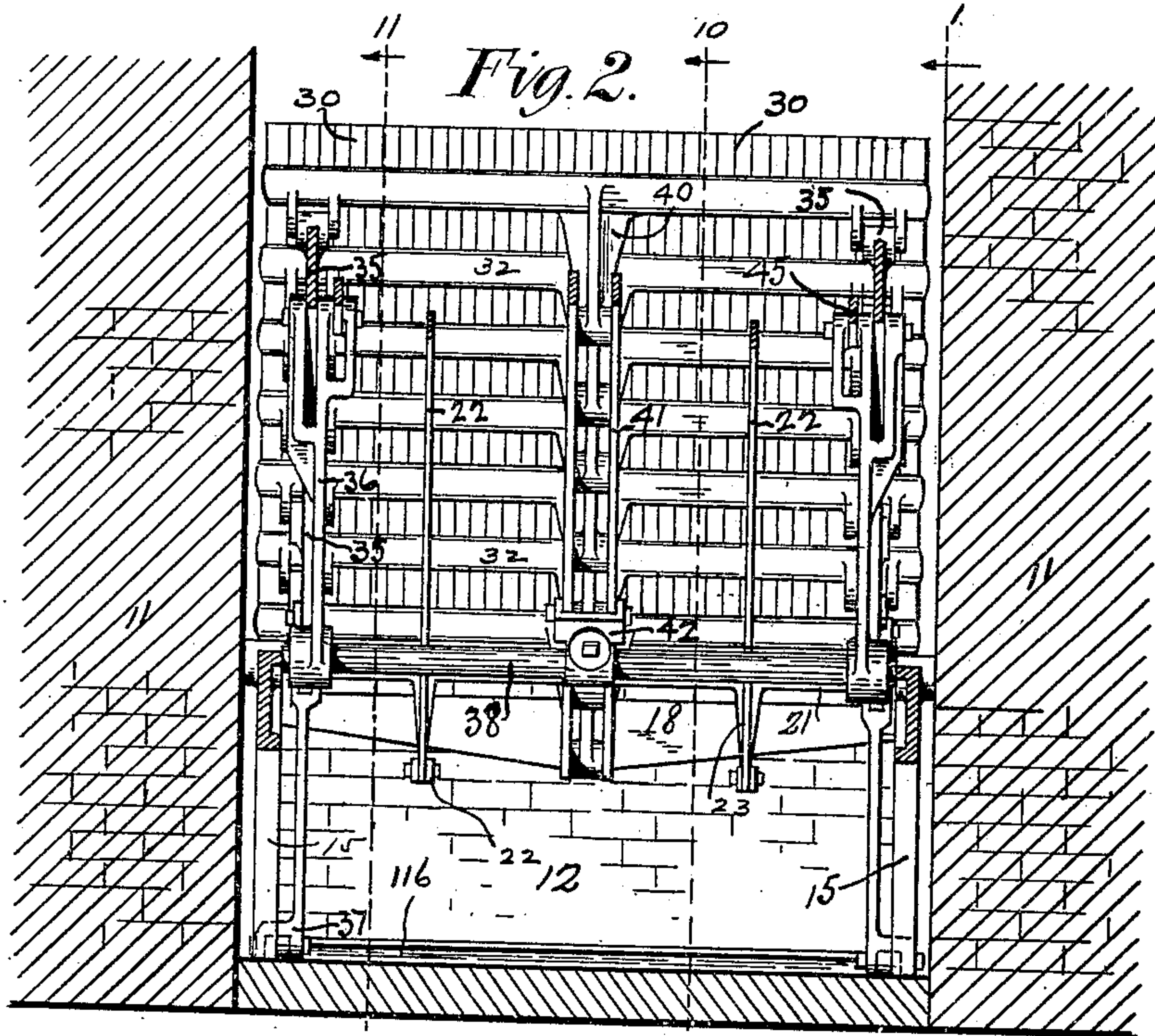


Fig. 4

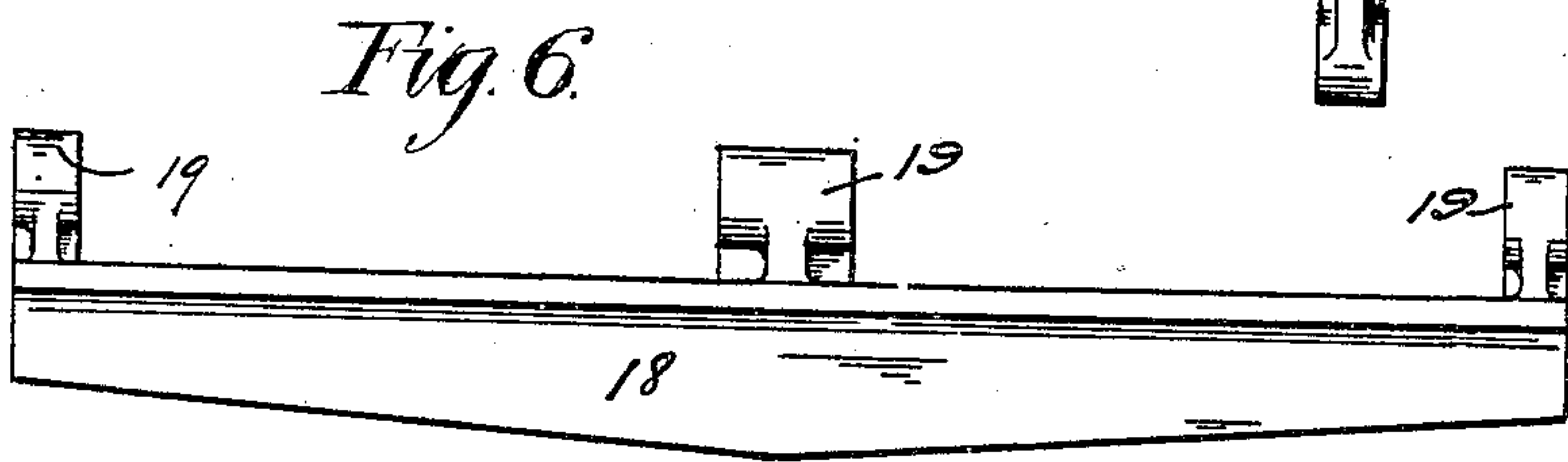


