

No. 754,199.

PATENTED MAR. 8, 1904.

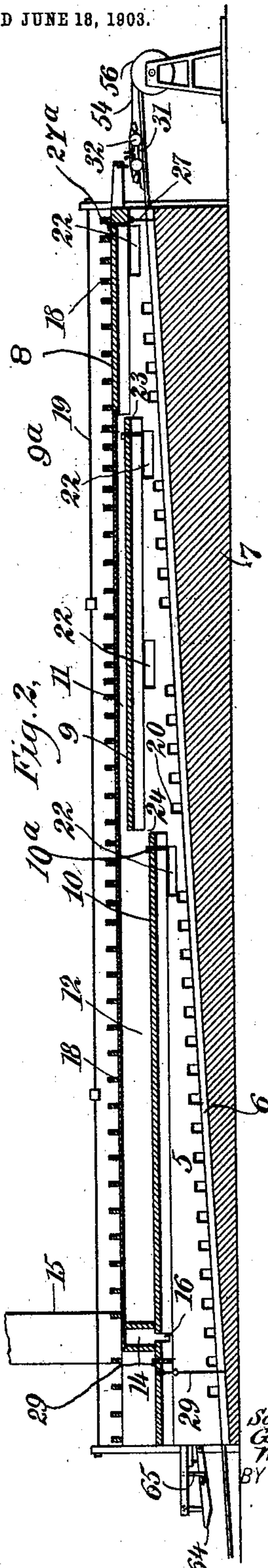
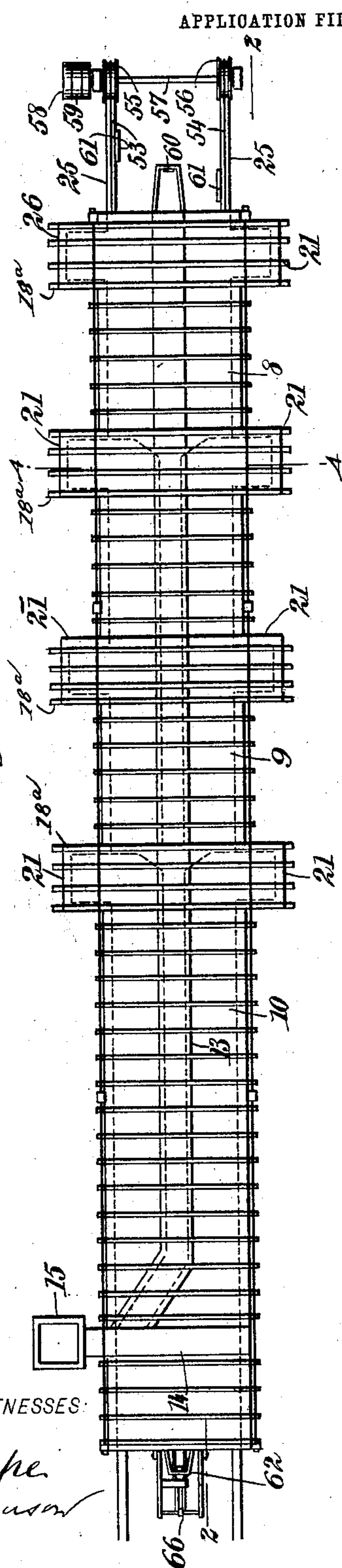
S. D. CRAIG, G. E. KELLY & W. TURNER.  
ROASTING FURNACE.

APPLICATION FILED JUNE 18, 1903.

NO MODEL.

4 SHEETS—SHEET 1.

Fig. 1.



INVENTORS  
Sanford D. Craig  
Guy E. Kelly  
William Turner  
BY  
MUNN & CO.  
ATTORNEYS

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4 SHEETS—SHEET 2.

Fig. 3.

