

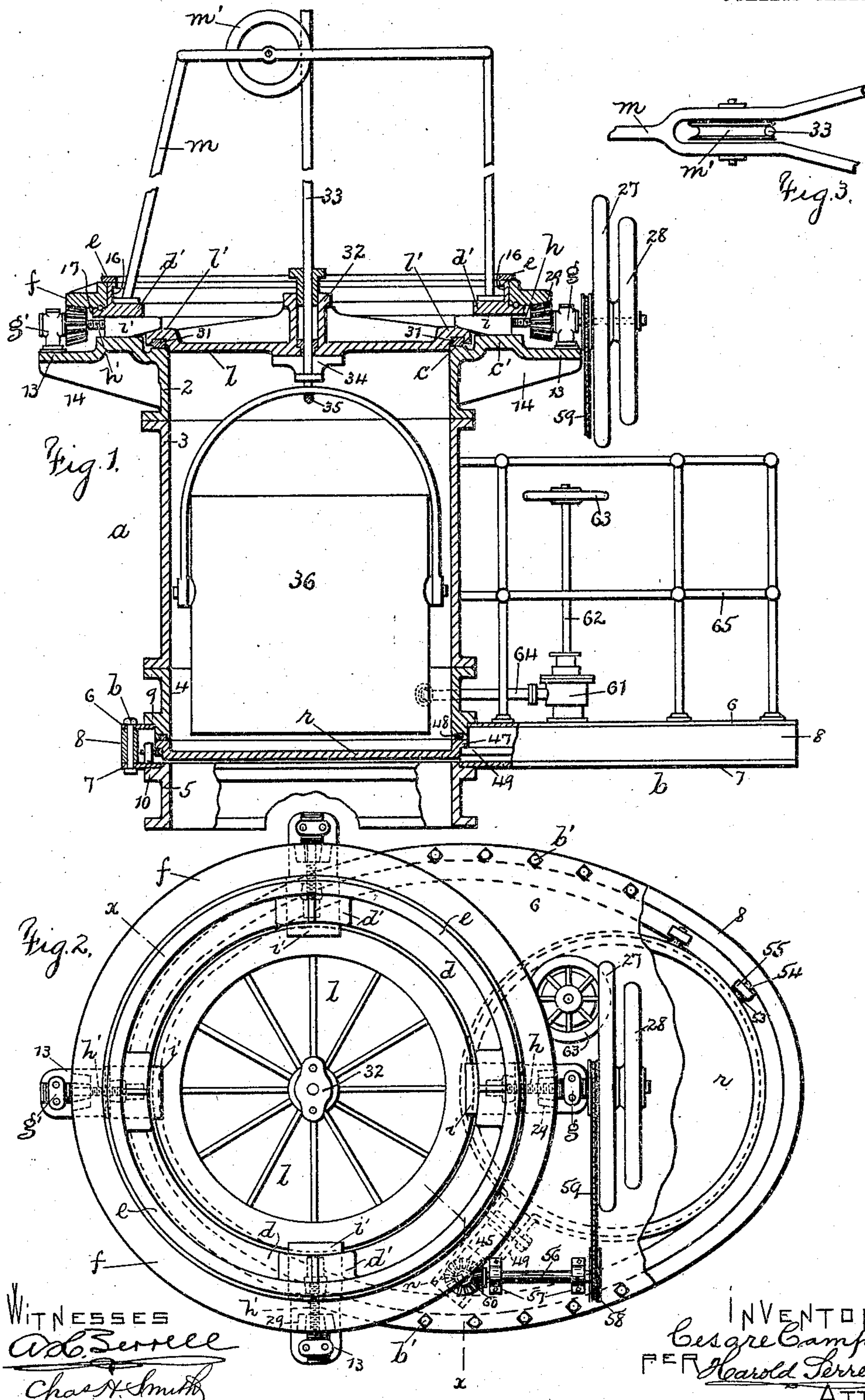
No. 782,596.

PATENTED FEB. 14, 1905.

C. CAMPUS.  
AIR LOCK.

APPLICATION FILED DEC. 6, 1904.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

