No. 616,789. Patented Dec. 27, 1898.

R. F. HALL & H. J. T. PIERCY.

MACHINERY FOR GAGING AND SORTING STEEL BALLS, &c.

(No Model.) (Application filed Dec. 20, 1897.) 5 Sheets—Sheet 1.

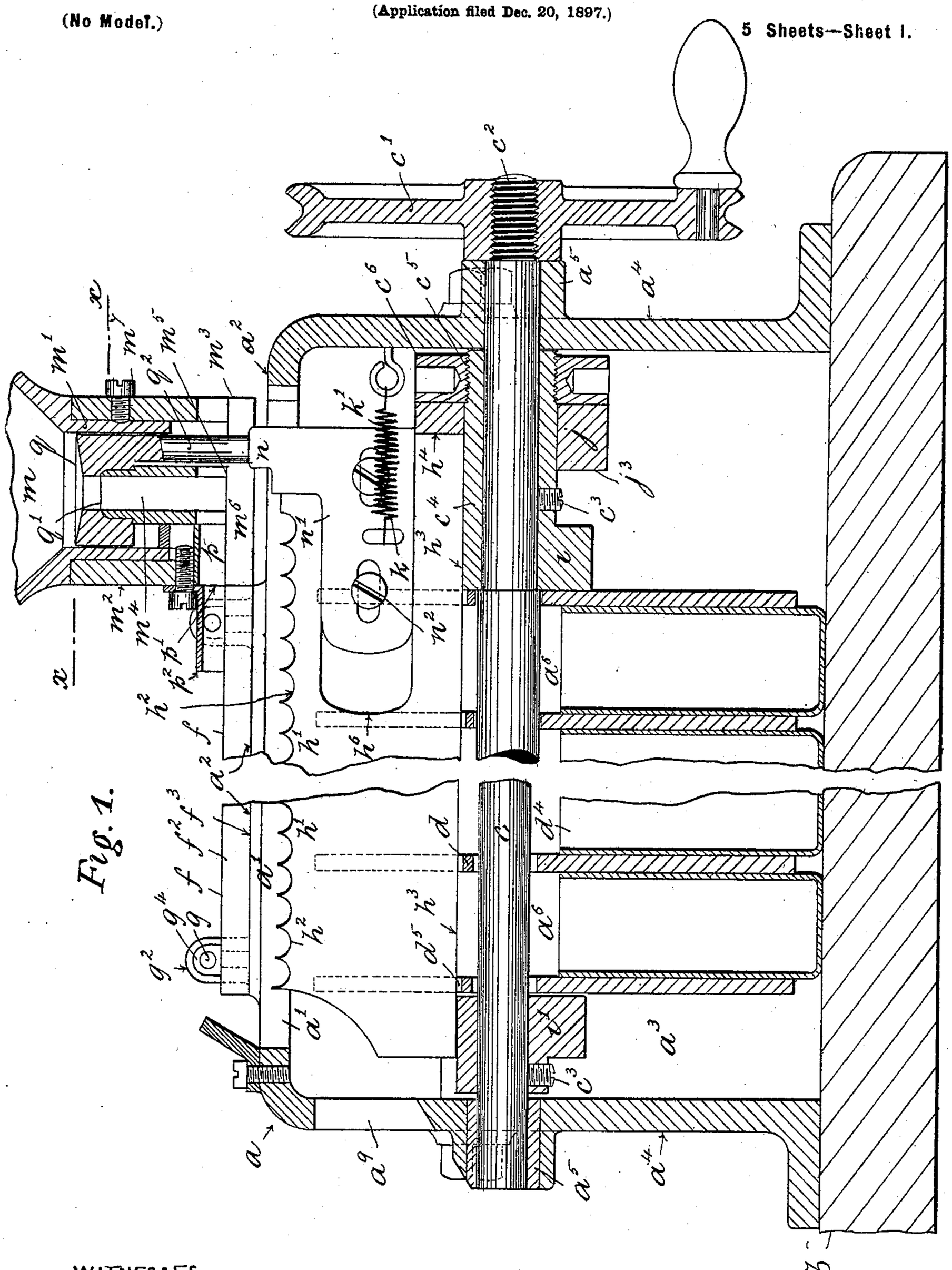

Fig. 1.

WITNESSES

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Fig. 2.

