No. 692,698. Patented Feb. 4, 1902.

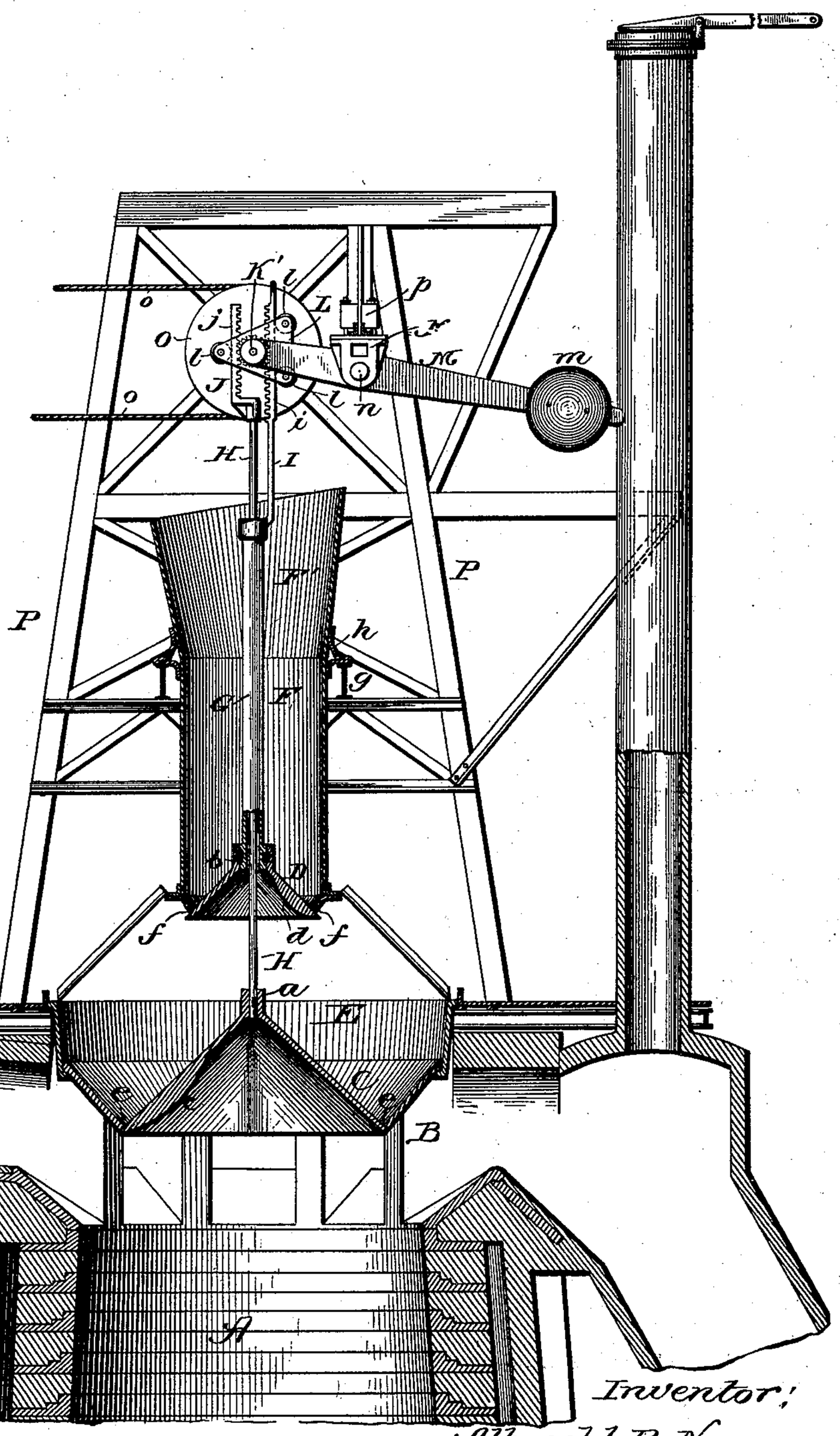
A. B. NEUMANN.