Fig. 6

Fig. 5

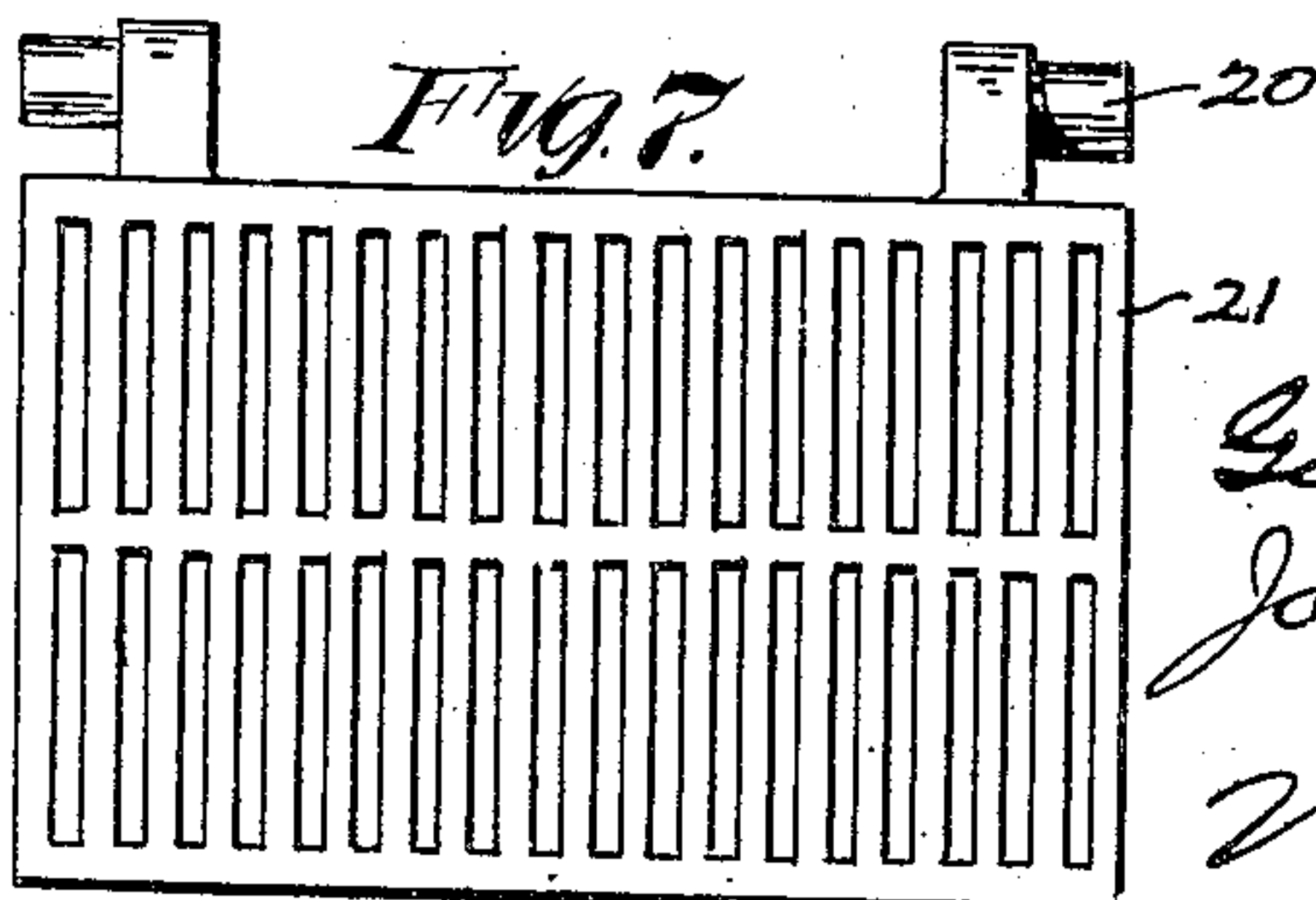
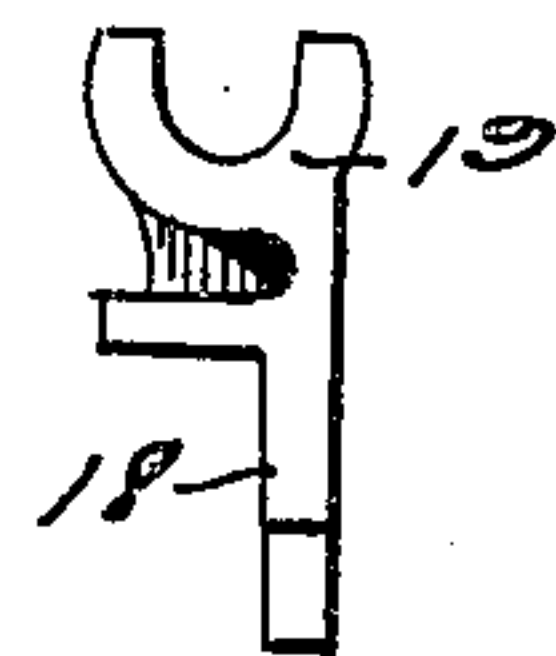