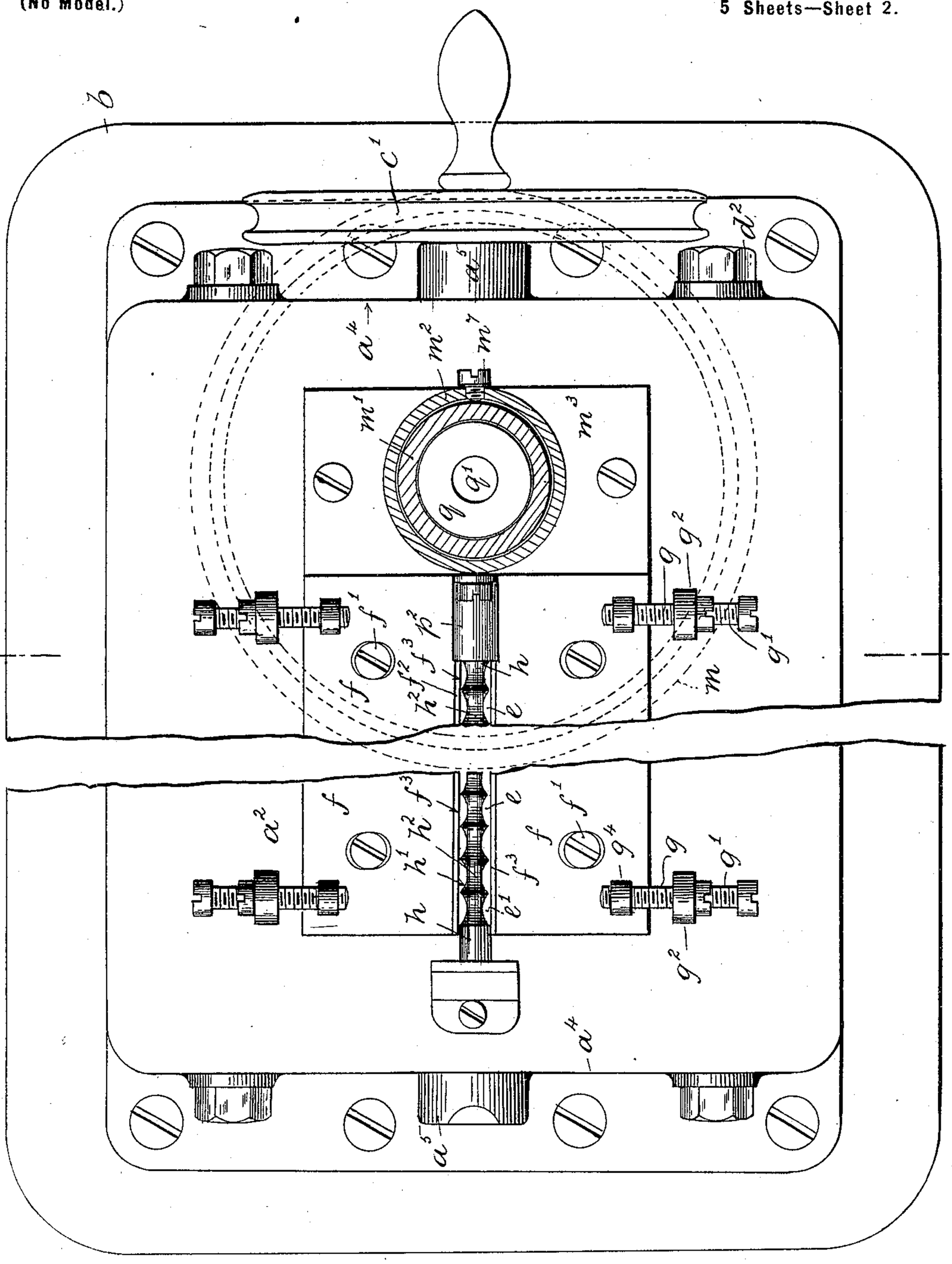

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Fig. 4.

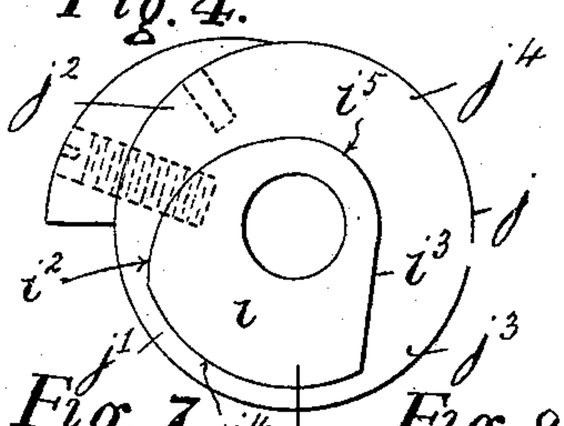

Fig. 6.

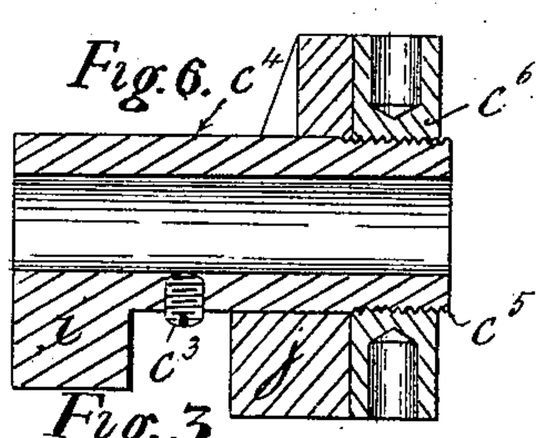

Fig. 5.

