(No Model.) 6 Sheets—Sheet 1.

R. F. RICE & A. M. TRUDE.

AUTOMATIC GRAIN SCALE.

No. 360,820. Patented Apr. 5, 1887.

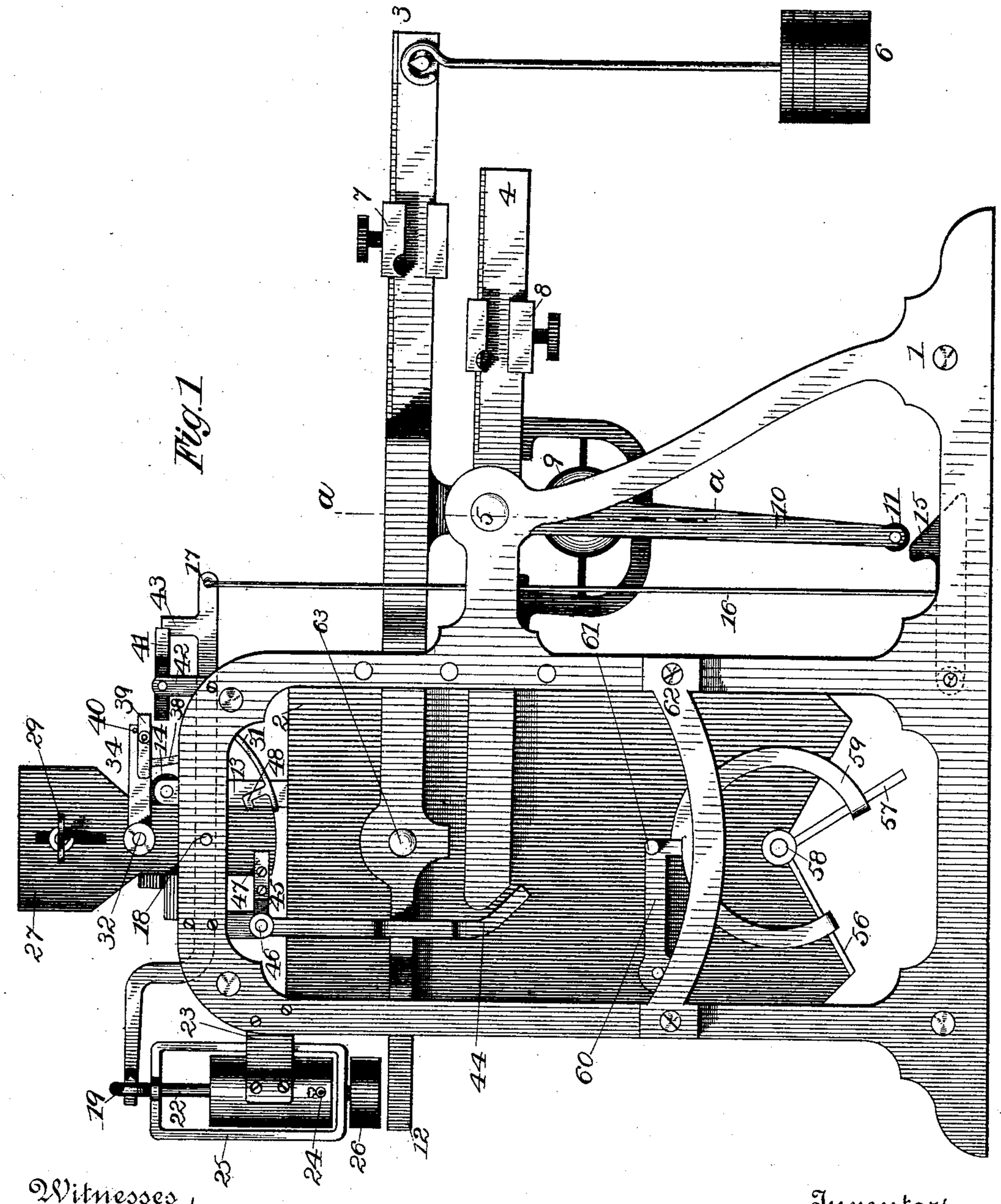

Fig. 1.