MECHANISM FOR FEEDING BLAST FURNACES.

(Application filed May 29, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1



Witnesses:
Chas. E. Gaylord.
John Enders Jr.

Inventor:
Albrecht B. Neumann,
By Banning & Banning,
Attys.

No. 692,698. Patented Feb. 4, 1902.

A. B. NEUMANN.

MECHANISM FOR FEEDING BLAST FURNACES.

(Application filed May 29, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

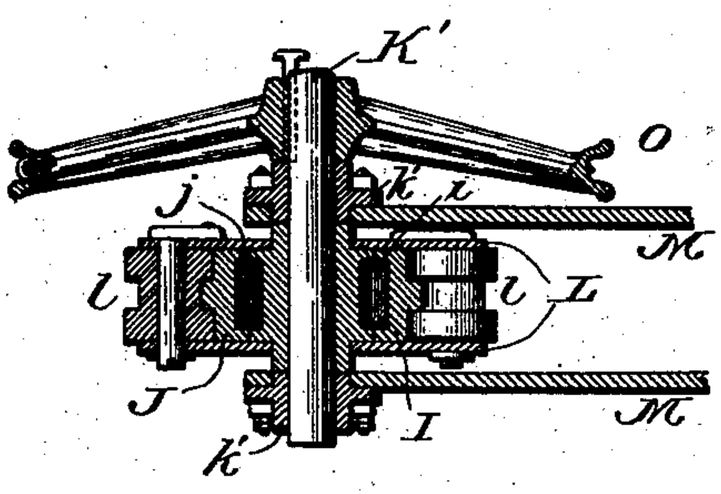


Fig. 5.

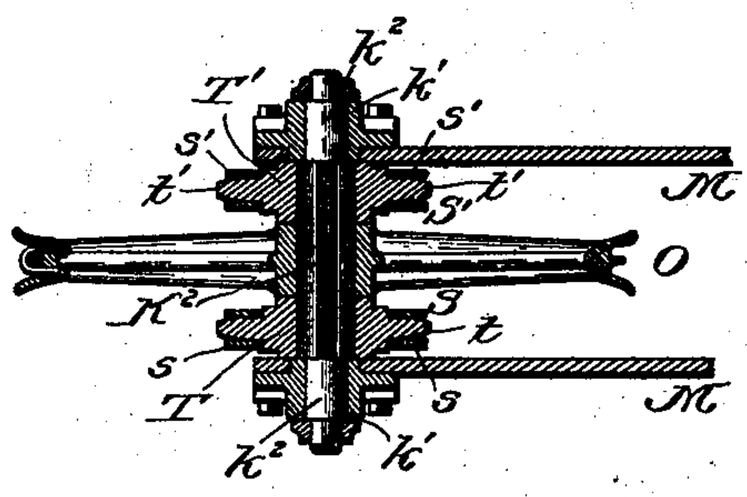


Fig. 2.