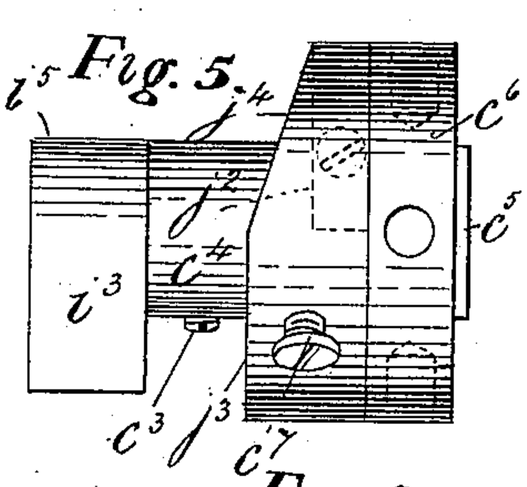

Fig. 7.

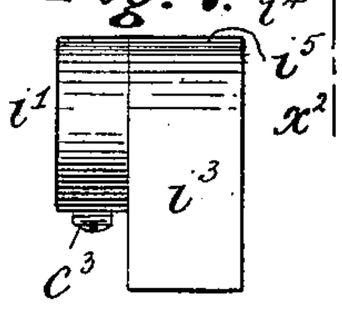

Fig. 8.

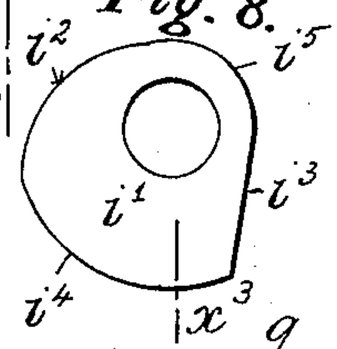

Fig. 3.

Fig. 9

WITNESSES.

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(No Model.) 5 Sheets—Sheet 4.

Fig. 10.

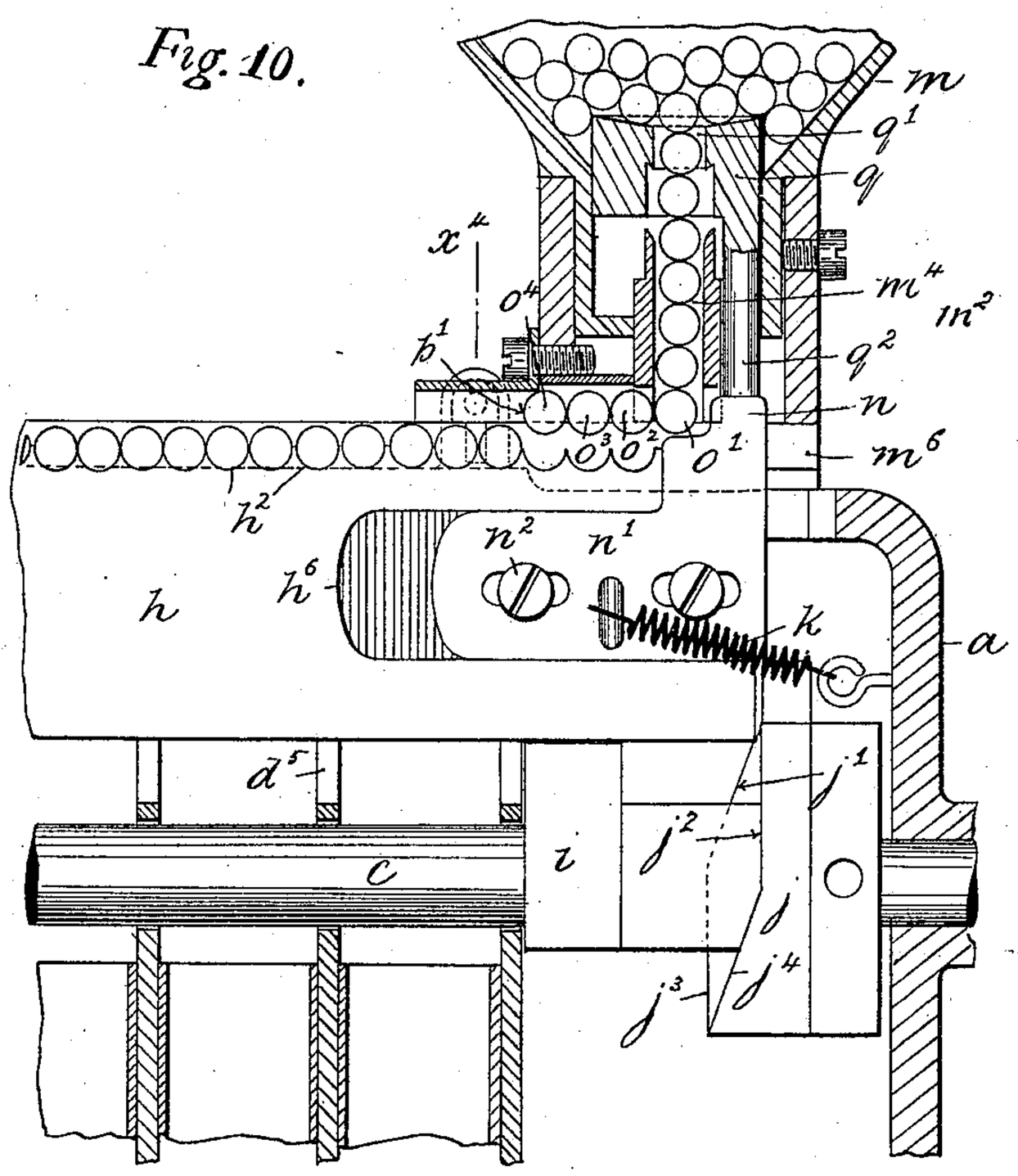

Fig. 11.