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Fig. 2

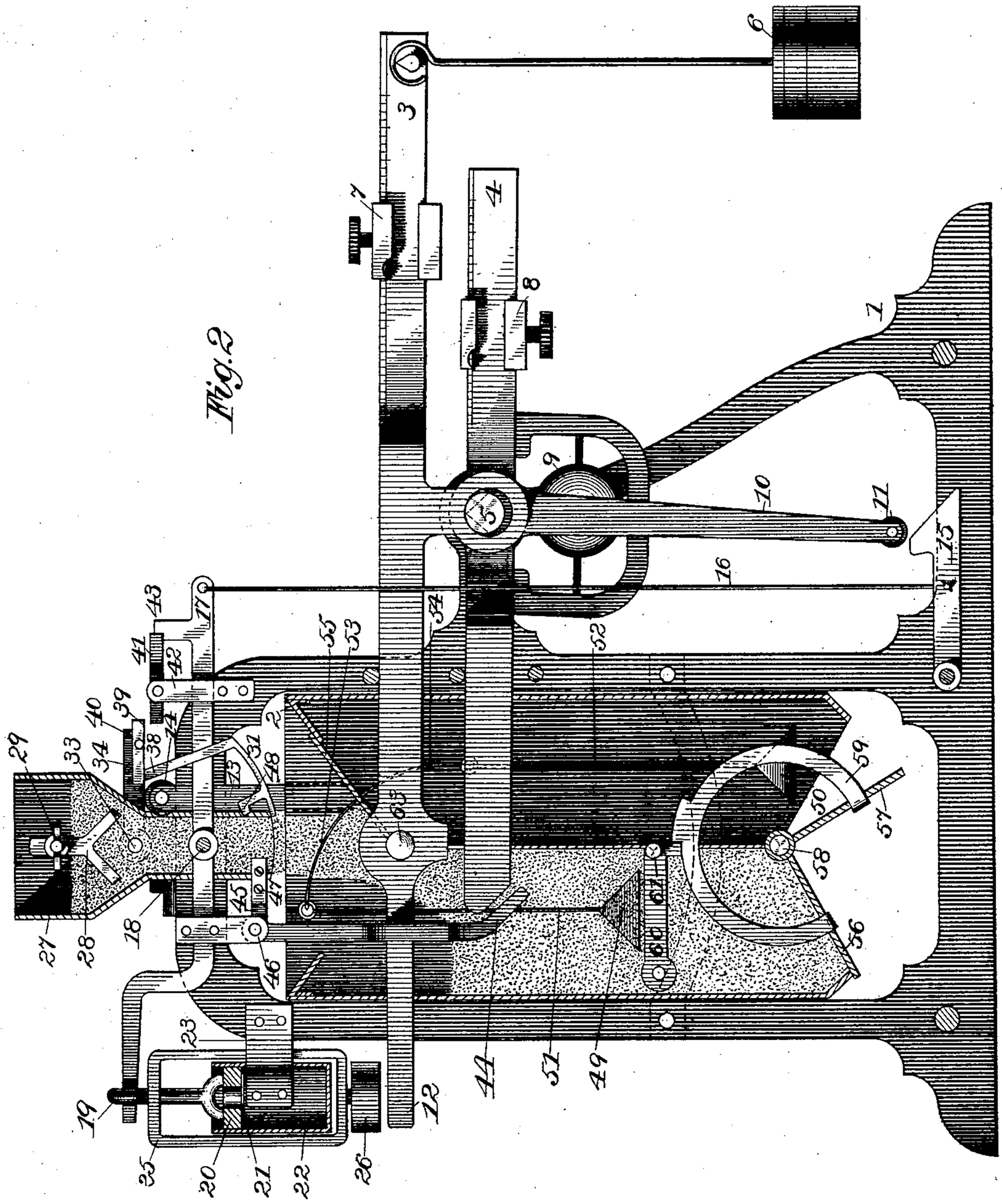

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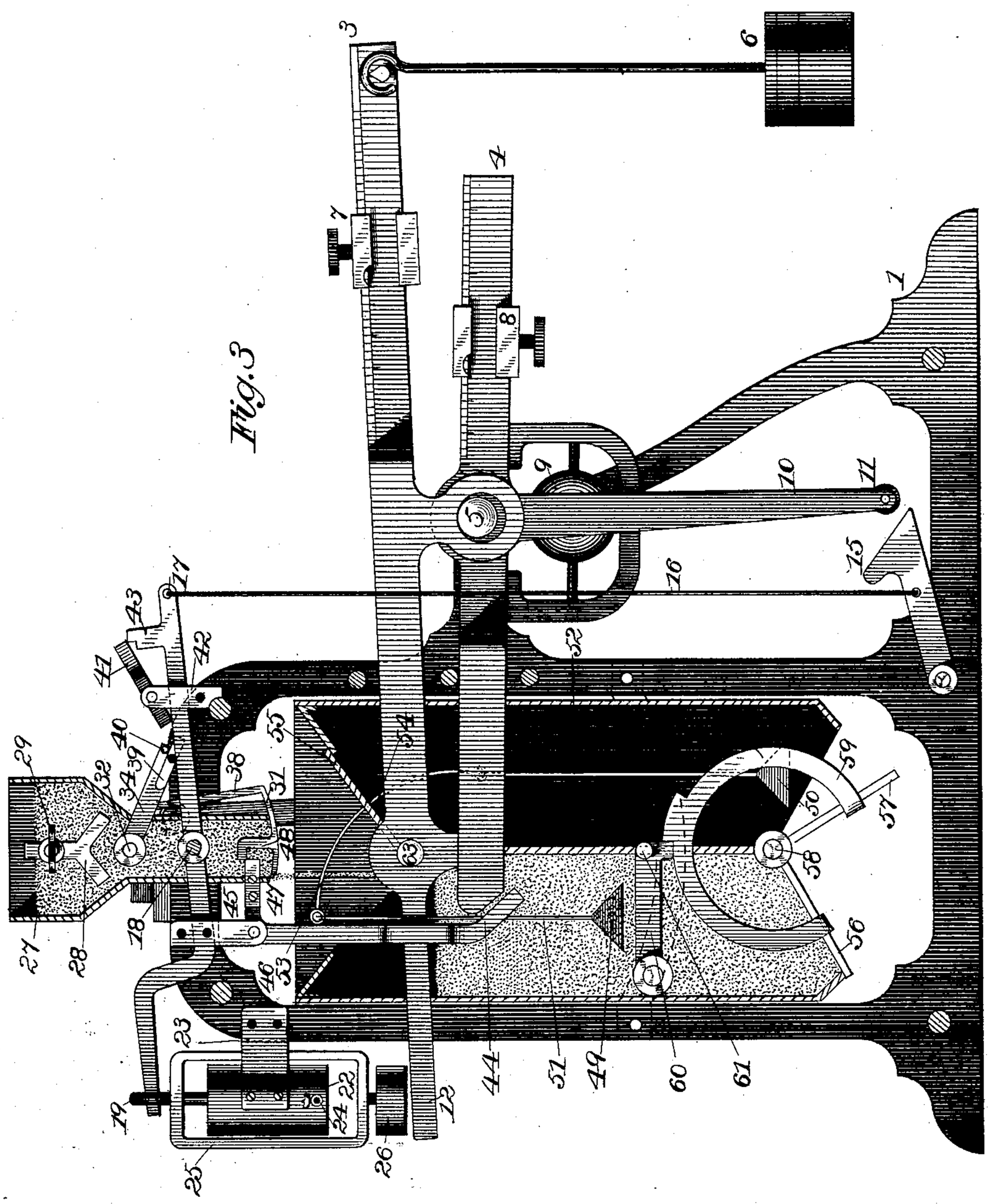
Fig. 3