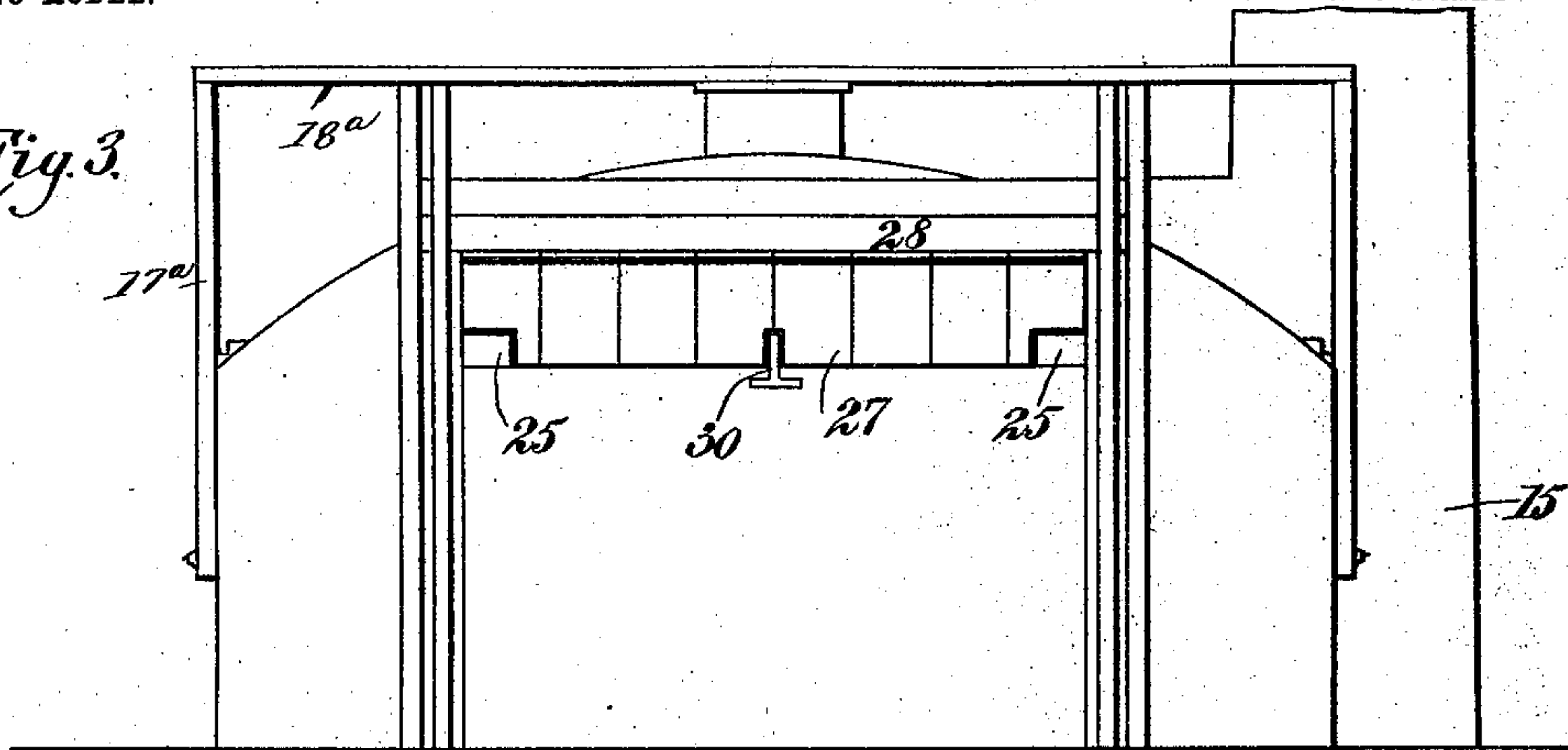


Fig. 4.