Fig. 7

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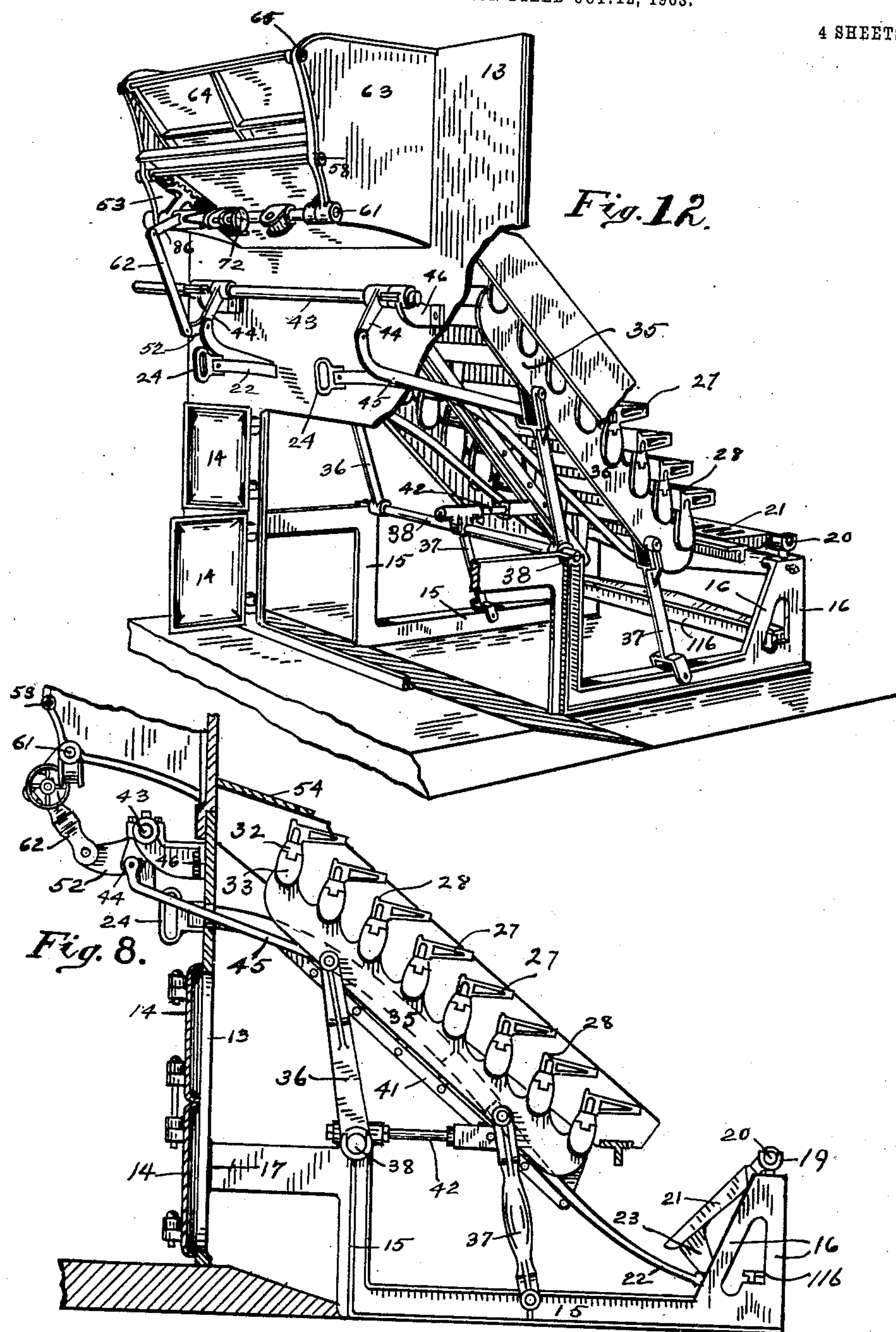
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4 SHEETS—SHEET 3.