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(No Model.) 6 Sheets—Sheet 4.

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AUTOMATIC GRAIN SCALE.

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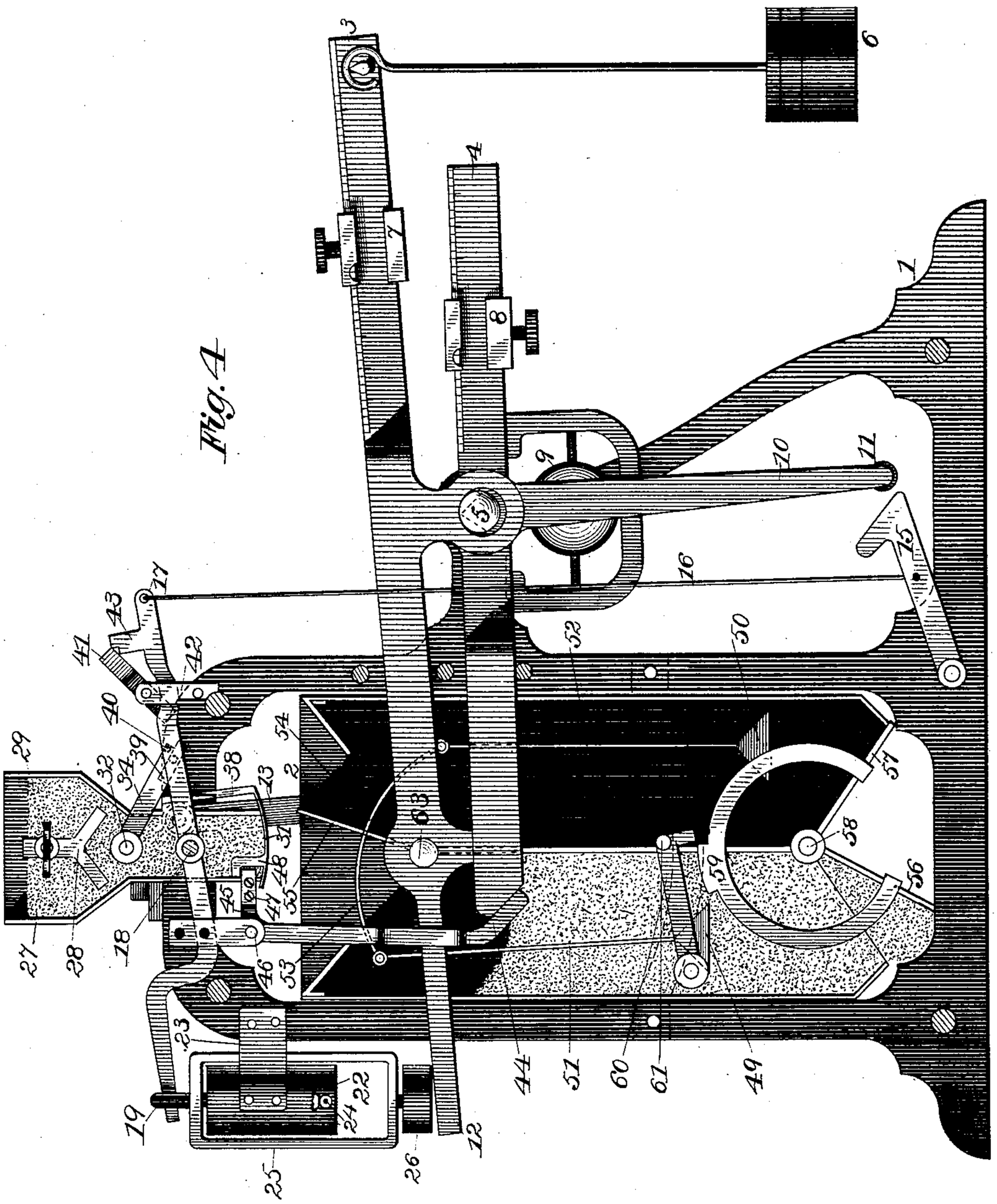