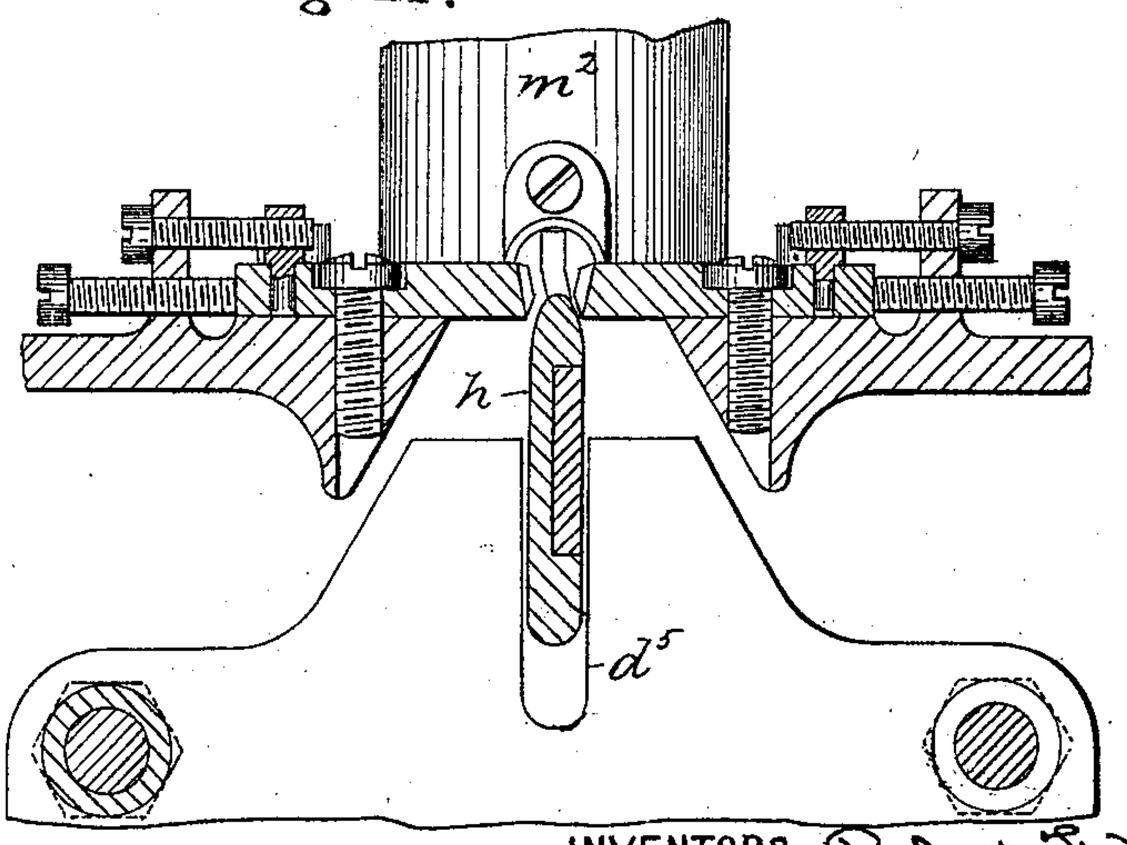

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Fig. 12.