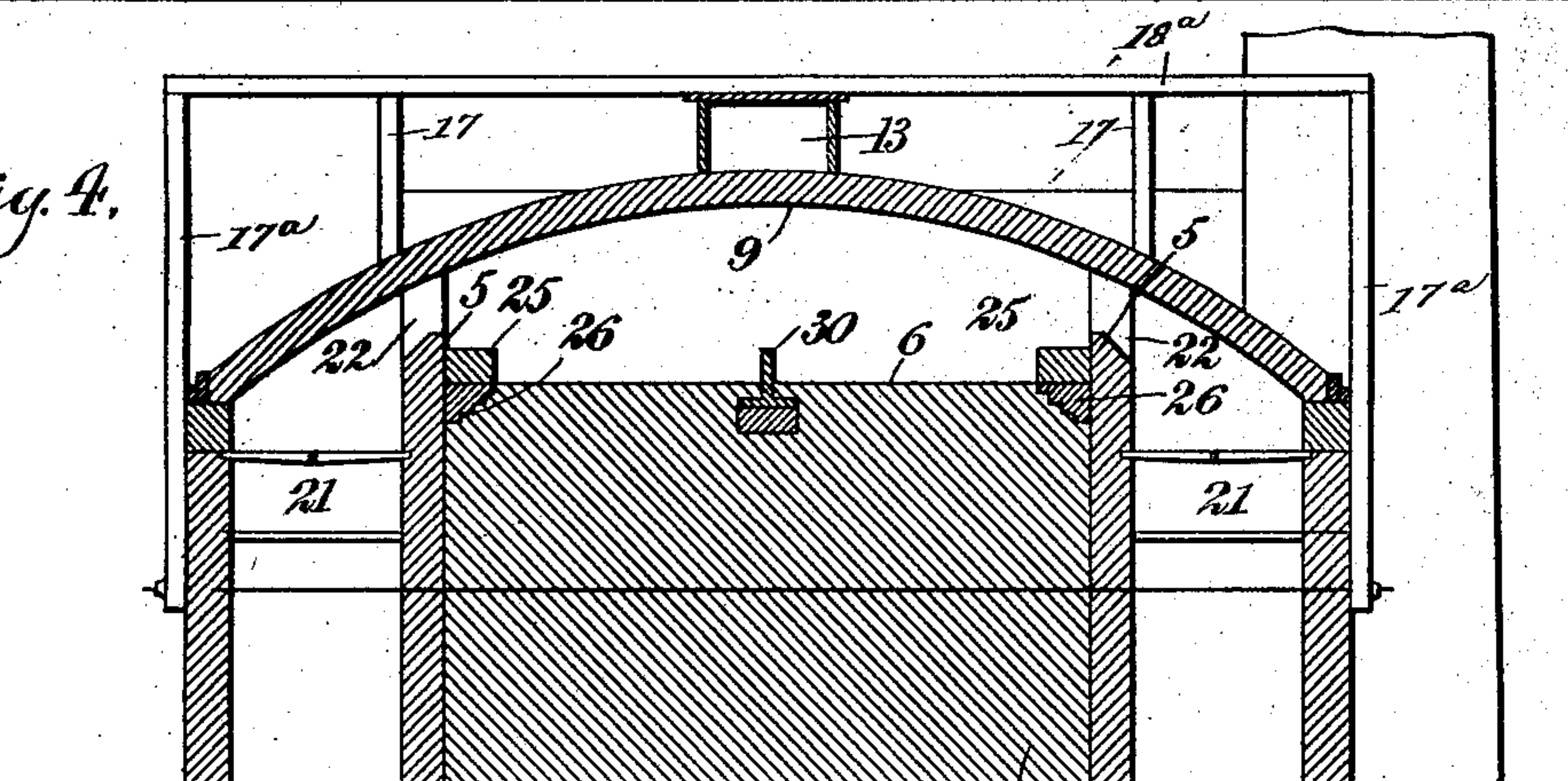
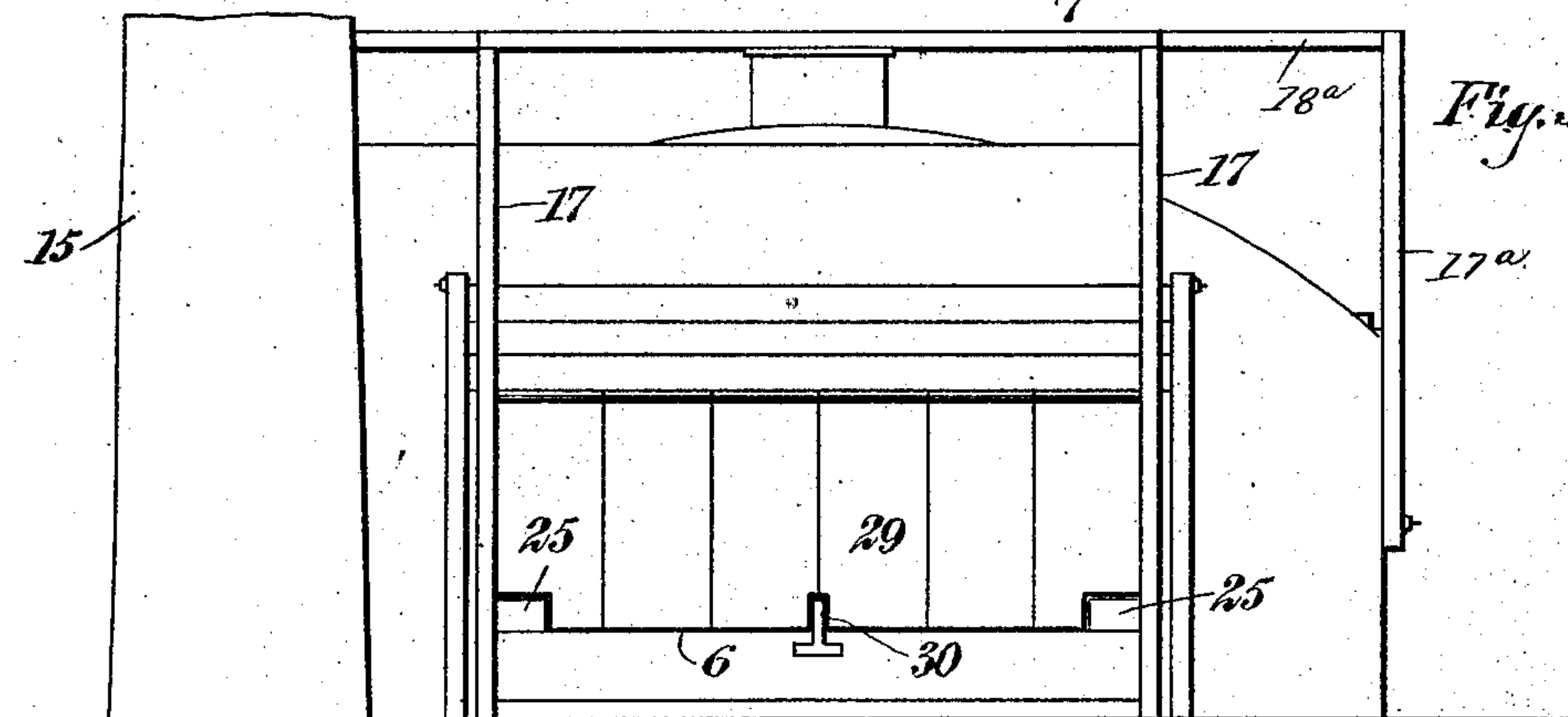


Fig. 5.



WITNESSES:

Edward Thorpe  
C. R. Ferguson

INVENTORS  
Sanford D. Craig  
Guy E. Kelly  
William Turner

BY

M. M. M.  
ATTORNEYS.



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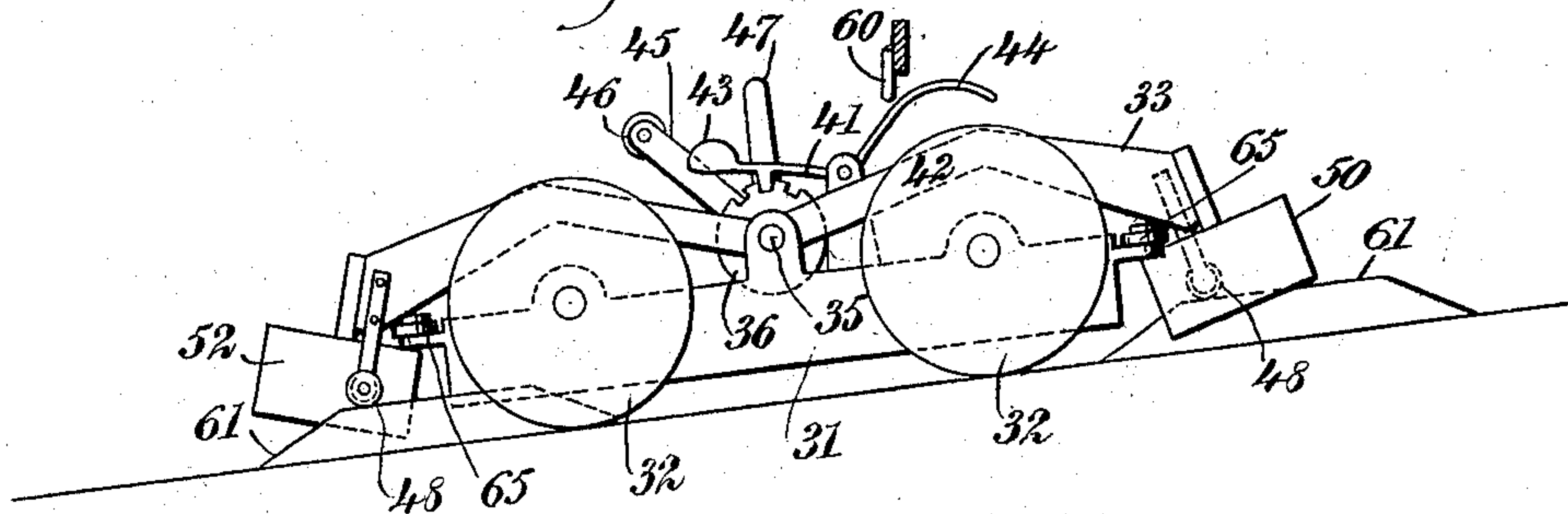
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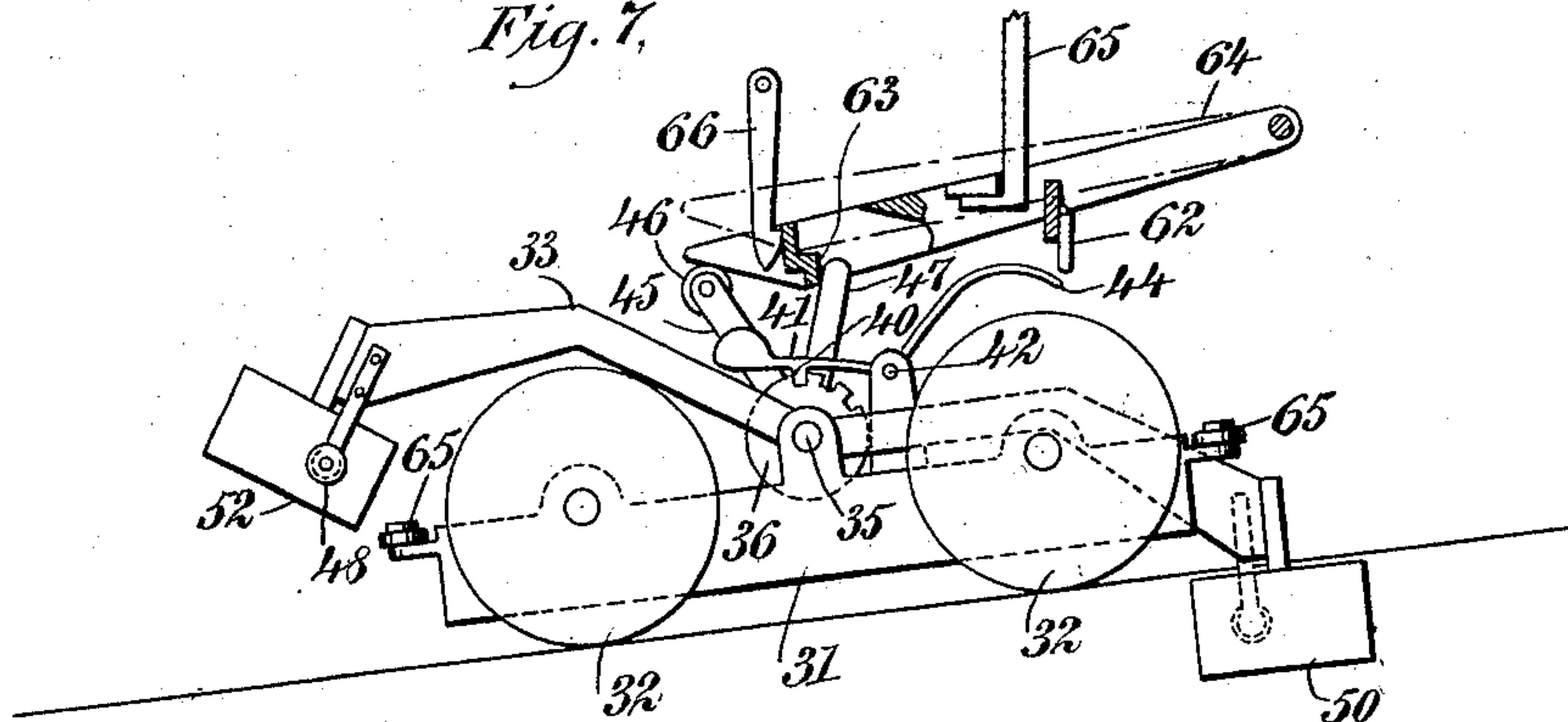
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4 SHEETS—SHEET 3.