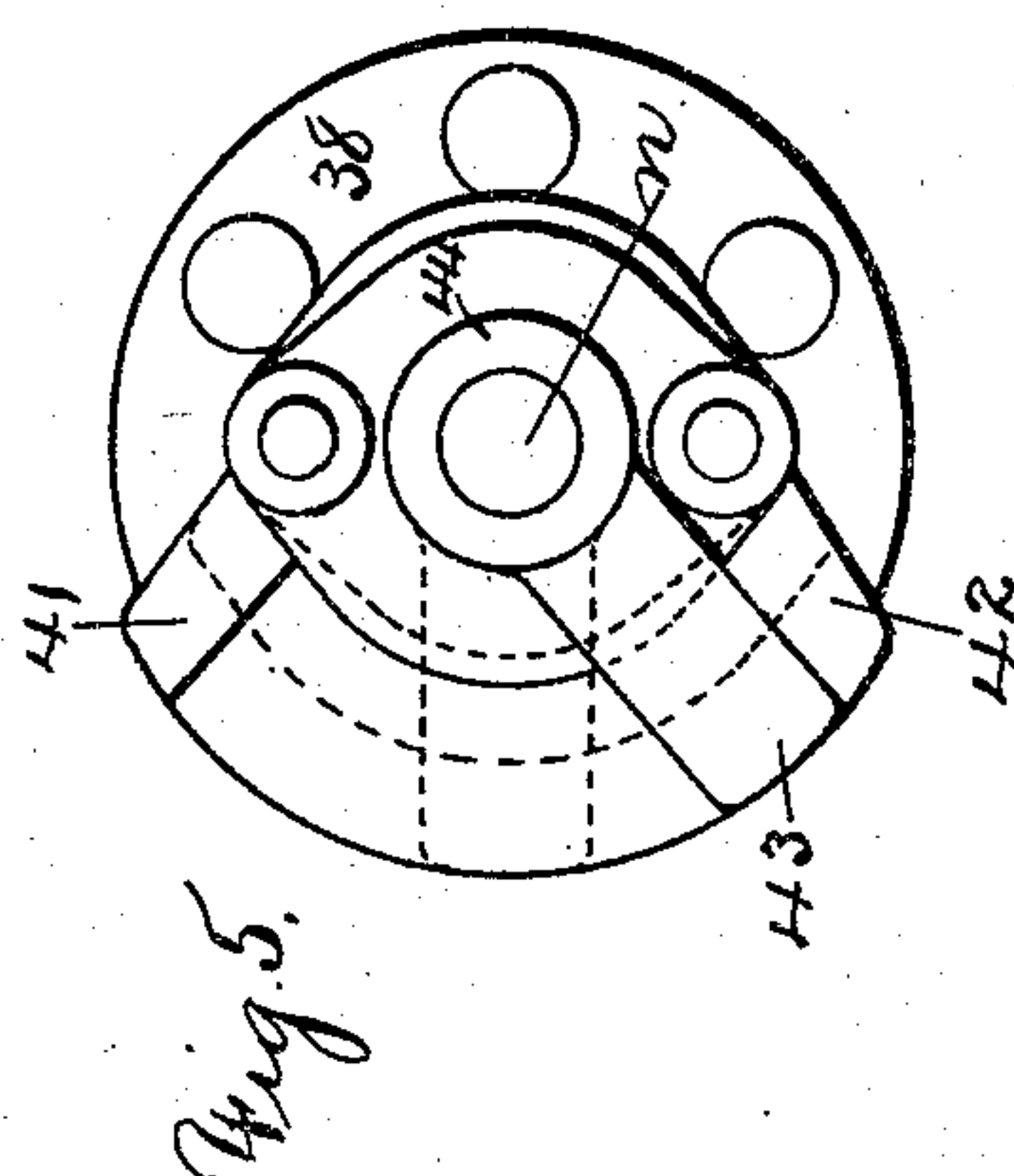
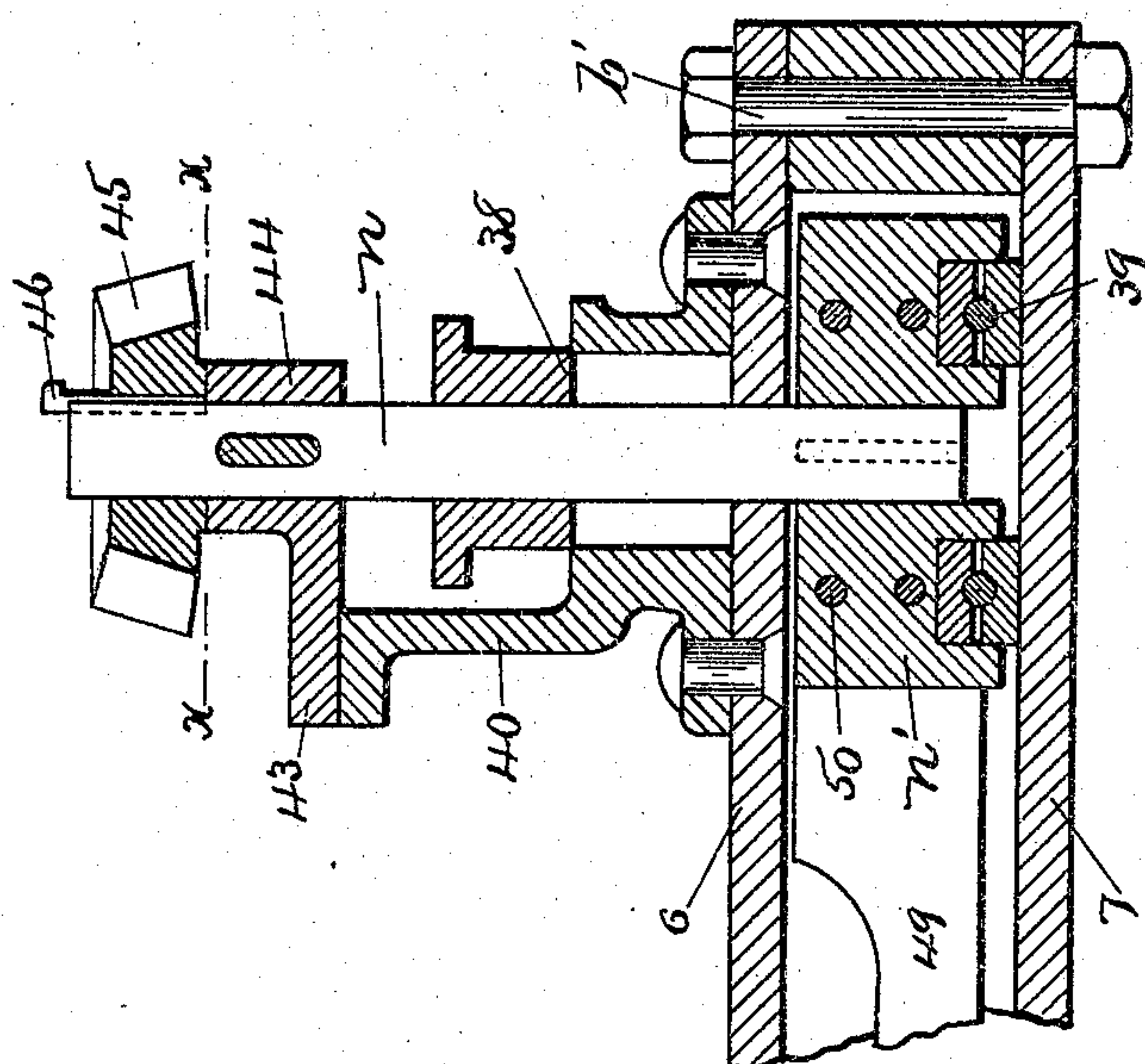