Fig. 4

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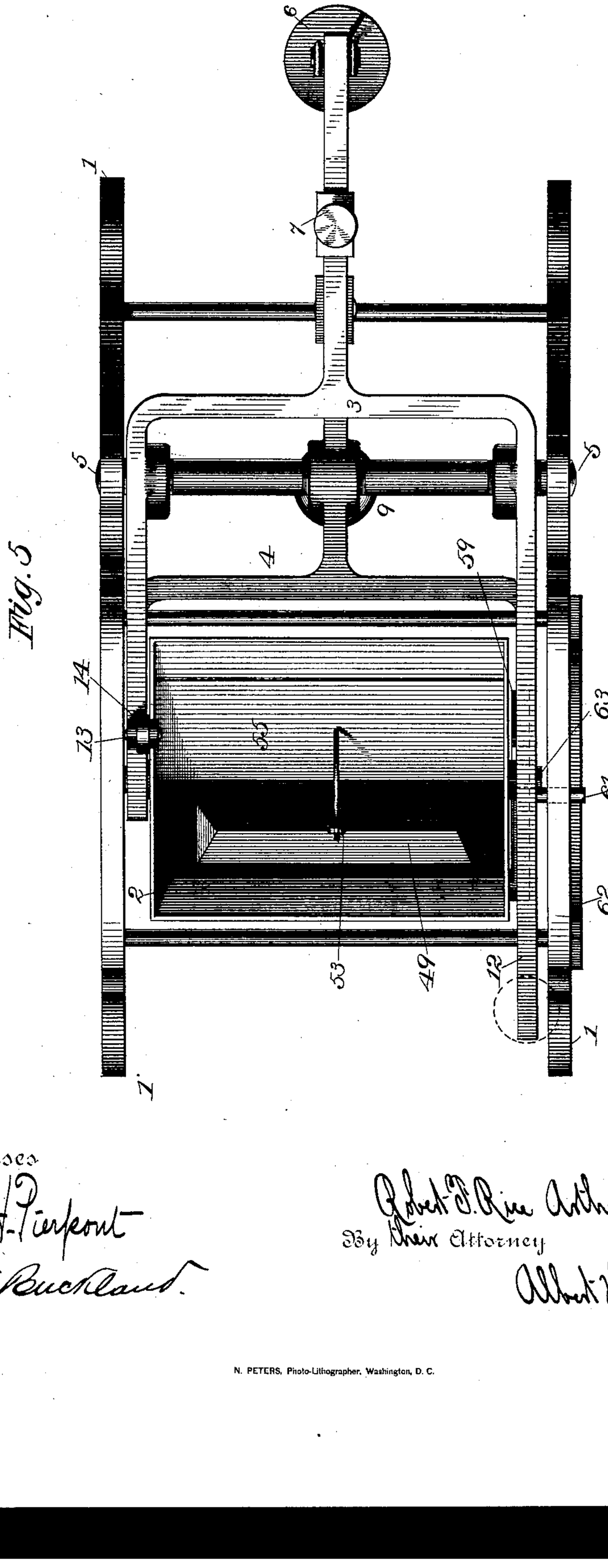

Fig. 5

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(No Model.) 6 Sheets—Sheet 6.

R. F. RICE & A. M. TRUDE.

AUTOMATIC GRAIN SCALE.