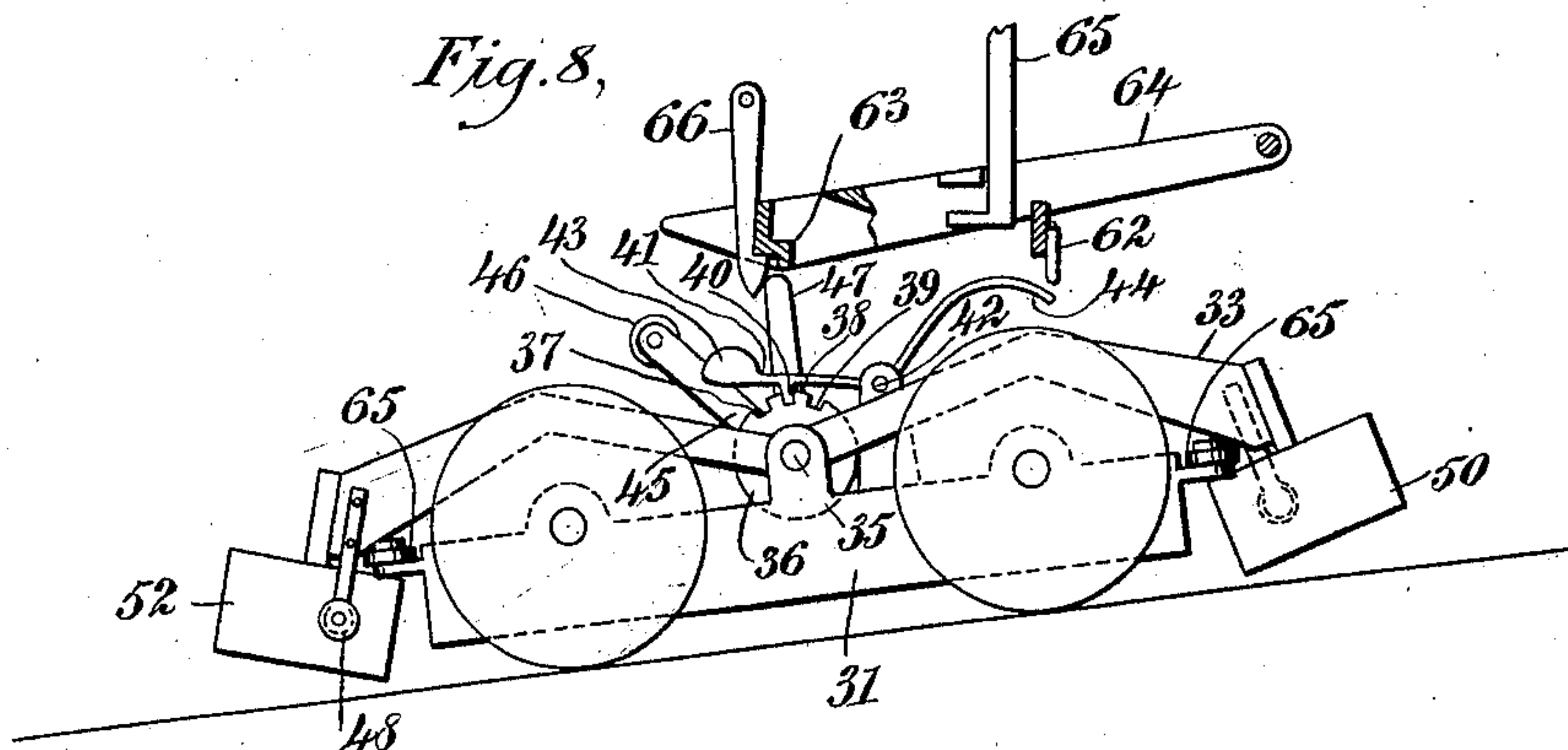
Fig. 6,



*Fig. 7.*



*Fig. 8,*



WITNESSES:

Edward Thorpe.  
C. R. Fingam

INVENTORS  
Stanford D. Craig  
Guy E. Kelly  
William Turner  
BY *Munn*  
ATTORNEYS.