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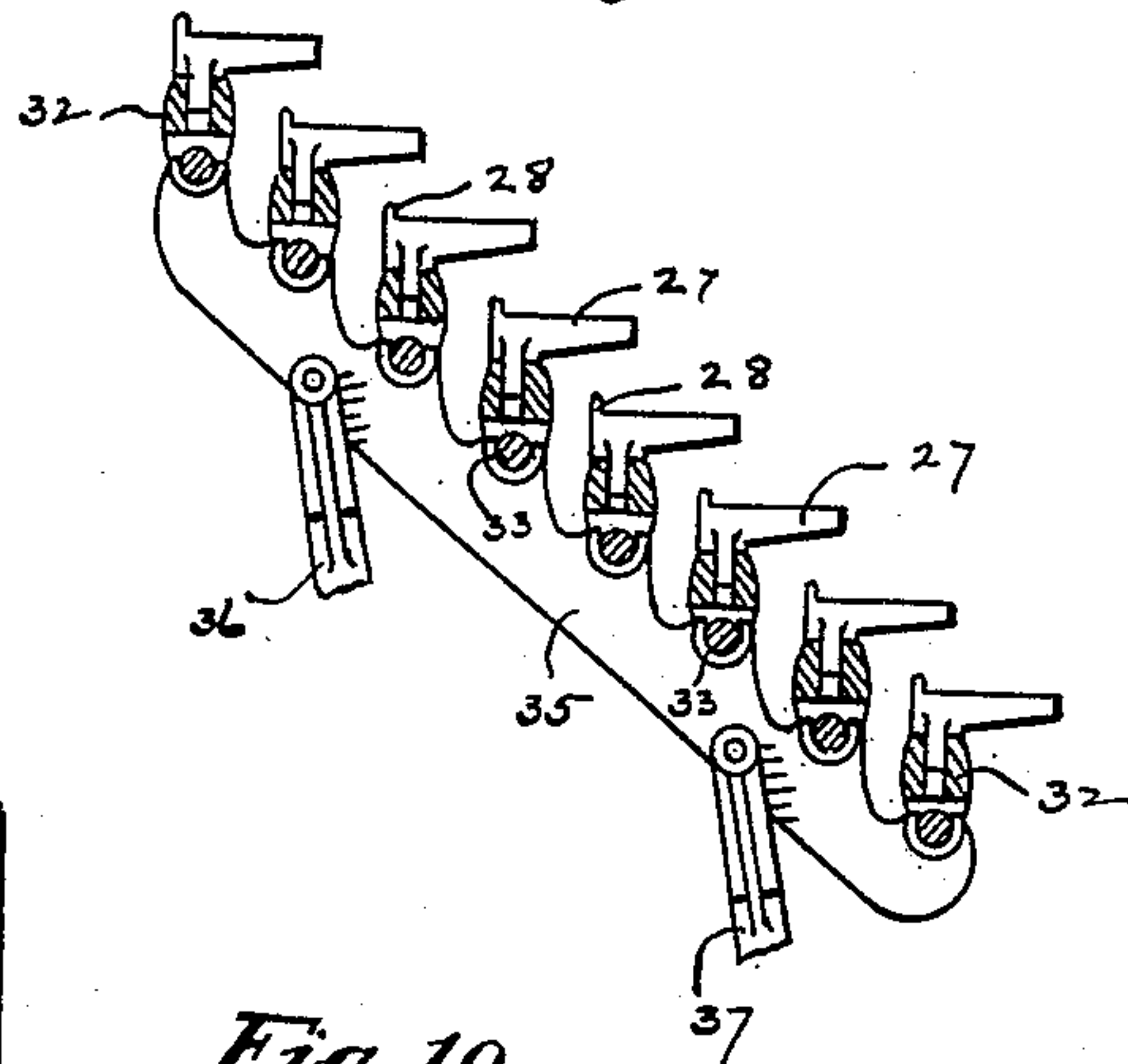
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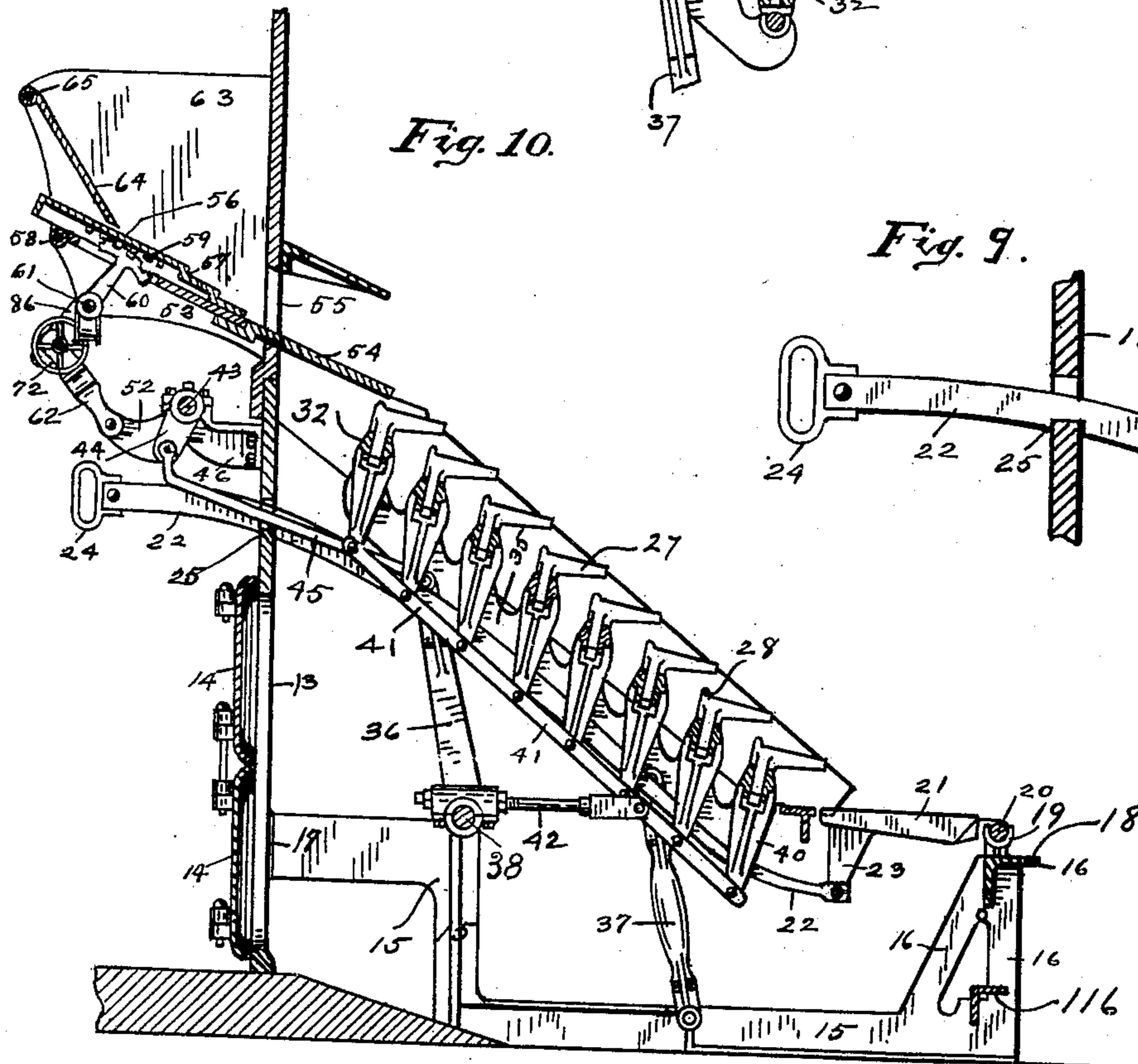
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4 SHEETS—SHEET 4.