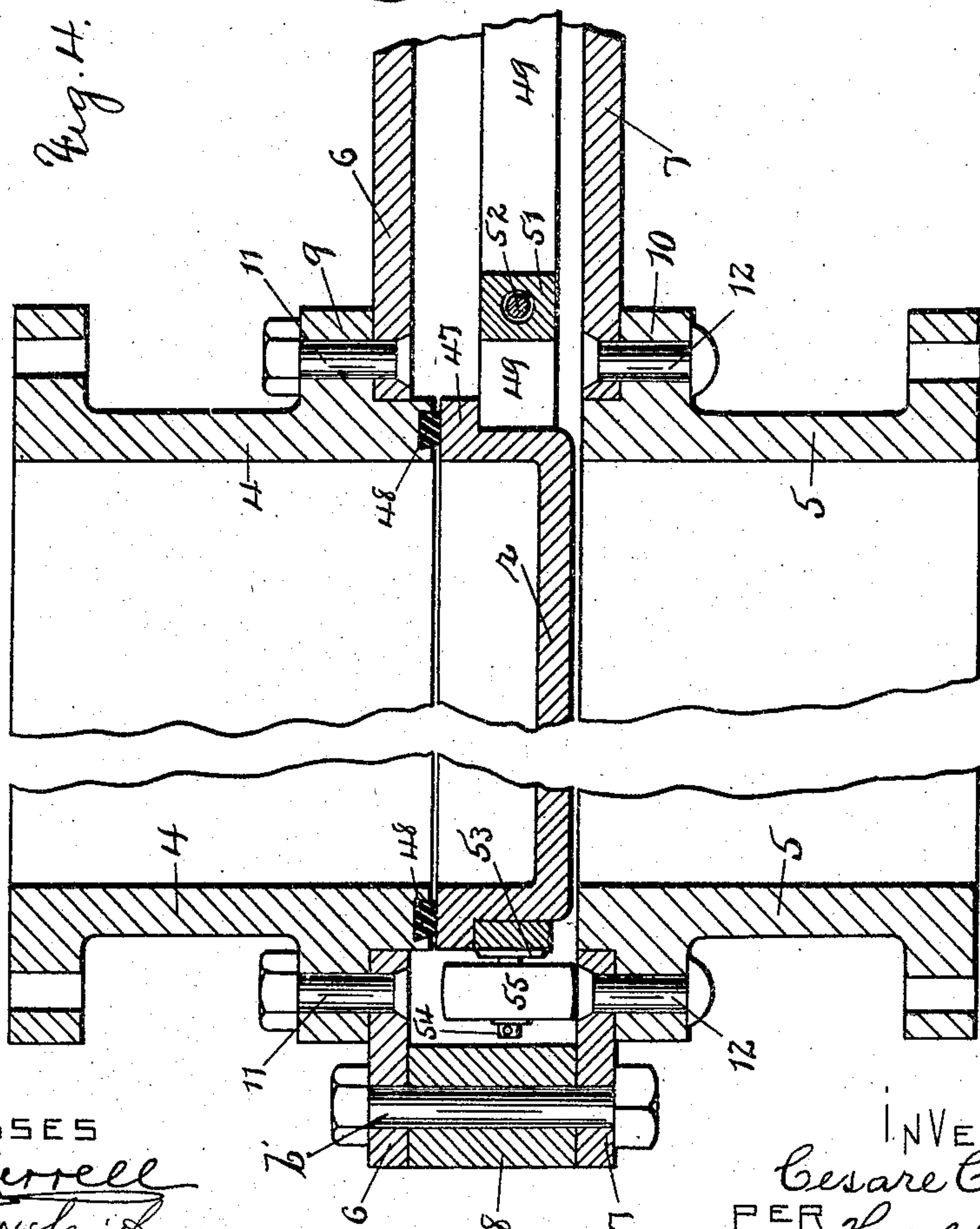