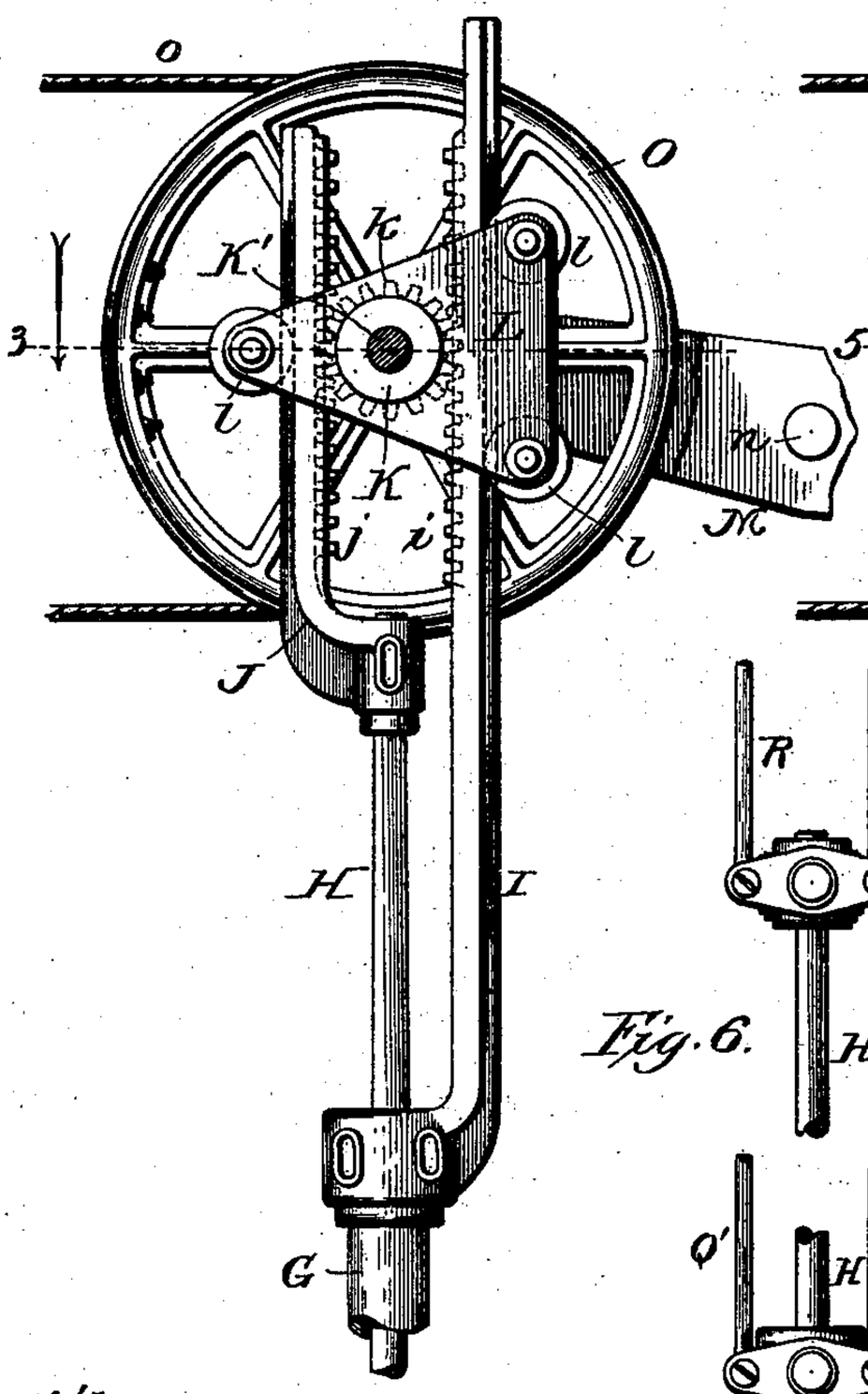


Fig. 4.