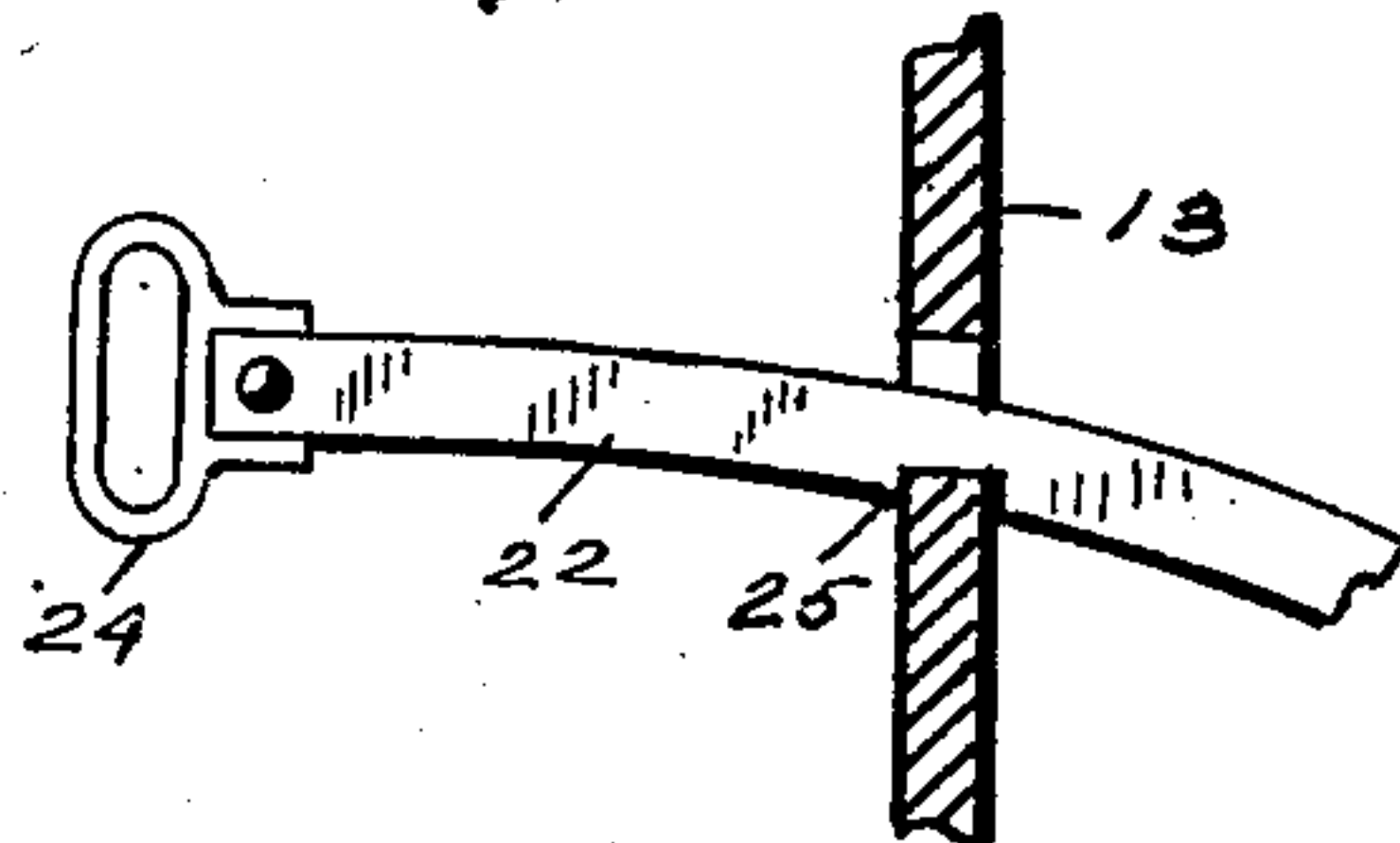
*Fig. 11.*



*Fig. 10.*



*Fig. 9.*



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Attorney



# UNITED STATES PATENT OFFICE.

GEORGE S. HUFF AND JAKE J. HUFF, OF INDIANAPOLIS, INDIANA,  
ASSIGNORS TO HUFF SMOKE CONSUMER AND STOKER COMPANY,  
OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

## FURNACE-GRATE.

No. 829,921.

Specification of Letters Patent.

Patented Aug. 28, 1906.

Original application filed May 20, 1903, Serial No. 157,964. Divided and this application filed October 12, 1903. Serial No. 176,811.

*To all whom it may concern:*

Be it known that we, GEORGE S. HUFF and JAKE J. HUFF, of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Furnace-Grate; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like numerals refer to like parts.

This application is divided from a former application by us for a smoke-consuming furnace, filed May 20, 1903, Serial No. 157,964.

This invention relates to certain improvements in smoke-consuming furnaces, particularly the grate construction thereof.

The chief object of the invention is to promote the successful feeding of coal in the furnace and to keep the coal scattered and distributed therein so that air will mix completely therewith to promote fully its combustion.

This and the other features of our invention will be understood from the accompanying drawings and the following description and claims.