Fig. 4.



WITNESSES

*A. B. Berrell*  
*Chas. H. Smith*

INVENTOR  
*Cesare Campus*  
PER *Harold Berrell*  
ATTY



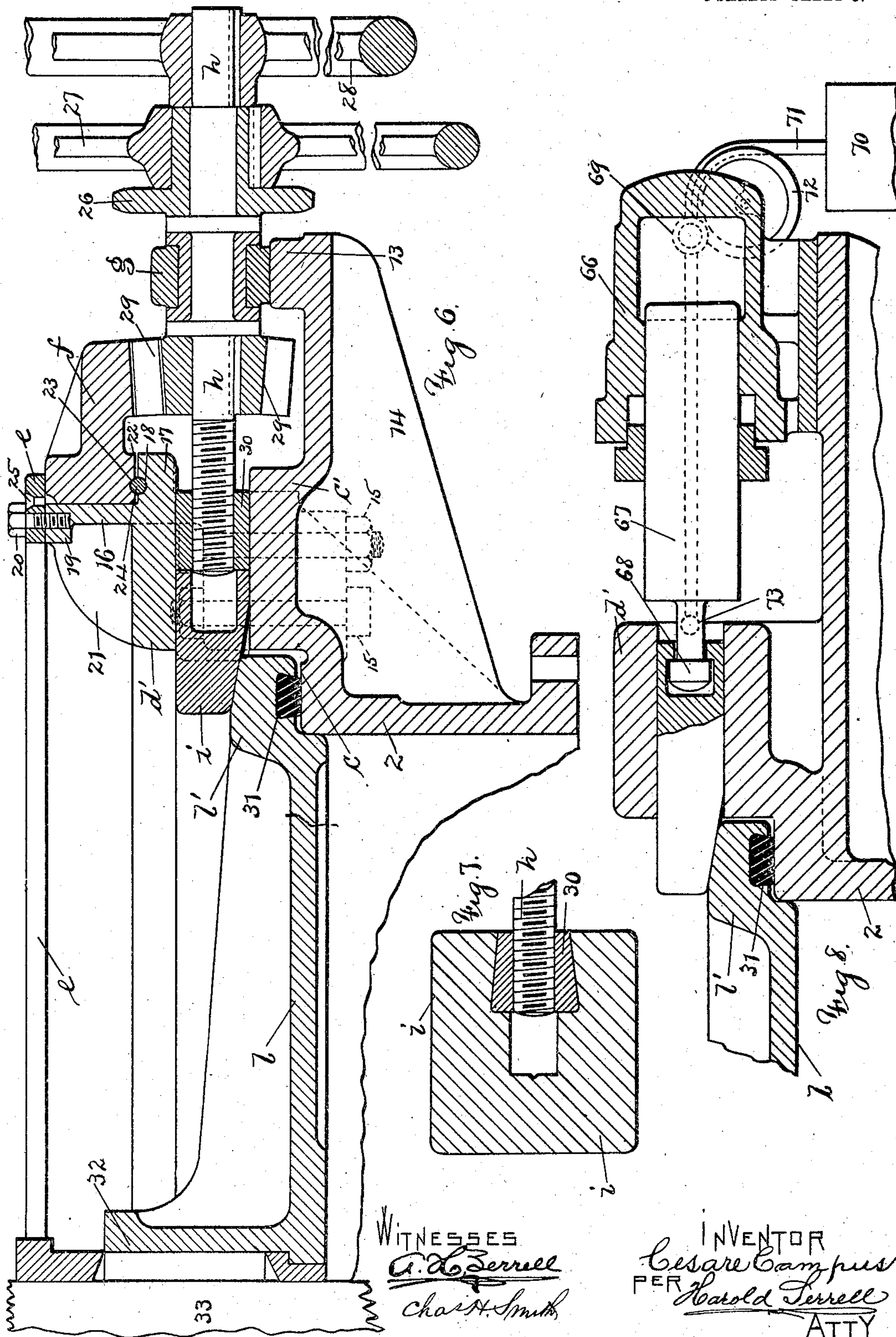
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# UNITED STATES PATENT OFFICE.

CESARE CAMPUS, OF NEW YORK, N. Y.

## AIR-LOCK.

SPECIFICATION forming part of Letters Patent No. 782,596, dated February 14, 1905.

Application filed December 6, 1904. Serial No. 235,719.

*To all whom it may concern:*

Be it known that I, CESARE CAMPUS, a subject of the King of Italy, and a resident of the borough of Manhattan, in the city, county, and State of New York, have invented an Improvement in Air-Locks, of which the following is a specification.

My invention relates to air-locks, and particularly to caisson air-locks. The object thereof is the provision of an air-lock of as small capacity as is permissible, so that in the operation of the same the loss in air-pressure is reduced to a minimum, and at the same time one that may be readily operated by a single attendant stationed in one place.

In carrying out my invention I employ a casing preferably cylindrical and built up of several sections, a second casing preferably elliptical in plan and intersecting the cylindrical casing transversely, an upper gate adapted to seat at the top of the cylindrical casing, devices for forcing the upper gate against its seat and maintaining the same in position thereon, means for simultaneously operating all of said devices, means whereby the upper gate is always raised with the bucket employed when the latter is removed from the air-lock, a lower gate, a seat for the same in the lower part of the cylindrical casing, means for swinging said lower gate within the elliptical casing to and from its seated position, means for exteriorly indicating the position of the lower gate, and means for equalizing the pressure in the air-lock and caisson, all of which will be hereinafter more particularly described.

In the drawings, Figure 1 is a partial sectional elevation of my improved air-lock. Fig. 2 is a plan of the same with the superstructure removed. Fig. 3 is a partial plan of the superstructure and the pulley mounted therein. Fig. 4 is a sectional elevation, on an enlarged scale, on line *x x*, Fig. 2. Fig. 5 is a plan of the indicating-arm and the stops therefor. Fig. 6 is a sectional elevation through one half of the upper gate and including the devices employed for operating the wedge-blocks by which the said gate is forced against its seat. Fig. 7 is a transverse section of a wedge-block, and Fig. 8 is a sec-

tional elevation of a modified means for operating the wedge-blocks.