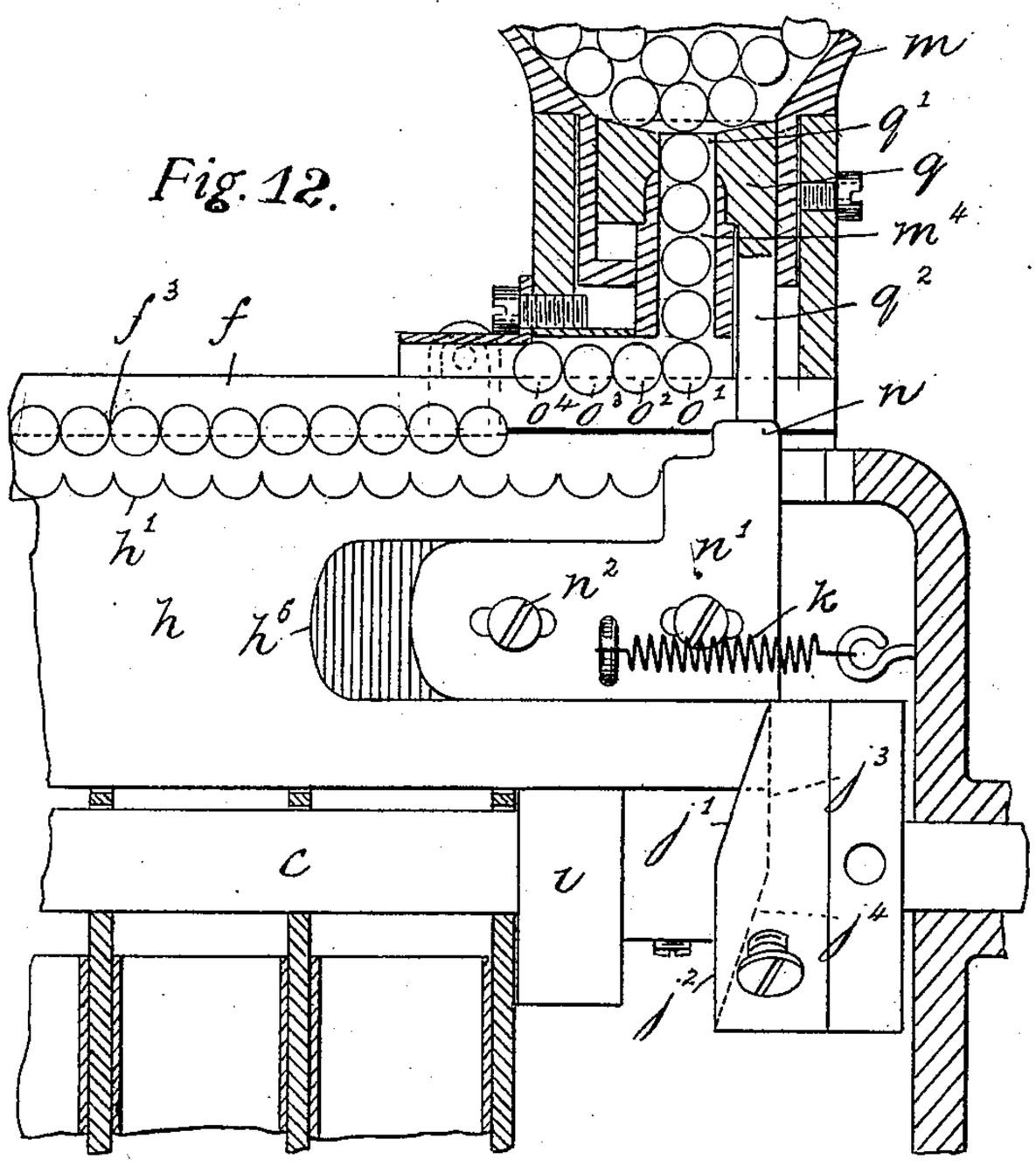
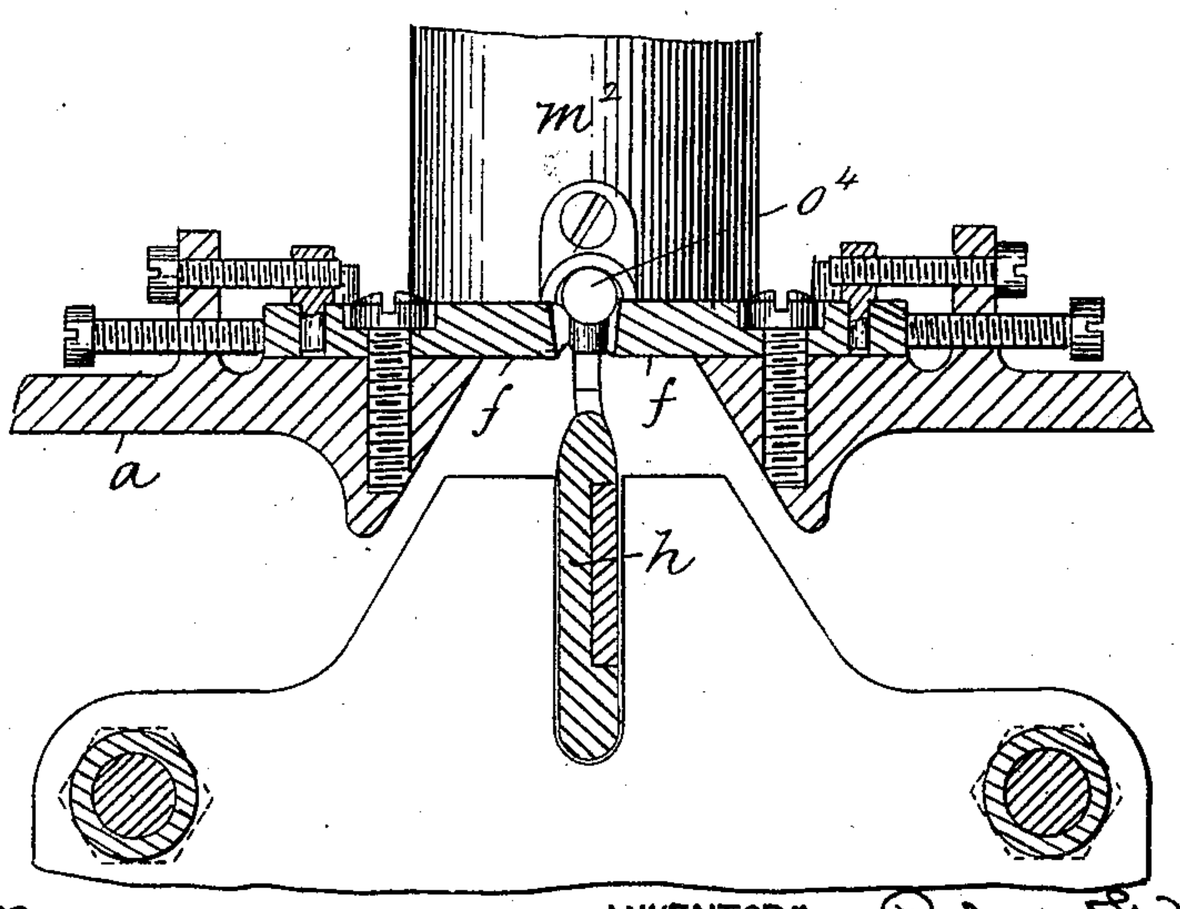