In the drawings, Figure 1 is a vertical longitudinal section on a line to the right of the forward portion of a furnace and boiler equipped with our smoke-consuming apparatus as in use, being on line 1 1 of Fig. 2, parts being broken away and the grate-bars being at their outward limit of movement. Fig. 2 is a vertical transverse section of the lower portion of the furnace on the line 2 2 of Fig. 1. Fig. 3 is a side elevation of a grate-bar and a transverse section of the means for mounting it. Fig. 4 is a front elevation of a part of a series of grate-bars and the means for mounting them, parts being broken away. Fig. 5 is an end elevation of the means for mounting the dumping-grate. Fig. 6 is a front elevation thereof. Fig. 7 is a plan view of the dumping-grate. Fig. 8 is a vertical section of the grate construction, the same as shown in the lower part of Fig. 1, showing the extreme inward movement of the grate-bars—in other words, said grate-bars being at their limit of movement opposite from that shown in Fig. 1 and the dumping-grate being shown dumped and parts being broken away. Fig. 9 is a vertical section of a portion of the front wall of the furnace at the point where the bar which controls the dumping-grate passes

through. Fig. 10 is a vertical section to one side of the center of the grate construction on the line 10 10 of Fig. 2, parts being broken away. Fig. 11 is an inside elevation of one of the side bars for supporting the grate-bars and a vertical section of the grate-bar supports on the line 11 11 of Fig. 2, just inside said supporting-plates. Fig. 12 is a perspective view of the grate and its operating mechanism.

In detail the construction is as follows: 10 is the boiler. 11 is the brickwork forming the side of the furnace-chamber. 12 is the bridge-wall, and 13 is the front wall of the furnace, it being provided with an ash-pit and draft-openings closed by the doors 14.

The grate construction and its mounting are independent practically of the brick walls of the furnace, being a metal construction that can be set up outside of the furnace as well as in the furnace construction. It is set upon the floor in suitable space provided for it in the furnace and is held in place by the front metallic wall of the furnace or by any other means desired. The frame supporting the grate-bars consists of two side metal frame-bars 15, that are located at each side of the construction and are bent upward at their front ends and secured to the front wall 13 of the furnace and at their rear ends have an A-shaped post 16, extending upward. The rear ends of the frame-bars 15 are held separated by the cross-bar 116 at the foot of the posts 16. The upward ends of the posts 16 are spread and held laterally in place by the cross-bar 18, as shown in Fig. 6.

The bar 18 has another function—namely, the supporting of the dumping-grates 21. Said bar has three bearing-posts 19 extending therefrom—one at each end and one midway between the other two. These support the spindles 20 of the two dumping-grates 21. Said dumping-grates are formed as shown in Fig. 7. They consist of a series of grate-bars, as appears in Fig. 7, normally horizontal, as shown in Fig. 1. The mounting of the dumping-grates, which has been explained, supports their rearward portion, while they are supported in front by the bars 22, pivotally connected with the lower ends of the arms 23, extending downward from the forward portion of the grate-bars. The bars 22 extend along beneath the main



grate-bars of the furnace and through the front wall 13, and each has a handle 24 outside. The bar 22 is held in its uppermost and outermost position by a notch 25 in said bar that engages the front wall, as appears in the lower part of Fig. 9. When the bar 22 is caught by said notch, as described, it will hold the dumping-grate 21 in its horizontal position. When it is desired to dump the grate, the handle 24 is lifted and released, whereupon it moves inward somewhat, and that permits the forward part of the grate 21 to dump downward.

The fire-grate proper consists of grate-bars mounted in transverse rows in a step-like series upward and forward from the dumping-grate 21, as appears in Fig. 1. Therefore the slag and refuse from the inclined series of grate-bars are ultimately deposited upon the dumping-grates 21 and are then dumped into the ash-pit below.

The individual grate-bars 27, of which the grate is formed, are shaped somewhat like an inverted boot, with the top about ten inches long and one-half inch wide and substantially horizontal and with the toes or rear ends of the bars of one row about one and one-half inches above the heels of the bars of the next row to the rear. The heel 28 of each bar is slightly elevated to prevent the coal from escaping forward between the row of grate-bars upon which the coal may light and the preceding row of grate-bars that lies immediately above and forward. Each grate-bar also has a shank 30 extending downward with its lower end reduced in width, as shown in Fig. 3, to form shoulders 31. This shank drops into a longitudinal slot in the transversely-extending bar 32, so that the shoulders 31 rest upon said bar, and the grate-bars are thereby supported side by side in transverse rows, as shown in Figs. 2 and 4. The bars 32 have downwardly-extending bearings 33, that rest in suitable bearing places in side bars 35, as seen in Fig. 8.

The side bars 35, that support the transverse rows of grate-bars, are pivotally supported on the upper ends of the arms 36 and 37. Said arms 36 are pivoted at their lower ends to the transverse shaft 38, that is mounted upon the bends of the frame-bars 15, and the arms 37 are at their lower ends pivoted to the lower portion of the frame-bars 15. Therefore the whole grate or series of rows of grate-bars can be given a swinging movement on said arms 36 and 37 toward the front and rear as a unit.

Midway of each row of grate-bars an arm 40 extends downwardly that is integral with the cross-bar 32, as appears in Figs. 2 and 10, and at their lower ends said arms are pivoted to the connecting-bars 41, one on each side of the row of arms 40, and said bars are held in place by a connecting-rod 42, that is at

one end secured to the bars 41 and at the other end to the shaft 38.

The grate or series of rows of grate-bars as a whole is shaken through a rock-shaft 43, carrying cranks 44, pivoted to the outer ends of the bars 45, which extend at a downward inclination into the furnace-chamber, and at their inner ends are pivoted to the upper ends of the arms 36. Hence when the arms 36 and 37 are actuated by the rock-shaft 43 and the intermediate bars 45 the grate as a whole is swung toward the front and the rear alternately, and since the means that supports each transverse row of grate-bars is pivotally mounted on the side bars 35 at a lower level than the top of the grate-bars and has the arms 40 extending downward and connected at their lower ends with substantially stationary means the swinging movement of the side bars 35 and the grate as a whole causes a simultaneous rocking movement of the individual grate-bars. These parts are so mounted also that when the grate as a whole is swung toward the front of the furnace to obtain a further supply of coal from the coal-supplying means hereinafter explained the individual grate-bars occupy substantially a horizontal position, as shown in Fig. 1. This enables the grate-bars to receive and retain the coal that is dumped upon them, although the series of rows is inclined downward toward the rear.