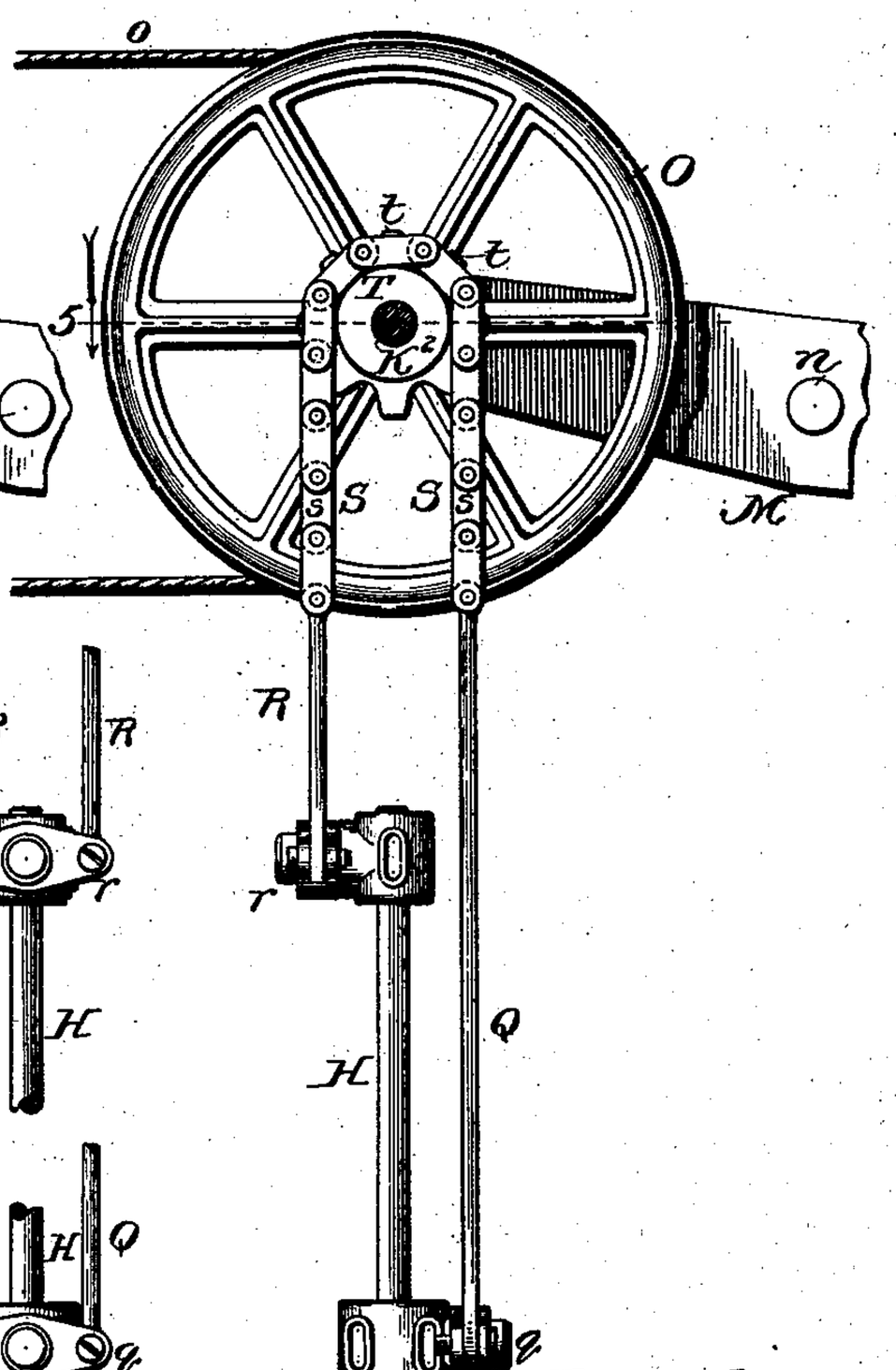


Fig. 6.

Witnesses:
Chas. E. Gaylord,
John Enders Jr.

Inventor:
Albrecht B. Neumann,
By Banning & Banning,
Attys.

UNITED STATES PATENT OFFICE.

ALBRECHT B. NEUMANN, OF JOLIET, ILLINOIS.

MECHANISM FOR FEEDING BLAST-FURNACES.

SPECIFICATION forming part of Letters Patent No. 692,698, dated February 4, 1902.

Application filed May 29, 1901. Serial No. 62,403. (No model.)

To all whom it may concern:

Be it known that I, ALBRECHT B. NEUMANN, a citizen of the United States, residing at Joliet, in the county of Will and State of Illinois, have invented a certain new and useful Improvement in Mechanism for Feeding Blast-Furnaces, of which the following is a specification.