Referring to the drawings, *a* represents a casing, preferably cylindrical and built up of several pipe-sections 2, 3, 4, and 5, which are provided with the usual flanges and secured together by bolts or otherwise, as is common in the art.

*b* represents a casing which is preferably elliptical in plan and built up of the elliptical plates 6 and 7, with an intervening elliptical peripheral spacing member 8, these parts being conveniently secured together by means of bolts *b'*, which pass through the plates 6 and 7 and the intervening member 8. Section 4 of the cylindrical casing is provided with a flange 9 and section 5 of the cylindrical casing with a corresponding flange 10, and the elliptical plates 6 7 have openings therein adapted, respectively, to receive the lower end of the section 4 and the upper end of the section 5, the plate 6 bearing against the under side of the flange 9 and secured thereto by means of the bolts or rivets 11 and the plate 7 bearing against the upper face of the flange 10 and secured thereto by means of the bolts or rivets 12, by which structure it will be apparent that there is open communication between the interior of the cylindrical and elliptical casings.

The upper end of the top section 2 of the cylindrical casing is provided with a gate-seat *c* and also a flange *c'*, projecting from which at suitably spaced-apart intervals are brackets 13, and the flange *c'* and brackets 13 are conveniently strengthened by means of ribs 14.

*d* represents a ring which is preferably of the same diameter as the flange *c'*, and this ring *d* at suitably-spaced intervals, corresponding with the positions in which the brackets 13 are employed, is provided with raised portions *d'*, the ring *d* being secured to the flange *c'* by bolts 15 passing through both of these members or otherwise, as may be found expedient. The ring *d* is also provided with an annular upright portion 16 and a horizontal projection 17, in the face of which is a semi-circular groove 18, whose function will be hereinafter set forth. At the upper extremity of the annular upright portion 16 of the ring



$d$  is an inwardly-extending flange 19, upon which an annulus  $e$  rests and is secured by means of bolts 20, the annulus  $e$  preferably overhanging the annular upright portion 16 to an appreciable extent, and at suitably-spaced intervals I may provide the ring  $d$  with ribs 21, extending between the upper face of the same and the annular upright portion 16.

$f$  represents a ring-gear whose interior diameter is approximately the same as the exterior diameter of the upright portion 16 of the ring  $d$ , over which latter and between the annulus  $e$  and the upper face of the projection 17 the said ring-gear fits. This gear is provided with a face 22 of approximately the same width as the upper face of the projection 17 and having a semicircular groove 23 corresponding in position with the semicircular groove 18 in the face of the projection 17, in which grooves I prefer to employ balls 24, forming a bearing for the ring-gear  $f$ , and the annulus  $e$  may be provided with an opening 25 directly above the adjacent faces of the upright portion 16 and the ring-gear  $f$ , adapted to receive an oil-cup or without this latter to receive the oil for the purpose of lubrication.

Referring particularly to Fig. 6, one of the brackets 13 supports a journal-box  $g$ , in which is journaled a shaft  $h$ , the end of which on one side of the journal-box is screw-threaded, and at the other side of the journal-box the sprocket 26 is loosely mounted, and a hand-wheel 27 is keyed to the hub of the sprocket 26, while at the extremity of the shaft  $h$  a hand-wheel 28 is keyed. On the shaft  $h$  and between the screw-threaded end of the same and the journal-box  $g$  is a gear 29, meshing with the ring-gear  $f$ .  $i$  represents a wedge-block which is preferably rectangular in cross-section and in which at one side a block 30 is set, which latter is provided with a screw-threaded opening adapted to receive the screw-threaded end of the shaft  $h$ , and this wedge-block  $i$  is slidably movable along the face of the flange  $c'$  and in an opening provided for this purpose in one of the raised portions  $d'$  of the ring  $d$ . Each of the other brackets 13 supports a journal-box  $g'$ , similar to the journal-box  $g$ , and in each of the journal-boxes  $g'$  an arbor  $h'$  is journaled, having one of its ends screw-threaded and adapted to be received in a block 30, secured in one of the wedge-blocks  $i'$ , of which I have illustrated three; but there may be as many employed as is found necessary to properly secure the upper gate against its seat, each of the wedge-blocks  $i'$  being slidably movable on the face of the flange  $c'$  and within an opening in a raised portion  $d'$ , on the ring  $d$ .  $l$  represents the upper gate provided with an offset peripheral flange  $l'$ , in the under face of which a gasket 31 is mounted, and centrally the gate  $l$  is provided with a stuffing-box 32, through which the rope or cable 33, employed in lowering and raising the bucket,

passes. Beneath the stuffing-box 32 and on the under side of the gate  $l$  is a stop-plate 34, against which the cross-bar of the hook 35, by which the bucket 36 is supported, contacts when the bucket is raised to position within the cylindrical portion of the air-lock, so that when the bucket is removed from the said cylindrical portion the gate  $l$  is in every instance carried upward with the bucket and is also returned with the same.  $m$  represents a superstructure which may conveniently be constructed of gas-pipe and in which is mounted a guide-pulley  $m'$ , the horizontal members of the superstructure being forked adjacent to the periphery of the pulley  $m'$ , as shown in Fig. 3, so that in returning the bucket these diverging horizontal portions of the superstructure act as a means for centering the cable, and hence properly returning the bucket and gate to position, and the superstructure may be supported upon the ring  $d$ , as shown, or otherwise.