When the grate as a whole is moved inward slowly with the load of coal, the mounting and arrangement described causes the individual grate-bars to be at the same time rocked downward toward the rear of the furnace-chamber. This compound movement of the grate-bars causes a slight agitation of the coal or fuel to prevent it from running together as a solid mass impervious to the air coming up from below, and the rocking movement of the grate-bars causes a slight and gradually rearward and downward feeding of the coal and the ash, slag, and the like from one cross row of grate-bars to the next row to the rear, and so on. Hence the coal is virtually fed downward from row to row of the grate-bars as it is being consumed, and the ashes are being continually shaken out, so that the slag and the like are ultimately deposited upon the dumping-grates. This compound movement of the grate-bars or horizontal swinging of the grate as a whole and the simultaneous rocking movement of the individual grate-bars is one of the chief features of the invention in the device herein shown.

It is to be noted that the above-described swinging-grate construction is so mounted as to be balanced under the load and in the various positions thereof. This is indicated in Figs. 1, 8, and 10. The grate construction is supported on the upper ends of the arms 36 and 37, that lean somewhat forwardly, so



that the weight of the grate as a whole when given a horizontal movement tends to swing with said arms downward and forward. Said tendency to swing downward and forward, however, is opposed and counteracted by the weight of the rearwardly-turned extensions of the individual grate-bars, so that the grate construction as a whole is substantially balanced on the pivots of the arms 36 and 37.

Above the mechanism which was last described the feeding mechanism is mounted, consisting of supporting end plates 63, that are secured on each side to the front wall of the furnace inclining downward toward the furnace and having secured upon their inner portions a coking-plate 54, that extends from one end plate 63 to the other and also extends into the furnace for several inches, as appears in Fig. 1. This coking-plate extends through a feed-opening 55 in the front wall of the furnace. The feed-plate 56 co-operates with the coking-plate 54 and overlaps it, as shown. It is inclined the same as the plate 54 and is oscillated to and fro toward the feed-opening, and to assist in feeding it is provided with steps 57 that push the coal in. The outer end of said plate 56 is mounted on the pins 58, that are secured in the plates 63. The feed-plate 56 is actuated by engagement of the rack 59 on its under side with a toothed crank 60, secured on the shaft 61 that extends from one end plate 63 to the other, and is mounted in them.

A hopper for feeding the coal is provided by two end plates 63, secured in front wall of the furnace in coöperation with the hanging loose front plate 64, which is pivoted at 65, and the oscillatory feeding-plate 56.

It is apparent from this described mechanism that coal which has been thrown into the hopper will be gradually fed to the furnace by the oscillation of the shaft 43 through the intermediate mechanism described and that a single means is employed for actuating the feeding of the coal and the shaking of the grates.

There is shown in the drawings a connection between the feeding mechanism and the grate-controlling mechanism, which, however, has no material bearing upon the invention claimed herein. This connection consists of the crank 52, secured to the shaft 43 and connected to connecting-bar 62, which in turn is pivoted to the crank 86 on the shaft 61, mounted in the end plate 63 of the fuel-hopper. The shaft 61 carries means controlled by the hand-wheel 72 for regulating the relative actions of the coal-feeding and grate mechanism.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In a smoke-consuming furnace, a grate formed of transverse rows of grate-bars, said rows being arranged step-like downward

from the front toward the rear of the furnace-chamber, and means for imparting to said grate-bars a forwardly and rearwardly rocking motion and for giving the grate as a whole a swinging motion simultaneously therewith.

2. In a mechanical stoker, the combination of side bars, a plurality of rows of transverse rocking bars carried thereby, grate-bars on said transverse bars, and means for imparting to said side bars a to-and-fro motion through an arc and simultaneously therewith a rocking motion to said grate-bars, said means being adapted to sustain said side bars at a substantially constant angle with respect to the horizon.

3. In a smoke-consuming furnace, a grate formed of transverse rows of grate-bars arranged step-like downward from the front to the rear of the furnace-chamber, said grate-bars being mounted so as to be susceptible of a forward and rearward movement, means for rocking each row of grate-bars with a downwardly-extending arm, approximately stationary means pivoted to the lower ends of said arms, and means for giving to the grate as a whole a forwardly and rearwardly swinging motion whereby said grate-bars will be rocked substantially as described.

4. In a smoke-consuming furnace, a bar at each side of the furnace-chamber, means for supporting said side bars so that they may be given a swinging movement forwardly and rearwardly, means for imparting said movement to said side bars, transverse bars mounted pivotally on said side bars, said transverse bars being provided with downwardly-extending arms, approximately stationary means pivoted to the lower ends of said arms, and grate-bars mounted on said transverse bars parallel with said side bars, whereby said grate-bars will have a rocking movement toward the front and rear simultaneously with said swinging movement of the grate as a whole.

5. In a stoking mechanism, the combination with side bars, a plurality of transverse bars pivotally mounted thereon and provided with depending arms, and grate-bars on said transverse bars, the centers of gravity of said grate-bars being between the vertical planes of their axes respectively, and one side of the furnace, of a plurality of upwardly-extending arms pivotally supported at their lower ends and pivotally connected at their upper ends to said side bars, said upwardly-extending arms being inclined toward the opposite side of the furnace, means for swinging said side bars, and means for anchoring the lower ends of said depending arms.