The charge for a blast-furnace is entered at the top, and in charging it is a requisite that the operation be performed in such manner as to prevent the escape of gas to any great extent and so as to retain in the furnace practically all of the gas, and to this end it is the practice to employ a charging means consisting of a receiver or hopper having its discharge end closed by a bell, from which receiver or hopper the charge is deposited into a receiving-chamber having its mouth or discharge also closed by a bell, the two bells having an opposite relation one to the other, so that the lower or inner bell for the receiving-chamber will be held closed when the upper or outer bell for the receiver or hopper is opened, and when the bell for the receiving-chamber is opened the bell for the receiver or hopper is held closed, by which arrangement practically all of the gas is retained in the furnace. The operation of the bells, which constitute the feeding means or devices for depositing the charge into the furnace, should be positive and reliable and at the same time operate under conditions not requiring too much care and attention in the operating of the feeding mechanism.

The object of this invention is to construct a mechanism by the use of which the feeding-bells will be operated to have one bell held closed as the other is opened and have the operation positive and reliable, with a mechanism possessing simplicity of construction and ease of operation; and the invention consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings, Figure 1 is an elevation showing the upper end or top of a blast-furnace with the feeding-tower thereon, the upper end of the furnace and the receivers and dropping bells for the charge being in section; Fig. 2, a detail, being a side elevation of the mechanism for operating the discharging or dropping bells; Fig. 3, a sectional plan view of the mechanism shown in Fig. 2, taken on line 3 of Fig. 2; Fig. 4, a detail, being a side elevation of a modification in part of the mechanism for operating the discharging or dropping bells; Fig. 5, a detail, being a sectional plan view of the mechanism shown in Fig. 4, taken on line 5 of Fig. 4; and Fig. 6, a detail showing the connection of Fig. 5 with some of the parts broken out.

The invention relates solely to mechanism for operating the discharging or dropping bells, and for this reason only so much of a blast-furnace as is necessary to illustrate the invention is shown, it being understood that the blast-furnace outside of the feeding mechanism of the invention is of any ordinary and well-known form of construction.

The top or receiving end of a blast-furnace A is all that is represented, such top or upper end being of the usual construction, provided with outlet for gas and necessary openings for explosion-door B. The lower or final discharging or dropping bell C is of the usual construction, except that on one side it is thickened, so as to form a bulge or rise *c* and give an increased weight on that side to maintain the center of gravity directly in line with the support in opening and closing the bell. The initial or upper discharging or dropping bell D is also of the usual construction, except that on one side it is thickened, so as to form a bulge or rise *d* and give an excess of weight on that side to maintain the center of gravity under the support in opening and closing the bell. The bell C closes the discharge or mouth *e* of a receiving-chamber E, entered into the head of the furnace, and the bell D closes the discharge or mouth *f* of a receiver or hopper F, into which the charge is deposited in any usual and well known manner, the upper end F′ of the hopper being of an increased size or widened out and higher on one side than on the other, as usual.

The initial or upper bell is carried by a hollow rod G, the lower end of which is entered into the neck *b* of the bell and secured therein by keys or otherwise. The final or lower bell is carried by a rod H, secured at its lower end into the neck *a* of the bell by a key or otherwise and passing up through the hollow rod G, with its upper end projecting above the up-

per end of the rod G the distance required. The upper end of the rod G has secured thereto a bar I, having on its inner face a rack *i*, and the upper end of the rod H has secured thereto a bar J, having on its inner face a rack *j*, in the construction and arrangement shown in Figs. 1, 2, and 3. The rack-bars I and J stand opposite each other, with the racks of the respective bars facing and separated a sufficient distance apart to receive between them a gear-wheel K, which is mounted on a shaft K′, and is so arranged as to have its cogs or teeth *k* mesh with both racks. The rack ends of the bars I and J lie between two plates, which form a guide-head L for the racks, and this head carries rollers *l*, which engage with the rear faces of both racks and maintain the rack-bars in a vertical line of travel and at the same distance apart, so that the operating-gear will be held in engagement with both racks.