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Fig. 9

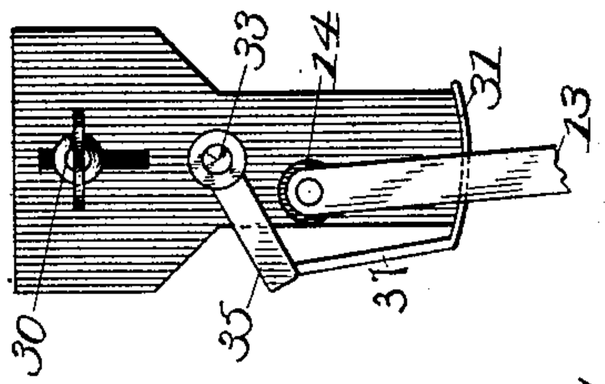


Fig. 8

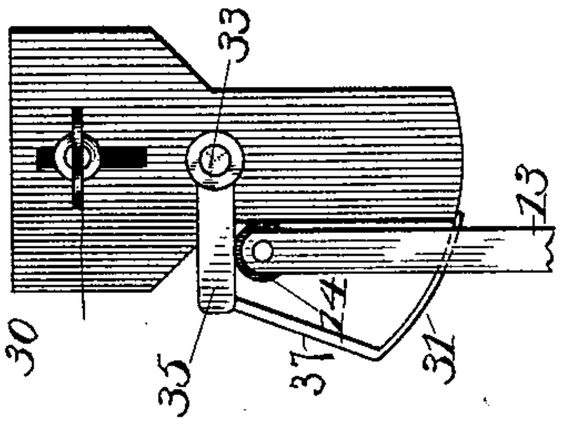


Fig. 7

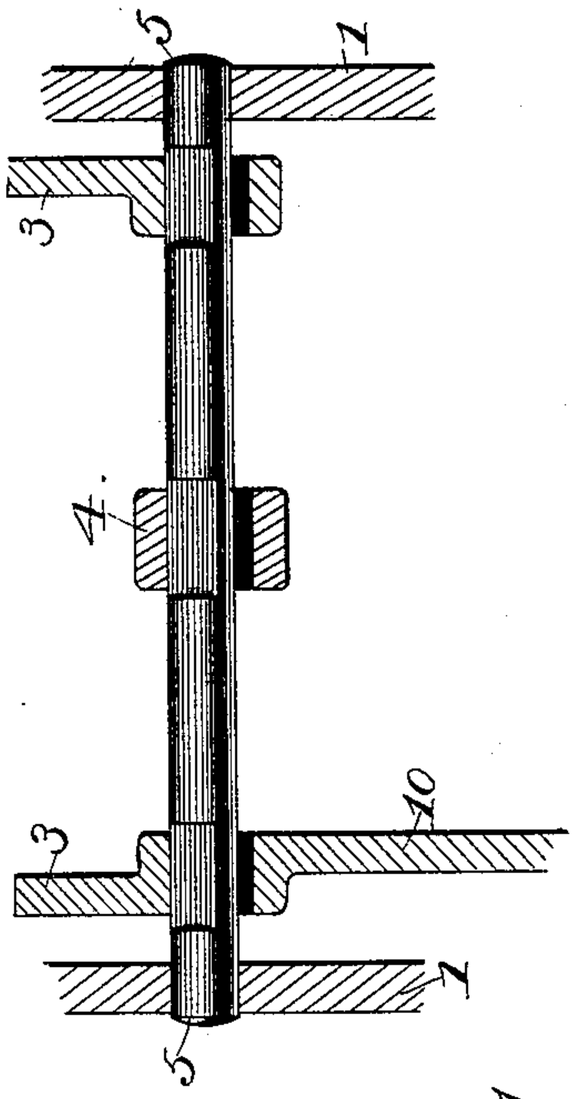
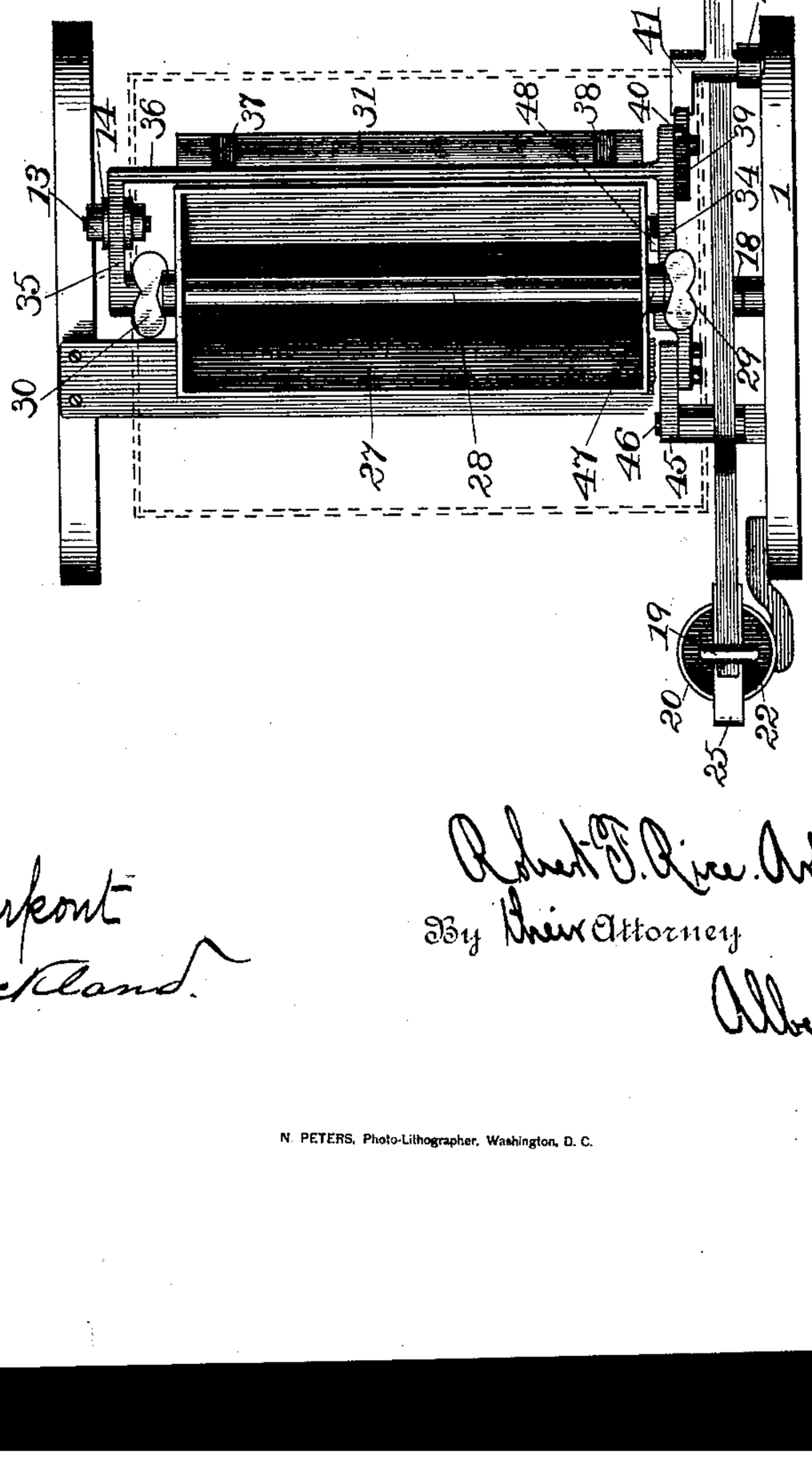