6. In a smoke-consuming furnace, a frame, supporting-arms extending upward therefrom and pivoted at their lower ends to said frame on each side of the furnace-chamber,



side bars pivoted on the upper ends of said supporting-arms, cross-bars pivotally mounted on said side bars, grate-bars carried by said cross-bars, arms depending from said cross-bars, means for holding the lower ends of said depending arms substantially stationary, and means for moving said side bars to and fro on said supporting-arms whereby the grate as a whole may be given a swinging motion and the grate-bars be simultaneously rocked.

7. In a smoke-consuming furnace, a frame within the furnace-chamber, supporting-arms extending upward from each side of the furnace-chamber and pivoted at their lower ends to said frame, a side bar at each side of the furnace-chamber pivoted to the upper ends of said supporting-arms, cross-bars pivotally mounted on said side bars and having each a longitudinal slot therein, grate-bars with shanks that fit in the slots in said cross-bars, arms depending from said cross-bars, means for holding said depending arms substantially stationary at their lower ends, and means for moving said side bars to and fro.

8. In a smoke-consuming furnace, a frame, supporting-arms extending upward therefrom and pivoted at their lower ends to said frame on each side of the furnace-chamber, side bars pivoted on the upper ends of said supporting-arms, cross-bars pivotally mounted on said side bars, grate-bars mounted on said cross-bars, arms depending from said cross-bars, a bar pivoted to the lower ends of all of said downwardly-extending arms, means for holding said bar substantially stationary, and means for moving said side bars to and fro on said supporting-arms.

9. In a smoke-consuming furnace, a frame in the furnace-chamber, supporting-arms extending upward therefrom and pivotally mounted on said frame at their lower ends on each side of the furnace-chamber, a side bar at each side of the furnace-chamber pivoted on the upper ends of said supporting-arms, cross-bars pivotally mounted on said side bars, grate-bars extending upward from the cross-bars and projecting rearward from them, arms depending from said cross-bars that counterbalance in part the rearwardly-extending ends of said grate-bars as the same are rocked, approximately stationary means pivoted to the lower ends of said depending arms, and means for swinging said grate as a whole.

10. In a smoke-consuming furnace, a frame within the furnace-chamber, supporting-arms extending upward therefrom and pivotally mounted on said frame at their lower ends at each side of the furnace-chamber, a side bar at each side of the furnace-chamber pivoted on the upper ends of said supporting-arms, cross-bars pivotally mounted on said side bars, grate-bars extending upward from the cross-bars and projecting rearward from

them, arms depending from said cross-bars that counterbalance in part the rearwardly-extending ends of said grate-bars, a bar pivotally connected with the lower end of all of said depending arms, means for holding said bar substantially stationary, and means for moving the side bars to and fro.

11. In a smoke-consuming furnace, a frame within the furnace-chamber, a pair of supporting-arms of equal length extending upward therefrom on each side of the furnace-chamber and pivoted at their lower ends to said frame, the supporting-arms nearer the front of the furnace-chamber being mounted at a higher level than the other supporting-arms, a side bar pivoted to the upper end of each pair of supporting-arms so that said side bars will be inclined downwardly toward the rear of said furnace-chamber, cross-bars pivotally mounted on said side bars, grate-bars mounted on said cross-bars and extending rearwardly therefrom, arms depending from said cross-bars that counterbalance in part the rearward extension of the grate-bars, means for pivotally engaging the lower ends of said depending arms and holding them substantially stationary, and means for moving said side bars to and fro.

12. In a smoke-consuming furnace, a frame within the furnace-chamber, a pair of supporting-arms of equal length extending upward therefrom on each side of the furnace-chamber and pivoted at their lower ends to said frame, the supporting-arms nearer the front of said furnace-chamber being mounted at a higher level than the other supporting-arms, a side bar pivoted on the upper ends of each pair of supporting-arms so that said side bars will be inclined downwardly toward the rear of said furnace-chamber, cross-bars pivotally mounted on said side bars, grate-bars mounted on said cross-bars and extending rearwardly therefrom, each cross-bar and the cross-row of grate-bars mounted thereon being at a lower level than the preceding cross-bar and cross-row of grate-bars, and the grate-bars of each cross-row extending at their rear ends over the ends of the following series of grate-bars, an arm depending from each cross-bar, substantially stationary means to which the lower ends of all the depending arms are pivoted, and means for giving said side bars a swinging movement.

13. In a smoke-consuming furnace, a frame within the furnace-chamber, a pair of supporting-arms of equal length extending upward therefrom on each side of the furnace-chamber and pivoted at their lower ends to said frame, the supporting-arms nearer the front of the furnace-chamber being mounted at a higher level than the other supporting-arms, a side bar pivoted to the upper ends of each pair of supporting-arms so that said side bars will be inclined downwardly toward the rear of said furnace-chamber, cross-bars piv-



otally mounted on said side bars, grate-bars  
mounted on said cross-bars and extending  
rearwardly therefrom, each cross-bar and the  
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5 ing at a lower level than the preceding cross-  
bar and row of grate-bars, and each cross-  
row of grate-bars at the rear end thereof ex-  
tending over the forward end of the grate-  
bars of the following row, an arm depending  
10 from each cross-bar, approximately station-  
ary means to which the lower ends of all the  
depending arms are pivoted, means for giv-  
ing said side bars a swinging movement, an  
inclined plate extending across the front part  
15 of said furnace-chamber over which coal may  
be fed onto said grate, the under end of said

plate extending over the front ends of the  
grate-bars of the front row so that the grate-  
bars when moved to the front will receive a  
load of coal from said plate, and as the grate- 20  
bars move toward the rear, will feed said coal  
down from one row of said grate-bars to the  
succeeding lower rows, substantially as de-  
scribed.

In witness whereof we have hereunto af- 25  
fixed our signatures in the presence of the wit-  
nesses herein named.

GEORGE S. HUFF.  
JAKE J. HUFF.

Witnesses:

HORACE G. STUART,  
NELLIE ALLEMONG.