The guide-head L is pivotally mounted on the shaft K′, and this shaft is supported in the forked inner end of a balanced lever M, as shown in Fig. 3, for which purpose the shaft is journaled in boxes *k′*, bolted to the ends of the lever on each side. The opposite or outer end of the balanced lever M carries an adjustable weight *m*, which can be set properly, so as to balance the charge and the weight of the bells, and this weight operates through the lever to return a bell after the charge has been dumped or deposited either into the receiving-chamber from the receiver or hopper or into the furnace from the receiving-chamber. The lever is pivotally mounted and supported by a bracket or ears N, through a pin or pivot *n*, and the bracket or ears depend from a beam or support *p*, to which they are bolted or otherwise secured, giving the lever the proper balance for operation. The shaft K′ of the gear at one end has keyed or otherwise fixedly attached thereto a pulley-wheel O for a driving cord or belt *o*, which is traveled from a suitable driving wheel and power, (not shown,) but which may be a driving wheel or pulley of an electric or other motor, so that the travel of the cord will drive the wheel O and revolve the shaft K′ for the shaft to revolve the gear K and move one or the other of the rack-bars, according to the direction in which the wheel O is driven. The hopper F is located in a tower P, of the usual construction, and is supported and held in position by risers *g* and brackets *h*, as usual, and the balance-lever and the parts connected therewith are located in the tower above the receiver or hopper, as shown in Fig. 1.

The charge after being deposited in the receiver or hopper F is to be emptied or dropped therefrom into the receiving-chamber E, for which purpose the bell D is to be opened and the bell C is to be kept closed. The initial or upper bell D is opened by forcing or pushing down its carrying-tube or hollow rod G, and this tube or rod is forced or pushed down by the action of the gear K, which is turned or revolved in a direction for its cogs to travel with a downward force or pressure against the rack *i* of the bar I, forcing the rack-bar, and with it the tube or hollow rod, downward, moving the bell away from the mouth of the receiver or hopper and at the same time the cogs of teeth of the gear K, having a lifting or upward pull on the rack *j* of the rack-bar J, by which the lower or inner bell will be held tightly against the discharge-mouth of the receiving-chamber. The gear K is rotated in the direction to push down on the rack *i* and pull up on the rack *j* to open the initial or upper bell and hold the final or lower bell closed by revolving the shaft K′ through the wheel O, which is driven in the proper direction for the purpose by the cord *o* from the driving power. The gear is in effect held between the two racks *i* and *j*, and by reason of such retention the downward movement of the rack-bar I, combined with the upward pull on the rack-bar J, which is held fixed, operates to travel the gear downward on the rack *j*, carrying with it the head L, turning the lever M on its pivot to raise the weighted end of the lever, with the result that the distance of travel for the gear is divided between the two racks and the weighted end of the lever is only raised half as much as it would be if the gear traveled solely on the rack which is being depressed, thus saving in distance traveled and in time required to open the bell. The charge in the receiver or hopper is discharged with the opening of the mouth of the receiver or hopper by the forcing away therefrom of the controlling-bell, and with the discharge of the contents of the receiver or hopper the weight, which before operated as an equalizer, has the balance of power and operates to at once return the parts to normal position, closing the bell of the receiver or hopper F and carrying the rack-bar J and its rack and the gear K to normal position.

The charge having been deposited in the receiving-chamber by the opening of the initial or upper bell is to be discharged from the receiving-chamber into the furnace, and such discharge is accomplished by opening the final or lower bell, with the initial or upper bell remaining closed. The final or lower bell is opened by a downward movement of its carrying-rod H; and such downward movement is given to the rod by forcing or pushing down the rack-bar J through the engagement of the gear K with the rack *j* of the bar. The gear in the operation of forcing or pushing down the carrying-rod H is given a reverse rotation to that for forcing down the carrying-tube or hollow rod G, and the gear is reversely rotated by driving the shaft K′, through the wheel O and cord *o*, in the reverse direction, the cord having a reverse travel from the operating power by which the wheel O is reversely driven. The gear K, as in the operation just described, is in effect held