Fig. 13.



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UNITED STATES PATENT OFFICE.

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MACHINERY FOR GAGING AND SORTING STEEL BALLS, &c.

SPECIFICATION forming part of Letters Patent No. 616,789, dated December 27, 1898.

Application filed December 20, 1897. Serial No. 662,622. (No model.)

To all whom it may concern:

Be it known that we, ROBERT FREDERICK HALL, manufacturer, of Sherlock street, and HENRY JAMES TAYLOR PIERCY, engineer, of Broad street, Birmingham, England, subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Machinery for Gaging and Sorting Steel Balls and other Spheres, of which the following is a specification, and for which invention Letters Patent of Great Britain have been obtained, dated April 9, 1897, No. 9,038.

This invention relates to machinery or apparatus for gaging and sorting steel balls and other spheres, and has for its principal object to give to each individual ball a positive and defined movement along a taper gaging-slot formed by the opposed knife-edges of a pair of hardened-steel gage-plates which are set in a horizontal plane instead of being inclined from the feed end of the machine downward, as is the usual practice, in which case the ball runs by gravity down the gaging-slot and frequently overruns that part of the said slot corresponding to its diameter and through which it should fall, and hence causes inaccurate gaging.

Figure 1 of the accompanying drawings represents a longitudinal vertical section, with parts in elevation, of a machine designed for gaging and sorting steel balls or like spheres according to our invention by carrying them progressively and by stages along a horizontal taper gaging-slot, and hence causing positive and accurate gaging. Fig. 2 is a top side plan of the said machine, but with a part in section upon the dotted line x, Fig. 1, thus removing the hopper of the feed mechanism. Fig. 3 is a transverse vertical section of Fig. 2 upon the dotted line x', showing more clearly the arrangements for adjusting the distance between the opposed edges of the horizontal rails by which the balls are gaged and sorted. Fig. 4 is an end view of the pair of cams secured to the right-hand or hopper end of the spindle or driving-axis of the machine, one of them being adapted to impart a traversing and the other a rising-and-falling movement to the serrated-edged blade, which raises the balls from off the knife-edges of the gaging-rails and carries them a determined distance forward, thereby giving them a positive movement. Fig. 5 is a side elevation of these cams and their accessory fittings, while Fig. 6 is a vertical section of the same upon the dotted line x^2, Fig. 4. Fig. 7 represents a side elevation of the single blade-lifting cam which is secured to the left-hand end of the spindle. Fig. 8 is an end view thereof, and Fig. 9 a vertical section of Fig. 8 upon the dotted line x^3. Fig. 10 represents, principally in vertical section, the ball-feed mechanism of the machine with a portion of the ball-conveyer blade and its adjuncts, showing the said blade in its raised position, lifting the balls clear of the gaging-rails and just before it is caused to make its longitudinal transverse movement for carrying the said balls the required distance farther along the gap between the said rails. Fig. 11 represents a transverse vertical section of Fig. 10 upon the dotted line x^4. Fig. 12 is a like view as Fig. 10, but showing the ball-conveyer blade or plate in the position it assumes after the completion of its compound and intermittent lift and traverse movements and showing the balls resting and supported between the edges of the gaging-rails. Fig. 13 represents a transverse vertical section of Fig. 12 upon the dotted line x^5.