Fig. 6



Witnesses
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UNITED STATES PATENT OFFICE.

ROBERT F. RICE AND ARTHUR M. TRUDE, OF HARTFORD, CONNECTICUT.

AUTOMATIC GRAIN-SCALE.

SPECIFICATION forming part of Letters Patent No. 360,820, dated April 5, 1887.

Application filed June 11, 1886. Serial No. 204,827. (No model.)

To all whom it may concern:

Be it known that we, ROBERT F. RICE and ARTHUR M. TRUDE, both of Hartford, Connecticut, have jointly invented a new and useful Automatic Grain-Scale, of which the following description and claims constitute the specification, and which is illustrated by the accompanying six sheets of drawings.

This apparatus automatically and accurately weighs a stream of grain falling into it from above and discharged from it below.

Figure 1 is a side elevation of the entire grain-scale. Fig. 2 is the same as Fig. 1, except that the nearer side of the frame is removed and except that the hopper and the bucket are shown in vertical section, the operating parts, which are attached to the nearer side of the frame, being in the positions they would occupy if the entire frame were there to support them. Figs. 3 and 4 are the same as Fig. 2, except that each of them represents a different position of the operating parts. Fig. 5 is a plan view of the apparatus with all parts above the bucket removed, and Fig. 6 is a plan view of the parts which are absent from Fig. 5. Fig. 7 is a vertical section of the fulcra of the weighing-beams on the line *a a* of Fig. 1. Figs. 8 and 9 are elevations of the remoter end of the hopper shown in Fig. 1, and those figures show the valve of the hopper in different positions.