between the two racks *i* and *j*, and by reason of such retention the downward movement of the rack-bar J, combined with the upward pull on the rack-bar I, which is held fixed, operates to travel the gear downward on the rack I, carrying with it the head L, turning the lever M on its pivot to raise the weighted end of the lever, with the same result, as in the preceding operation, of having the distance traveled by the gear divided between the two racks, and the lever is only moved a half-throw, the same as in opening the initial or upper bell, thus saving in distance traveled and in the time required to open the final or lower bell. It will thus be seen that in opening the initial or upper bell the final or lower bell is held tightly closed by reason of the upward pull of the gear on the rack-bar J, and that in opening the final or lower bell the initial or upper bell is held tightly closed by reason of the upward pull of the gear on the rack-bar I, thus insuring the maintenance of either bell tightly closed with the opening of the other bell during the operation of depositing a charge from the hopper into the furnace.

The essential feature of the invention is a quick, positive, and reliable mechanism for opening and closing the bell, and other means than the rack and gear can be utilized for the purpose. A construction having the feature of rapid opening and closing is shown in Figs. 4, 5, and 6, in which the tube or hollow rod has attached thereto a rod Q, by a connection *q*, and the rod H has attached thereto a rod R, by a connection *r*, and the connections *q* and *r* are of a form to attach a companion rod Q′ for the rod Q and a companion rod R′ for the rod R, the rods Q and Q′ being respectively opposite the rods R and R′ in their relation. The rods Q and R have connected to their upper ends a sprocket-chain S, the links of which are engaged by the teeth *t* of a sprocket-wheel T, fixed on a shaft K^2, corresponding to the shaft K, and the rods Q′ and R′ have a sprocket-chain S′, connected at its ends with the ends of the rods for the links *s′* of the chain to engage with the sprocket-teeth *t′* of a sprocket-wheel L′, fixed on the shaft K^2, as shown in Fig. 5. The shaft K^2 has a journal at each end mounted in a box or bearing *k′*, bolted to the forked end of the lever M, and this shaft, between the sprocket-wheels S and S′, has fixed thereto the pulley or belt wheel O, over which travels the belt *o*, driven from a suitable power, as already described. The operation is essentially the same as described for the operation of the rack mechanism. The rotation of the shaft K^2 in a direction for the sprocket-wheels to engage and push down on the side of the sprocket-chains connected with the rods Q and Q′ causes the chains on that side of the sprocket-wheels to be slacked or forced down and at the same time tightens the chains on the side connected with the rods R and R′, lifting upward on the chains and through the rods R and R′ exerting an upward pull on the carrying-rod H to hold the bell C closed. The slacking or forcing down of the chains on the side connected with the rods Q and Q′ allows the tube or hollow rod G to drop from the weight of the contents of the hopper on the initial or upper bell, allowing such bell to open and discharge the contents of the hopper into the receiving-chamber, and in such operation the sprocket-wheels travel downward on the chains on the side connected with the rods R the same as the sprocket-wheel travels down on the rack I, so that the lever M makes the same movement as that described for the movement of the lever with the rack construction. The discharge of the contents of the hopper into the receiving-chamber gives the weight of the lever the balance of power, by which the sprocket-wheels are returned to normal position and closing the initial or upper bell and at the same time holding the final or lower bell closed. The final or lower bell is opened to discharge the receiving-chamber by giving the shaft K^2 a reverse rotation through the wheel O and its driving-belt, for such rotation to cause the sprocket-wheels to slack or force down the sprocket-chains on the side connected with the rods R and R′ and tighten the sprocket-chains on the side connected with the rods Q and Q′, the slacking or forcing down of the sprocket-chains on the side connected with the rods R and R′, allowing the rods to descend, carrying with them the rod H, by the weight of the charge in the receiving-chamber, opening the final or lower bell for the charge to descend into the furnace. The emptying of the receiving-chamber gives the weight of the lever M the balance of power and returns the parts to normal position for the next operation of filling the hopper and depositing the charge into the furnace. It will thus be seen that with the sprocket wheels and chains the same result is obtained as with the racks and gear in carrying out the invention, as these appliances are of a nature to slack, force down, or release on one side and to draw up or hold taut on the other side, with the provision of having the operation move the lever only half-way in order to obtain the full result in opening and closing the bells.