The same letters of reference indicate corresponding parts in the several figures of the drawings.

a is the main framing of the machine, mounted upon the base-board b and having a longitudinal middle gap a' running throughout nearly the whole length of the top a^2 of the same, the sides a^3 being open, while the ends a^4 constitute the supports of the frame and have within them the bearings a^5 of the right and left-hand ends of the main spindle or axis c of the machine, which is driven through a wheel c', made fast on its screwed end c^2 and adapted to be actuated either by hand or by power. The interior space between the ends of the framing is subdivided up into a series of compartments a^6 by partition-plates d, threaded upon side pins d', secured to the said ends a^4 by nuts d^2 and having distance pieces or sleeves d^3 threaded upon them for separating the said partition-plates d, the spaces between which contain a series of ball receptacles or boxes d^4, into

which the balls that fall through the taper gap *e* between the adjustable gage-rails *f* drop. The said gaging-rails *f* consist of bars or strips of hardened steel set in a perfectly horizontal plane and adjustably secured by means of the screws *f'*, one on either side of the gap *a'* in the framing-top a^2, whereon the said rails rest as a bed. Their opposed or inner sides f^2 are inclined or chamfered off toward one another into hardened knife-edges f^3, which together constitute the gaging or sorting gap *e*, the said rails being adjusted laterally away from or toward each other by means of the sets of screws *g g'* in such a manner that the gap at its left-hand end *e'*, or that end farthermost from the feed, is wider to a very slight extent than at the right-hand end, in which position the said rails are locked by the screws *f'*, thereby forming a gradually-tapering slot or gap along which the balls to be gaged and sorted are moved and through which they are allowed to fall into the boxes d^4 set below to receive them on being brought to a part of the gap of a greater width than their diameter.

The positive and defined motion which it is necessary to give to the balls in order to insure absolute uniformity in gaging is imparted to them through the plate or blade *h*, located below the gaging-gap, and being guided in its rising, traversing, falling, and return movements by vertical gaps d^5, cut downward from the tops of the partition-plates *d*, while its top edge *h'* is provided with a series of semicircular-shaped notches or seatings h^2, into which the balls being gaged come and rest when lifted off the knife-edges f^3 of the gaging-rails and while being traversed a further distance along the gaging-gap. The aforesaid movements are given to the said ball-conveyer plate or blade by means of a series of cams *i*, *i'*, and *j*, made fast, so as to turn with the spindle *c*, by set-screws c^3, the cams *i i'*, which respectively come at the right-hand and left-hand ends of the said spindle, being the lifting-cams, each having a throw corresponding to the height to which the said plate *h* is to be lifted, with their acting faces i^2 i^3 working upon the bottom edge h^3 of the said plate, while *j* is the traversing cam for giving the forward movement by its face acting upon the end h^4 of the plate, whose backward or return movement is effected by a pair of springs *k*, made fast at one end *k'* to the framing and at the other end to the conveyer-plate or to an attachment thereof. This latter cam *j* is made adjustable by being threaded over a sleeve c^4, (see Figs. 4, 5, and 6,) one end of which carries the cam *i*, while the other end c^5 is screwed to take an adjusting-ring c^6, by the rotation of which the said cam *j* is moved along the sleeve, to which it is locked after adjustment by the screw c^7. These cams are so set relatively to one another that when the lifting-cams, which each have acting peripheral parts i^2 i^3 and pauses i^4 i^5, are imparting a lifting movement to the conveyer-plate the traverse-cam, which has inclines j' j^4 and pause-flats j^2 j^3, is inoperative, and vice versa—that is, assuming that the spindle is moving from left to right and that the parts i^2 of each of the cams *i* and *i'* are wiping under the edge h^3 of the conveyer-plate and gradually raising the same, then its end h^4 is bearing against the pause or rest and inoperative part j^2 of the cam-face *j*, so that during this time the plate makes no forward movement; but so soon as its edge comes upon the rests i^4 of the said cams *i i'*, whereby it is for a time sustained in its elevated position, then the incline or acting part *j'* of the cam commences to wipe past the end h^4 of the plate and traverse it forward to the required extent. By the time that this movement is completed the flats or drops i^3 come under the plate, thereby allowing it to fall, the pause j^3 of the cam *j* meantime wiping inactive past the end h^4; but so soon as the plate has completed its fall and drops onto the rest i^5 the receding incline j^4 comes against its end h^4 and allows it to be drawn backward into the position shown in Figs. 1 and 12 by the contracting force of the springs *k*. The conveyer-plate thus makes four movements to every rotation of the spindle—viz., it is first lifted to a height corresponding to the full throw of the cams *i i'* and its top edge comes against the under sides of the balls supported by the knife-edges of the gage-rails, which balls fall into the semicircular seatings h^2 and are lifted clear of the said rail edges. The plate, with the series or row of balls now carried by it, next makes a forward traverse to the extent approximating to the diameter of one single ball, and then descends, depositing or leaving the balls gently again upon the edges of the rails, but in an advanced position to that which they previously occupied, and when the plate has descended to a sufficient extent below and clear of the under side of the rails to allow any such balls as can do so to fall through the gaging-gap into the receptacles set to receive them it then makes a return traverse back to its original position ready for the repetition of the operation.