The numeral 1 everywhere indicates the fixed frame of the apparatus. The double bucket 2 is between the two sides of the frame, and is pivoted at 63 to the upper bifurcated scale-beam, 3, between the forks thereof. The lower bifurcated scale-beam, 4, has its forks directly under those of the upper scale-beam, and both scale-beams turn on knife-edges on the upper side of the fulcrum-bar 5. The upper scale-beam is provided with the poise 6 and the poise 7, and the lower scale-beam is provided with the poise 8 and the poise 9. The arm 10, provided at its lower end with the roller 11, projects downward from the nearer fork of the bifurcated scale-beam 3. The arm 12 projects horizontally from the same fork of the same scale-beam, and the arm 13, provided at its upper end with the roller 14, projects upward from the other fork thereof. The cam-lever 15 is pivoted to the frame under the arm 10, so as to be worked thereby, and is connected by the rod 16 to the lever 17, which lever is pivoted to the inner side of the nearer side of the frame at 18, and sustains, at its working end, the piston-rod 19 and the piston 20. That piston has the valve 21, and works in the cylinder 22, which cylinder is bolted to the arm 23 of the frame 1, and is provided with the cock 24. A frame, 25, flanks the cylinder, on diametrically-opposite sides thereof, and has its upper end rigidly attached to the piston-rod 19, while its lower end supports the weight 26. The hopper 27 is supported by the frame 1 directly over the center of the double bucket 2, and is provided in the inside with the gate 28, which is adjustable in vertical slits in the end walls of the hopper by means of the set-screws 29 and 30. The hopper-valve 31 has the curve of a circle of which the pivots 32 and 33 are the center. The arms 34 and 35 turn on those pivots, respectively, and are connected by the cross-bar 36, from which cross-bar the arms 37 and 38 extend downward and sustain the valve 31. The arm 34 is longer than the arm 35, and its extremity is provided with the trip 39, the left-hand end of which is heavier than the other end, which latter is, however, limited in upward movement by the stud 40. The trip 41 is pivoted to the arm 42 and engages with a notch in the upper end of the arm 43, which latter projects upward from the lever 17. The arms 44 and 45 vibrate together on the pivot 46, the lower end of the former being bent to engage with the adjacent end of the nearer fork of the scale-beam 4, and the outer end of the arm 45 being provided with the adjustable extremity 47 for engagement with the finger 48 on the nearer edge of the hopper-valve 31. The floats 49 and 50 are suspended in the two compartments of the double bucket 2 by the rods 51 and 52, respectively, the upper ends of those rods being attached to the outer ends of the arms 53 and 54, respectively, and those arms having their inner ends fixed to the valve 55, which valve oscillates upon a pivotal bearing coincident with its lower edge. The valves 56 and 57 are fixed to the pivot 58, and the segmental ring 59 is attached to their nearer ends and is adapted to engage with the latch 60, which latch is provided with the stud 61 for engagement with the bracket 62.

The mode of operation is as follows: The

stream of grain falls continuously from above into the hopper 27, and its flow in the hopper is regulated by the position of the gate 28, while its descent into the bucket 2 is controlled by the valve 55, all the parts of the apparatus being in the primary positions shown in Figs. 1 and 2. When a predetermined proportion of one load of grain—for example, ninety-five per cent. of such a load—has fallen into that compartment of the bucket which is being filled, its weight overbalances the gravity of the right-hand end of the upper scale-beam and its appurtenances, and thus causes the left-hand end of the upper scale-beam, together with the entire bucket and its contents, to descend until the upper scale-beam collides with the lower scale-beam. That descent withdraws the arm 13 and roller 14 from any longer supporting the arm 35, so that gravity at once causes the arms 34 and 35, the bar 36, the arms 37 and 38 to descend and to carry the valve 31 from the position shown in Figs. 1, 2, 6, and 8 to that shown in Fig. 3, where further movement of the valve 31 is stopped by the finger 48 colliding with the adjustable extremity 47 of the arm 45. That colliding leaves the valve slightly open, so that the grain will slowly drip from the hopper into the open compartment of the bucket until another predetermined proportion of one load—for example, five per cent. of such a load—has fallen into the bucket and overbalanced the left-hand end of the lower scale-beam and its appurtenances. Then the bucket 2 descends still farther, carrying with it the left-hand ends of both scale-beams. The downward motion of the left-hand end of the lower scale-beam instantly carries the extremity of its nearer fork into collision with the lower end of the arm 44, forcing it to swing to the left, and thus to draw the arm 45 and its extremity 47 downward and away from all contact with the finger 48. That withdrawal allows gravity to instantly move the valve 31 from the position shown in Fig. 3 to that shown in Figs. 4 and 9, and thus to entirely cut off the drip of grain from the hopper into the bucket; but the former descent of the valve not only operated to nearly close the same, but also carried the shorter end of the trip 39 into collision with the adjacent ends of the trip 41, and that end of the trip 39, being prevented from much upward movement by stud 40, operated to force the adjacent end of the trip 41 downward and its other end upward and away from all contact with the arm 43, as shown in Fig. 3. Thereupon the weight 26 began to descend, but was retarded in so doing by the resistance afforded to the downward motion of the piston 20 by the partly-confined air in the cylinder 22. Now, by the time the valve 31 is completely closed and the drip cut entirely off, the weight 26 and the parts from which it is suspended have overcome that resistance, so as to drop the weight upon the extremity of the nearer fork of the upper scale-beam, 3. That added gravity carries the scale-beams and the bucket downward from the balanced position which follows the final closing of the valve 31 to the discharging position shown in Fig. 4. The discharging is effected by the collision of the stud 61 with the bracket 62 and the consequent lifting of the latch 60 from the detent on the upper edge of the segmental ring 59. When that occurs, the gravity of the grain in the bucket throws the valve 56 open and shuts the valve 57. As the grain falls out of the bucket it carries the float 49 downward, and thus raises the float 50 upward, and carries the valve 55 from the position shown in Figs. 2, 3, and 5 through that shown in Fig. 4 to a position wherein the valve 55 entirely closes the left-hand compartment of the bucket. Soon after the discharge of the grain begins the bucket rises, and thus allows the latch 60 to engage with the detent on the segmental ring 59, and thus to lock the valves 56 and 57 in the position shown in Fig. 4. The rising of the bucket also allows the bifurcated ends of the scale-beams to rise. The resulting oscillation of the upper beam, 3, carries the arm 10 toward the left and forces the roller 11 into collision with the inclined surface of the cam-lever 15, thus forcing that lever downward and, through the rod 16 and the lever 17, raising the weight 26 from the position shown in Fig. 4 to that shown in Fig. 1. The lowering of the right-hand end of the lever 17 allows the right-hand and heavier end of the trip 41 to again engage with the notch in the arm 43. The same oscillation of the scale-beam 3 also lifts the arm 13 and the roller 14 into contact with the arm 35, and thus lifts the valve 31 and its appurtenances from the position of Figs. 4 and 9 to that of Figs. 1, 2, 6, and 8. In this movement the shorter end of the trip 39 is carried past the longer end of the trip 41, the longer end of the trip being free to rise in order to permit the downward movement of the shorter end. After being carried past the trip 41 the trip 39 assumes the position shown in Fig. 1, with the gravity of its longer end keeping its shorter and lighter end in contact with the stud 40. The upward movement of the lower scale-beam, 4, allows the arms 44 and 45 to return to the position shown in Figs. 1, 2, and 3. Thus all parts of the apparatus are restored to the positions shown in Figs. 1 and 2, except that the valve 57 is now closed and the valve 56 open, instead of contrariwise, and except that the valve 55 now closes the upper end of the left-hand compartment of the bucket 2, instead of closing the upper end of its right-hand compartment. Thereupon the stream of grain fills the left-hand compartment, and the apparatus otherwise works as before. The alternate filling and discharging of the two compartments of the bucket automatically continues as long as grain falls into the hopper 27, and the apparatus can be made to keep a register of the amount of grain weighed