It will be seen that in the operation of the mechanism the pressure or force exerted on the rack-bars or on the sprocket-chains is at one side of the central line of the carrying-rods and the bell, with the result that the center of gravity would be displaced, so that the bell in making its movements would swing or tip to one side and would not open and close in a direct line, which would interfere with the closing of the bells tightly. It is for the purpose of obviating this objection that the bulge or rise is provided on each bell, the bulge or rise being on the opposite side of the bell to that of the moving device, overcoming the tendency of the moving device of

the rod to overweight the bell on that side and tip it to one side out of a true vertical line of movement.

While I have described the construction and operation with more or less minuteness of detail, I do not wish to be understood as limiting myself thereby to any greater extent than is pointed out in the claims.

What I regard as new, and desire to secure by Letters Patent, is—

1. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a rod for carrying the initial or upper bell, a rod for carrying the final or lower bell, and a common means for reciprocating both rods, oppositely acting on the rods simultaneously in manipulating the bells, substantially as described.

2. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a rod for carrying the initial or upper bell, a rod for carrying the final or lower bell, and a common means for reciprocating both rods arranged to have an upward pull on one rod coincident with a downward push on the opposite rod, for the downward push to open a bell, substantially as described.

3. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper, and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a hollow rod for carrying the initial or upper bell, a rod for carrying the final or lower bell and movable within the rod of the initial or upper bell, means for reciprocating each rod, the same means operating both rods and oppositely acting on the rods simultaneously and a balance-lever carrying the means for reciprocating the rods, substantially as described.

4. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a tube or hollow rod for carrying the initial or upper bell, a rod for carrying the final or lower bell and sliding within the tube or hollow rod of the initial or upper bell, a rack-bar on the upper end of each rod, a gear engaging the racks of both bars, and means for revolving the gear in either direction for the gear to act oppositely on the racks and the rods, substantially as described.

5. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a tube or hollow rod for carrying the initial or upper bell, a rod for carrying the final or lower bell and slidable in the tube or hollow rod of the initial or upper bell, a rack-bar on the upper end of each rod, a gear engaging the racks of both bars, a head inclosing the rack-bars, and means for rotating the gear in either direction, for the gear to act oppositely on the racks and the rods, substantially as described.

6. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a tube or hollow rod for carrying the initial or upper bell, a rod for carrying the final or lower bell and slidable in the tube or hollow rod of the initial or upper bell, a rack-bar on the upper end of each rod, a gear engaging the racks of both bars, a head inclosing the rack-bars, a balance-lever carrying the head, and means for revolving the gear in either direction for the gear to act oppositely on the racks and the rods, substantially as described.

7. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controlling the communication between the receiving-chamber and the furnace, a tube or hollow rod for carrying the initial or upper bell, a rod for carrying the final or lower bell and slidable in the tube or hollow rod of the initial or upper bell, a connection common to both rods for moving the rods, oppositely acting on the rods simultaneously, and a head for carrying the connection, substantially as described.

8. In a mechanism for feeding blast-furnaces, the combination of a receiver or hopper, a receiving-chamber having communication with the receiver or hopper and with the furnace, an initial or upper bell for controlling the communication between the receiver or hopper and the receiving-chamber, a final or lower bell for controling the communication between the receiving-chamber and the furnace, a tube or hollow rod for carrying the initial or upper bell, a rod for carrying the final or lower bell and slidable in the tube or hollow rod of the initial or upper bell, a connection common to both rods for moving the rods oppositely acting on the rods simultaneously, a head carrying the connection, and a balance-lever for supporting the head, substantially as described.

ALBRECHT B. NEUMANN.

Witnesses:
THOMAS B. MCGREGOR,
SAMUEL W. BANNING.