Referring particularly to Fig. 4, I prefer to employ a stuffing-box 38, which is placed upon the upper plate 6 of the elliptical casing in a position adjacent to one extremity of the minor axis of the said elliptical casing. A vertical shaft  $n$  passes through a stuffing-box 38, and the lower end of the shaft is secured in a block  $n'$ , revolvably mounted upon roller-bearings 39 within the elliptical casing. The stuffing-box is provided with a segmental arm 40, at the extremities of which are the stops 41 and 42. The shaft  $n$  is provided with an indicator-arm 43, whose hub 44 is keyed to the said shaft, and this indicator-arm is adapted to move over the upper surface of the segmental arm 40 and to contact with the said stops 41 and 42 at the extremities thereof, thereby limiting the revoluble movement of the said shaft  $n$ , which at its upper end and above the hub 44 of the indicator-arm 43 is provided with a gear 45, which is preferably secured to the shaft  $n$  by a key 46.  $r$  represents the lower gate, which is preferably so constructed as to have a depressed center whose diameter is approximately that of the interior of the cylindrical casing. At the upper side of the lower gate  $r$  is a peripheral flange 47, and the lower extremity of the section 4 of the cylindrical casing is provided with a suitable gasket 48. 49 represents a strap the respective ends of which are secured to the opposite sides of the block  $n'$  by means of bolts 50, which pass through the ends of the strap 49 and the said block  $n'$ , the strap 49 passing around the body portion of the lower gate  $r$ , beneath the peripheral flange 47, and maintained in position by a spacing-block 51, placed adjacent to the lower gate  $r$  and held in place by means of a bolt 52 passing through the said block 51, and both members of the strap  $r$  and the indicator-arm 43 is so placed on the shaft  $n$  as to be in line with the arms of the strap 49, so as to indicate the position of the



same, and consequently the lower gate *r* within the elliptical casing. In suitable positions the strap 49 is provided with lugs 53, in which are mounted arbors 54, carrying the rollers 55, adapted to bear against the upper surface of the elliptical plate 7 and to partially support the lower gate *r* and upon which the same is swung to and from its seated position within the elliptical casing.

56 (see Fig. 2) is a short auxiliary shaft mounted in suitable bearings 57, placed upon the upper surface of the elliptical plate 6. Upon one end of the shaft 56 is a sprocket 58, around which, together with the sprocket 26, mounted on the shaft *h*, a chain 59 passes, and on the opposite end of the shaft 56 a gear-wheel 60, meshing with the gear-wheel 45 on the shaft *n*, is fixed.

61 represents a valve which may be of any desired type, provided with a valve-rod 62 and hand-wheel 63 and communicating with the interior of the cylindrical casing by means of pipe connections 64 and with the interior of the elliptical casing by direct connection.

65 represents a suitable guard-rail structure mounted upon the upper surface of the plate 6, which, it will now be manifest, may be employed as a platform for the operating attendant, from which the various hand-wheels employed in the operation of the air-lock are easily within reach without necessitating the attendant changing his position.

In the operation of the apparatus, assuming that the bucket has been raised from the caisson to the air-lock, the lower gate is swung from the position shown in Fig. 2 to that indicated in Fig. 1 by means of turning the hand-wheel 27, which through the sprockets 26 58 and chain 59 turns the shaft 56, which in turn imparts a partial revolution to the shaft *n*, thereby causing the lower gate to swing, as indicated, upon the rollers 55 by the intervention of the strap 49 and the block *n'*, secured to the shaft *n*. After the lower gate has been brought to the position shown in Fig. 1 the hand-wheel 28 is turned in that direction, which will cause the screw-threaded end of the shaft *h* to withdraw the wedge-block *i* from the position shown in Figs. 1 and 6. Through this turning of the shaft *h* the ring-gear *f* will be actuated by means of the gear 29, thereby turning the gears on the arbors *h'* and simultaneously withdrawing all the other wedge-blocks *i'* and releasing the upper gate *l*, which then, with the bucket, may be raised by the cable 33 through the intervention of any suitable means, it being manifest that the moment the seal is broken between the gasket secured in the upper gate *l* and its seat the pressure within the caisson will cause the lower gate *r* to be forced against the gasket 48 in the lower extremity of the section 4, whereby the said lower gate is seated. Upon the bucket being emptied the same, with the upper gate, is returned to

the cylindrical casing of the air-lock and the hand-wheel 28 turned in the opposite direction, thereby forcing the wedge-blocks inward upon the periphery of the upper gate *l*, and thereby seating the same. After the upper gate *l* has been seated the valve 61 is opened to equalize the pressure between the caisson and the cylindrical portion of the air-lock. After this is done the turning of the hand-wheel 27 in the opposite direction will cause the lower gate *r* to be returned to the position indicated in Fig. 2, whereupon the bucket may be lowered into the caisson.

It will be understood that I do not limit myself to the precise means hereinbefore described for forcing the upper gate *l* against its seat and maintaining the same in position thereon, for it is obvious that other means may be employed without departing from the nature and spirit of my invention. One embodiment of such other means is illustrated in Fig. 8, wherein 66 represents a cylinder, 67 a piston provided with a head 68, adapted to engage the wedge-block *i*; 69 is the inlet and exhaust of the cylinder 68, which may be operated hydraulically or pneumatically, and 70 is a counterweight, to which at one end a rope or cable 71 is secured, is passed over the pulley 72 and secured at 73 or at any other convenient point to the piston 67 for the purpose of returning the piston to its normal position upon the release of the pressure within the cylinder, and thereby drawing back the wedge-block from contact with the periphery of the upper gate. It is also to be understood that the lower gate *r* is not rigidly fixed in that portion of the strap 49 surrounding it, but is merely mounted therein and carried thereby, there being sufficient play between these parts to permit of a slight vertical movement of the gate by the pressure in the caisson for the purpose of bringing the same to its seat, and, moreover, the depressed center of the lower gate forms a receptacle for any and all particles which may be dropped from the bucket while the same is in or being removed from the cylindrical casing.