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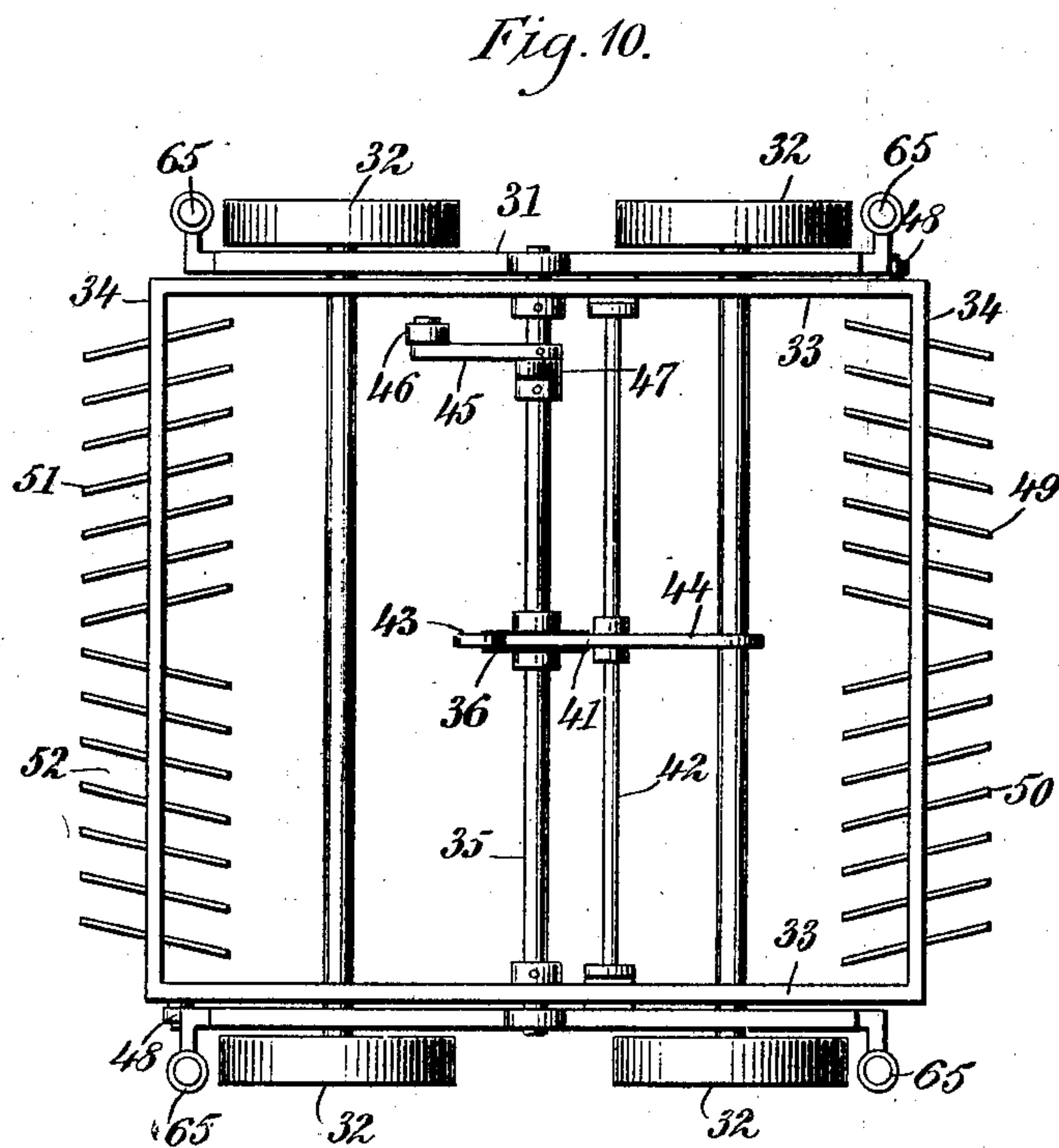
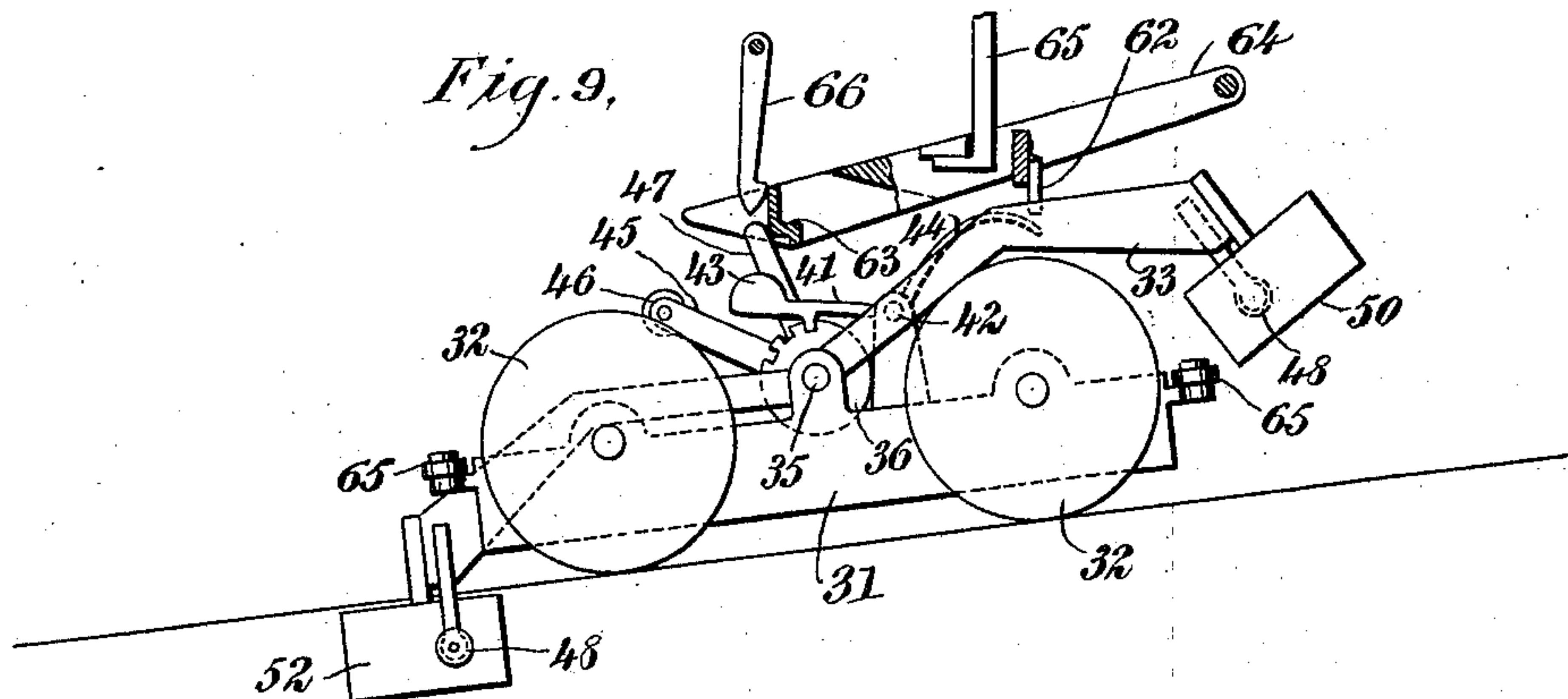
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4 SHEETS—SHEET 4.



WITNESSES:

*Edward Thorpe.*  
*C. R. Ferguson*

INVENTORS  
*Sanford H. Craig*  
*Guy E. Kelly*  
*William Turner*

BY *Wm. M. M.*  
ATTORNEYS.



# UNITED STATES PATENT OFFICE.

SANFORD D. CRAIG, GUY ELMER KELLY, AND WILLIAM TURNER, OF  
LAHARPE, KANSAS.

## ROASTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 754,199, dated March 8, 1904.

Application filed June 18, 1903. Serial No. 162,016. (No model.)

*To all whom it may concern:*

Be it known that we SANFORD D. CRAIG, GUY ELMER KELLY, and WILLIAM TURNER, citizens of the United States, and residents of Laharpe, in the county of Allen and State of Kansas, have invented a new and Improved Roasting-Furnace, of which the following is a full, clear, and exact description.

This invention relates to improvements in ore-roasting furnaces or kilns, an object being to provide a furnace in which ores may be rapidly and thoroughly roasted while being agitated by an automatically-controlled device.

We will describe a roasting-furnace embodying our invention and then point out the novel features in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of a roasting-furnace embodying the invention. Fig. 2 is a section on the line 2-2 of Fig. 1. Fig. 3 is an upper end view thereof. Fig. 4 is a section on the line 4-4 of Fig. 1. Fig. 5 is a lower end view. Figs. 6 to 9 are side elevations of an agitating device employed, showing the parts in different positions; and Fig. 10 is a plan view thereof.

The furnace comprises a long casing or shell having side walls 5 and a bottom wall 6, said bottom wall 6 being inclined downward from one end to the other and resting on a bed 7, of dirt or other suitable material. Arranged at the upper end is an arched top plate 8, and below this plate 8 or toward the outlet end of the furnace are arched plates 9 10, which form not only the top walls of the furnace, but the bottom walls of flues 11 12, the top wall of the flue being indicated at 13. This flue communicates with a cross-flue 14, which ends in a smoke-stack 15. The lower arched plate 10 is also provided with openings 16, which provide communication between the furnace and said cross-flue 14. It will be noted that the arched or flue plates 8, 9 10 are of different lengths and on different horizontal planes—

that is, the plate 9 is below the plane of the plate 8, while the plate 10 is below the plane of the plate 9. By this construction three different temperatures are maintained in the furnace. Baffle-plates 9<sup>a</sup> 10<sup>a</sup>, depending from the plates 9 10, serve to check the heat and direct it into the flues.

The furnace is suitably braced by vertical side rails 17 17<sup>a</sup> and by top cross-rails 18 18<sup>a</sup>. Extended along the top of the furnace and connected at its ends to uprights at the ends thereof is an expansion-rod 19, designed to brace the furnace against expansion and contraction lengthwise. At suitable intervals the side walls of the furnace are provided with openings 20, through which an instrument may be passed for cleaning the interior of the furnace or for other purposes. These openings, however, will be normally closed by removable brick.

Arranged along the sides of the furnace are fire-boxes 21, which of course are provided with suitable doors. Four fire-boxes are here shown; but the number may be varied without departing from the spirit of the invention. The products of combination pass from the fire-boxes into the furnace through the throats 22, and products of combustion pass into the flues 11 12 through the spaces 23 24. Extended along the floor of the furnace at opposite sides are track-rails 25, preferably consisting of plates of brick or other refractory material. As indicated in Fig. 4, these track-rails are mounted on brickwork 26, which is stepped on the under side. At the upper end there are a number of swinging doors 27. These doors are mounted to swing on a rod attached to the under side of a brick bar 28, and at the lower end there are similar swinging doors 29, but of course somewhat longer than the doors 27, because of the difference in distance at the opposite ends between the floor of the furnace and the arched plates. These doors are to permit the passing in and out of the agitating device, to be hereinafter described, so that when the agitating device passes in the doors will immediately close, so that a draft will be maintained



through the furnace. The hangers for the doors are protected from undue strain by depending plates 27<sup>a</sup> 29<sup>a</sup>.

Between the track-rails 25 the floor itself is divided lengthwise by a rail 30, which extends a short distance above the floor. The material to be roasted is placed between this rail 30 and the track-rails.

The agitating device will now be described.

This agitating device consists of a carriage formed of a frame 31, mounted on wheels 32, which engage with the track-rails 25. Mounted to swing on the frame 31 is an agitator or scraper carrying frame consisting of the side bars 33 and end bars 34. As here shown, the said frame is rigidly secured to a shaft 35, mounted to swing in bearings on the frame 31. Also rigidly attached to this shaft 35 is a wheel 36, having three notches 37 38 39, in any one of which a lug 40 on a lever 41 may engage. The said lever is mounted to swing on a rod 42, attached to the frame 31, and at its free end it is provided with a weight 43. The end opposite the weight 43 is curved upward, as indicated at 44. Extended from the shaft 35 is an arm 45 carrying a pulley 46, and also arranged on the shaft at an angle with relation to the arm 45 is another arm 47. On diagonally opposite corners of the agitator-frame are downwardly-extended hangers supporting rollers 48, the purpose of which will be hereinafter described. Attached to one end bar 34 are two sets of agitating-plates 49 50, the said plates being extended diagonally across the bar and the outer ends of one set of plates converging toward the outer ends of the other set of plates. On the other bar 34 are also two sets of agitating-plates 51 52, the outer ends of the sets being convergent, and the plates of the sets 51 52 are placed at a reverse angle to the plates 49 50, as clearly indicated in Fig. 10. By this arrangement it is obvious that as the device moves in one direction through the furnace the plates 49 50 will cause the ore to be scraped or moved toward the center of the furnace and when moved in the opposite direction the scrapers 51 52 will cause an outward movement of the ore, and thus it will be seen that the ore will be thoroughly agitated while being roasted.

The carriage for the agitator is connected by cables 53 54 with sheaves 55 56 on a shaft 57, provided with a fast pulley 58 and a loose pulley 59, these pulleys being designed to be engaged with a belt driven from any desired source.