by it by means of any suitable counter so applied to either of its scale-beams as to indicate the number of its oscillations.

The employment of two scale-beams enables us to automatically almost, (but not entirely) close the valve 31 before the entire load is put into the bucket, and thus to eliminate the inaccuracy of weighing due to the momentum of the full stream of falling grain, when that stream is allowed to continue till the bucket is entirely loaded. The employment of the weight 26, restrained in falling by the partly-confined air in the cylinder 22, enables us to cut off the drip of grain when the scale-beams are both balanced, and then to discharge the load by means of the falling of the retarded weight. We believe we are the first to employ two scale-beams thus operating, and also the first to employ a retarded weight for the purpose of overbalancing a filled and balanced bucket in an automatic grain-scale. The width of the narrow opening left between the valve 31 and the left-hand wall of the hopper may be adjusted by advancing or retracting the extremity 47 of the arm 45, and the retardation of the weight 26 may be adjusted by means of the cock 24 being made to vary the vent of the air in the cylinder 22.

We claim as our joint invention—

1. The combination of two scale-beams so constructed and arranged that one of them is first caused to oscillate independent of the other by a portion of the load to be weighed, and the other is afterward caused to oscillate by the loaded end of the first one falling upon the corresponding end of the second one, all substantially as described.

2. The combination of a scale-beam adapted to be balanced by a load to be weighed and a weight adjusted to be vertically raised when the scale-beam is rising and to fall vertically upon the beam when it is balanced, and thus to overbalance it when the load is ready to be discharged, all substantially as described.

3. The combination of the piston 20, provided with the valve 21, the cylinder 22, provided with the cock 24, and the weight 26, rigidly connected with the piston, the whole being so constructed and arranged that the air in the cylinder retards the fall of the piston and the weight, when neither the weight nor the piston is supported otherwise than by the air, all substantially as described.

4. The combination of the scale-beam 3, provided with the arm 13, and the valve 31, controlled by the arm 35, the whole being so constructed and arranged that the fall of the loaded end of the scale-beam withdraws the arm 13 from supporting the arm 35, and thus permits the valve 31 to fall toward a closure, all substantially as described.

5. The combination of the scale-beam 4, the arms 44 and 45, and the valve 31, the whole being so constructed and arranged that the oscillation of that scale-beam will permit the valve to close, all substantially as described.

6. The combination of the scale-beam 3, provided with the arm 10, the cam-lever 15, the rod 16, the lever 17, and the weight 26, so constructed and arranged that the oscillation of the scale-beam will raise the weight, all substantially as described.

7. The combination of the arm 34, the trip 39, the trip 41, the lever 17, and the weight 26, all so constructed and arranged that the falling of the said arm causes the said trip 39 to trip the trip 41, and thus allow the lever 17 to oscillate and the weight 26 to fall, all substantially as described.

8. The combination of the floats 49 and 50 and the valve 55, so constructed and arranged that the floats alternately operate the valve, all substantially as described.

Hartford, Connecticut, June 9, 1886.

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ARTHUR M. TRUDE.

Witnesses:
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