I claim as my invention—

1. In an air-lock and in combination, a longitudinal casing, a transverse casing, an upper gate, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating said devices, a lower gate and means for swinging said lower gate to and from its seated position.

2. In an air-lock and in combination, a longitudinal casing, a transverse casing, an upper gate, a seat for the same, devices for forcing said upper gate on its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a lower gate, a seat for the same and means for swinging said lower gate within said transverse casing to and from its seated position.



3. In an air-lock and in combination, a longitudinal casing, a transverse casing, an upper gate, a seat for the same, devices for forcing said upper gate on its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a lower gate, a seat for the same, means for swinging said lower gate within said transverse casing to and from its seated position, and means for equalizing pressure in the air-lock and caisson.

4. In an air-lock and in combination, a longitudinal casing, a transverse casing, an upper gate, a door for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, means for simultaneously raising the upper gate with the removal of the bucket from the cylindrical casing, a lower gate, a seat for the same, and means for swinging said lower gate within the said transverse casing to and from its seated position.

5. In an air-lock and in combination, a longitudinal casing, a transverse casing, an upper gate, a door for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, means for simultaneously raising the upper gate with the removal of the bucket from the cylindrical casing, a lower gate, a seat for the same, means for swinging said lower gate within the said transverse casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.

6. In an air-lock and in combination, a longitudinal casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of the said longitudinal casing, devices for forcing the upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a lower gate, a seat for the same and means for swinging said lower gate within the elliptical casing to and from its seated position.

7. In an air-lock and in combination, a longitudinal casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of the said longitudinal casing, wedge-blocks for forcing said gate against its seat and holding the same in position thereon, means for simultaneously operating all of said wedge-blocks, a lower gate, a seat for the same and means for swinging said lower gate within the transverse casing to and from its seated position.

8. In an air-lock and in combination, a longitudinal cylindrical casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of the said cylindrical casing, wedge-blocks, a shaft, a bearing for the same, means actuated by the turning of said shaft for simultaneously operating said wedge-blocks, a lower gate, a seat for the same and means for swing-

ing said lower gate within the elliptical casing to and from its seated position.

9. In an air-lock and in combination, a longitudinal cylindrical casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of said cylindrical casing, brackets on the upper portion of the cylindrical casing, a shaft having a screw-threaded end, a bearing for said shaft supported by one of said brackets, a wedge-block engaged by the screw-threaded end of said shaft, a hand-wheel fixed on said shaft, other wedge-blocks at spaced-apart intervals around the upper portion of said cylindrical casing, means actuated by the turning of said shaft for operating all the said other wedge-blocks simultaneously with the one operated directly by the turning of said shaft, a lower gate, means for swinging said lower gate within the elliptical casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.

10. In an air-lock and in combination, a longitudinal cylindrical casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of said cylindrical casing, brackets on the upper portion of the cylindrical casing, a shaft having a screw-threaded end, a bearing for said shaft supported by one of said brackets, a wedge-block, a block set in said wedge-block and engaged by the screw-threaded end of said shaft, a hand-wheel fixed on said shaft, other wedge-blocks at spaced-apart intervals around the upper portion of said cylindrical casing, means actuated by the turning of said shaft for operating all of the said other wedge-blocks simultaneously with the one operated directly by the turning of said shaft, a lower gate, means for swinging said lower gate within the elliptical casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.

11. In an air-lock and in combination, a longitudinal cylindrical casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of said cylindrical casing, brackets on the upper portion of the cylindrical casing, a shaft having a screw-threaded end, a bearing for said shaft supported by one of said brackets, a wedge-block, a block set in said wedge-block and engaged by the screw-threaded end of said shaft, a hand-wheel fixed on said shaft, a gear on said shaft, a ring-gear meshing with said gear, other wedge-blocks at spaced-apart intervals around the upper portion of the cylindrical casing, means actuated by the turning of said ring-gear through the intervention of the said shaft and gear thereon for simultaneously operating all the said other wedge-blocks, a lower gate, a seat for the same, means for swinging said lower gate within the elliptical casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.

12. In an air-lock and in combination, a longitudinal cylindrical casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of said cylindrical casing, brackets on the upper portion of the cylindrical casing, a shaft having a screw-threaded end, a bearing for said shaft supported by one of said brackets, a wedge-block, a block set in said wedge-block and engaged by the screw-threaded end of said shaft, a hand-wheel fixed on said shaft, a gear on said shaft, a ring-gear meshing with said gear, other wedge-blocks at spaced-apart intervals around the upper portion of the cylindrical casing, means actuated by the turning of said ring-gear through the intervention of the said shaft and gear thereon for simultaneously operating all the said other wedge-blocks, a lower gate, a seat for the same, means for swinging said lower gate within the elliptical casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.



tical casing, an upper gate, a seat for the same at the top of said cylindrical casing, brackets on the upper portion of the cylindrical casing, a shaft having a screw-threaded end, a bearing for said shaft supported by one of said brackets, a wedge-block, a block set in said wedge-block and engaged by the screw-threaded end of said shaft, a hand-wheel fixed on said shaft, a gear on said shaft, a ring-gear meshing with said gear, other wedge-blocks at spaced-apart intervals around the upper portion of the cylindrical casing, an arbor for each of said other wedge-blocks, each arbor having a screw-threaded end engaging its wedge-block, a bearing for each of said arbors, a gear on each of said arbors meshing with the said ring-gear, a lower gate, a seat for the same, means for swinging said lower gate within the elliptical casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.