In the operation it will be understood that the agitating device moves downward by gravity, because at this time the driving-band will be on the loose pulley 59, and during this movement it does no work, because the scraping devices at both ends will be in elevated position, as indicated in Fig. 6. To bring

the parts to this position, as the carriage moves out of the upper end of the furnace the curved part 44 of the lever 41 will engage with a cross-bar 60, rocking the lug 40 out of the notch of the wheel 36, in which it may be engaged, and then the rollers 48 will engage with inclined blocks 61, moving the scraping-plates to a substantially level position or substantially on one plane, and as the curved portion of the lever passes the bar 60 the lug will drop into the central notch 38, thus holding the parts in their upper position. The device will now pass down through the furnace, and when it passes out of the lower door the curved portion of the lever 44 will be raised by engaging with a cross-bar 62, releasing the lug 40 from the central notch. The arm 47 next engages with a shoulder 63 on a swinging bar 64, causing the agitator-frame to swing to move the upper set of scrapers 49 50 to lowered position to engage in the ore, this position being indicated in Fig. 7. As the frame is thus rocked the lug 40 will drop into the notch 37. As the carriage starts on its upward trip the pulley 46 will engage with the inclined end of the bar 64 and elevate the same, permitting the curved end 44 of the lever 41 to pass underneath the cross-bar 62. After the carriage shall have again left its uppermost position, with the scraper-plates in the condition indicated in Fig. 6, the said carriage in passing out of the lower door will pass underneath the bar or lever 64 and also the arm 47 will pass underneath the shoulder 63, so that by the next return motion the said arm 47 will engage with the outer side of said shoulder 63, rocking the lower set of scraper-plates 51 52 into operative position, where they will be held by the lug 40 engaging in the notch 39.

Of course during the several movements of the agitator through the furnace the products of combustion will be passing rapidly and freely through the furnace.

To prevent lateral movement of the carriage with relation to the rails 25, it is provided at its sides with rollers 65, which engage against the sides of the furnace.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. A roasting-furnace comprising a long casing having a downwardly-inclined floor, a series of arched roof-plates arranged at different horizontal planes, a flue leading to an uptake, certain of said plates forming the bottom walls of said flue, an agitator, and means for causing said agitator to move through the furnace.

2. A roasting-furnace having a downwardly-inclined floor, arched roof-plates of different lengths and arranged on different horizontal planes, a plurality of fire-boxes arranged on opposite sides of the furnace and communi-



cating with the interior thereof, and a scraper movable through the furnace.

3. A roasting-furnace having a downwardly-inclined bottom wall or floor, a series of 5 arched roof-plates, a flue, certain of said plates forming the bottom walls of said flue, fire-boxes communicating with the interior of the furnace, the side walls of said furnace being provided with openings having removable 10 doors or closures, swinging doors at the ends of the furnace, an agitating device movable through the furnace, and means for causing the movement of said device upward on the inclined floor, the movement of said device 15 downward being by gravity.

4. A furnace comprising a long casing, having an inclined floor, track-rails extended along the floor, a carriage movable on said track-rails, a swinging frame on said carriage, 20 means for locking the frame in its adjusted position, means for releasing the locking device, and agitator-plates on opposite ends of said swinging frame.

5. A furnace comprising a long casing having an inclined floor, track-rails on said floor, 25 a carriage mounted on said rails, a frame mounted to swing on the carriage, two sets of scraper-plates arranged on each end of said swinging frame, the plates of the series at the 30 ends being at reverse angles, and the plates at one end being at reversed angles to the plates of the other ends, means for holding the plates at one end in lowered position while holding the plates at the other end in 35 an upper position, and means for reversing the positions.

6. A furnace having an inclined floor, track-rails on the floor, swinging doors at the opposite ends of the furnace, each door consisting 40 of a plurality of sections, a carriage movable along said track-rails, a shaft at the upper end of the furnace, sheaves on said shaft, cable connections between the carriage and sheaves, a swinging frame on the carriage, 45 and agitator-plates on opposite ends of said frame.

7. The combination with a furnace having an inclined bottom wall, of an agitator movable through the furnace, the said agitator comprising a carriage, a frame mounted to 50 rock on the carriage, a notched wheel carried on the shaft of said frame, diagonally-arranged agitating-plates on opposite ends of the frame, a swinging lever having a lug to engage in any one of the notches of the said wheel, and 55 means for swinging said lever to move the lug out of the notch.

8. The combination with a furnace having an inclined floor, of a carriage movable along said floor, a frame mounted to swing on the 60 carriage, diagonally-disposed agitating-plates on the front and rear ends of said frame, means for holding the frame with either set of agitators in operative position, means for holding both sets of agitators out of operative 65 position, and means for drawing the carriage up the incline.

9. A furnace having an inclined bottom wall, track-rails arranged on said bottom wall, a bar arranged along the floor between the 70 rails, a carriage movable on said track-rails, scrapers mounted on the carriage for forcing material toward said center rail, and agitators on the carriage for moving material outward from said center rail. 75

10. The combination with a furnace and an agitator movable therethrough, of a trip mechanism for the agitator at one end of the furnace, comprising a swinging lever, a cross- 80 bar carried by the lever, means for limiting the downward movement of said lever, and means for holding said lever in elevated position.

In testimony whereof we have signed our names to this specification in the presence of 85 two subscribing witnesses.

SANFORD D. CRAIG.  
GUY ELMER KELLY.  
WILLIAM TURNER.

Witnesses:

C. E. LENHART,  
W. O. LENHART.