The balls to be sorted are placed in a hopper *m*, the reduced neck *m'* of which fits (and is made fast by a set-screw m^7) into the mouth of a socket m^2, carried by the attachment-plate m^3, secured by screws or otherwise to the top of the framing, and from this hopper they fall down a throat or chute m^4 onto the bottom m^5 of the said socket, from whence they are fed one at a time into a vacant recess in the top edge of the conveyer-blade, which is at the time in its elevated position and just about completing its forward movement through the medium of an arm *n*, carried by the supplementary plate *n'* lying within the recess h^6 of and adjustably connected by screws n^2 to the said conveyer-

plate, with which it makes a common movement. Thus the feed-arm n is lifted by the upward movement of the said plate h through a slot m^6 in the socket bottom m^5 and comes at the back of the ball o' which last descended the throat. (See Fig. 10.) Then the plate traverses and the arm is carried forward with it to an extent equal to the diameter of one ball, and this movement is communicated through the intermediate balls o^2 o^3 to the ball o^4 lying in the mouth p' of the exit-passage p, which is thereby expelled and drops into a vacant recess in the scalloped edge of the conveyer-plate, and thus becomes one of the series which are being gaged. The arm then drops with the plate and makes its return movement clear of the balls lying above the slot m^6. This movement is repeated once to every rotation of the spindle, one ball being fed onto the conveyer each time it makes a forward traverse, and is deposited on the edges of the gaging-rails on the plate falling, and thus the feeding of the balls is maintained constant and *pro rata* with the intermittent transportation of them along the gaging-slot.

The exit end of the passage p is filled with an attached cover or hood p^2, while in order to prevent the balls jamming or sticking in the neck of the hopper it is provided with a loose and vertically-movable false bottom q, having a central hole q' coincident with the throat m^4, and a depending stalk q^2, adapted to be raised into the position shown in Fig. 10 (so as to ease or loosen the balls and facilitate their entrance one by one into the said throat) by the arm n coming against it when making its upward movement through the slot m^6, and when the said arm moves forward in completing its feed-stroke it leaves the said stalk, which then, together with the loose hopper-bottom, fall by their own weight into the position shown in Fig. 12. Those balls which are too large in diameter to pass between the gaging rails or plate on reaching the end of the gage-gap may fall onto an inclined tray, lead, or chute, which passes through the opening a^9, into a suitable receptacle set to receive them, whence the balls thus sorted may be removed to another machine adapted to gage balls of a larger diameter.

For adjusting the gage-plate the screws g pass through screwed eyes g^2 in the brackets g^3 and into nuts g^4, made fast to the said plates, and constitute the means for drawing the plates away from one another and increasing the width of the gap, while the ends of the screws g', which pass through holes g^5 in the said brackets, bear against the edges of the plates and when screwed inward force the plates with them and narrow the gage-gap to a corresponding extent.

Having fully described our invention, what we desire to claim and secure by Letters Patent is—

1. In a machine for gaging and sorting balls, the combination with a pair of adjustable, horizontal gage-rails having a space between them, of a ball-carrier or conveyer-plate having a series of seats for the balls in its upper edge, a pair of cams arranged to act simultaneously on the lower edge of the conveyer-plate, a cam to act upon the end of said plate, and a spring connected to said plate and exerting its tension against the throw of the cam last named, substantially as described.

2. In a machine for gaging and sorting balls, the combination with a pair of adjustable gage-rails of a ball-carrier or conveyer-plate having a series of seats in its upper edge for the balls, means for raising said plate between the rails to receive the balls in said seats, lift them off the rails, advance them a definite step toward the exit end of the gage-slot between said rails and deposit them again upon the rails, a hopper over the entrance end of the slot and a vertically-movable false bottom in said hopper having a passage for the balls and provided with a depending stalk adapted to be engaged by an arm upon the conveyer-plate, substantially as described.

3. In a machine for sorting and gaging balls, the combination with a pair of horizontal rails, of a ball-carrier or conveyer-plate having its upper edge provided with a series of seats for the balls, and a shaft carrying three cams, two of which raise said ball-carrier, the third cam acting upon its end, after the rising movement, to produce longitudinal movement, the downward movement and the return longitudinal movement being produced respectively by gravity and by a spring substantially as described.

4. In a ball sorting and gaging machine, the combination with two horizontal rails of a ball-carrier or conveyer-plate having a series of seats in its upper edge for the balls, means for giving said ball-carrier a movement to lift the balls off the rails, advance them, and again deposit them upon the rails, a hopper at one end of the rails having a vertical passage in which the balls lie, one upon another said passage communicating with a horizontal exit-passage for the balls, and an upwardly-extending arm adjustably mounted on the ball-carrier and moving with the latter its end being adapted to traverse the lower end of the vertical passage and push the balls one by one into the horizontal passage by the advancing movement of the ball-carrier, whereby the balls are dropped successively into the rearward seat in the edge of the ball-carrier, substantially as described.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

ROBERT FREDERICK HALL.
HENRY JAMES TAYLOR PIERCY.

Witnesses:
HENRY SKERRETT,
ARTHUR T. SADLER.