13. In an air-lock and in combination, a longitudinal, cylindrical casing, a transverse elliptical casing, an upper gate, a seat for the same at the top of said cylindrical casing, brackets on the upper portion of the cylindrical casing, a shaft having a screw-threaded end, a bearing for said shaft supported by one of said brackets, a wedge-block, a block set in said wedge-block and engaged by the screw-threaded end of said shaft, a hand-wheel fixed on said shaft, a sprocket loose on said shaft and a hand-wheel fixed on the hub of said sprocket, a gear on said shaft, a ring-gear meshing with said gear, a bearing for the ring-gear, other wedge-blocks at spaced-apart intervals around the upper portion of the cylindrical casing, an arbor for each of said other wedge-blocks, each arbor having a screw-threaded end engaging its wedge-block, a bearing for each of said arbors, a gear on each of said arbors meshing with the said ring-gear, a lower gate, a seat for the same, means for swinging said lower gate within the elliptical casing to and from its seated position, and means for equalizing the pressure in the air-lock and caisson.

14. In an air-lock and in combination, a cylindrical casing, an upper gate, a seat for the same, means for forcing said upper gate against its seat and holding the same in position thereon, means for raising said upper gate at the same time and by the same operation that removes the bucket from the cylindrical casing, a lower gate, means for swinging said lower gate to and from its seated position, and means for equalizing the pressure in the cylindrical casing, and caisson.

15. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a transverse elliptical casing, a lower gate, a seat for the

same, a block revolubly mounted within the said elliptical casing, a connection between the said block and the said lower gate, and means for turning said block to swing the said lower gate to and from its seated position within the elliptical casing.

16. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a transverse elliptical casing, a lower gate, a seat for the same, a block revolubly mounted within the said elliptical casing, a connection between the said block and the said lower gate, means for turning said block to swing the said lower gate to and from its seated position within the elliptical casing, and means for indicating the position of said lower gate within the elliptical casing.

17. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a transverse elliptical casing, a lower gate, a seat for the same, a block revolubly mounted within the elliptical casing, a strap passing around the said gate and having its ends secured to the opposite sides of said block, rollers, bearings for the same secured to said strap, a block extending between the respective members of said strap adjacent to the said lower gate, means for turning said block to swing the lower gate to and from its seated position within the elliptical casing, and means for indicating the position of the lower gate within the elliptical casing.

18. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a transverse elliptical casing, a lower gate, a seat for the same, a block revolubly mounted within the elliptical casing, a strap passing around the said gate and having its ends secured to the opposite sides of said block, rollers, bearings for the same secured to said strap, a spacing-block extending between the respective members of said strap adjacent to the said lower gate, a shaft passing into the said transverse casing and having its end secured within said block, means for imparting a partial revolution to said shaft to turn said block and thereby swing the lower gate to and from its seated position within the elliptical casing, and means for indicating the position of the lower gate within the elliptical casing.

19. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said up-



per gate against its seat and holding the same in position thereon, means simultaneously operating all of said devices, a transverse elliptical casing, a lower gate, a seat for the same, a block revolubly mounted within the elliptical casing, a strap passing around the said gate and having its ends secured to the opposite sides of said block, rollers, bearings for the same secured to said strap, a spacing-block extending between the respective members of said strap adjacent to the said lower gate, a shaft passing into the said transverse casing and having its ends secured within said block, a stop-block, an arm fixed on said shaft for indicating the position of the lower gate within the transverse casing, and means for imparting a partial revolution to the said shaft to swing the lower gate to and from its seated position within the elliptical casing.

20. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, means for simultaneously operating all of said devices, a transverse elliptical casing, a lower gate, a seat for the same, a block revolubly mounted within the elliptical casing, a strap passing around the said gate and having its ends secured to the opposite sides of said block, rollers, bearings for the same secured to said strap, a spacing-block extending between the respective members of said strap adjacent to the said lower gate, a shaft passing into the said transverse casing and having its end secured within said block, a stop-block, an arm fixed on said shaft for indicating the position of the lower gate within the transverse casing, a gear fixed on said shaft, an auxiliary shaft, bearings for the same mounted on the upper surface of said transverse casing, a gear on said auxiliary shaft meshing with the aforesaid gear, and means for turning said auxiliary shaft to impart a partial revolution to the said shaft to swing the lower gate to and from its seated position within the elliptical casing.

21. In an air-lock and in combination, a longitudinal cylindrical casing, an upper gate, a seat for the same, devices for forcing said upper gate against its seat and holding the same in position thereon, a shaft, a bearing for the same, a hand-wheel fixed on said shaft, a sprocket loose on said shaft, a hand-wheel fixed on the hub of said sprocket, means for operating all of said devices simultaneously by the turning of said shaft, a transverse casing, a lower gate, a seat for the same, a block revolubly mounted in said elliptical casing, a strap passing around said lower gate and having its respective ends secured to opposite sides of said block, a spacing-block extending between the respective members of the said strap adjacent to said lower gate, rollers, bearings for the same secured to said strap, a shaft passing into the said transverse casing and having one end se-

cured within the said block, a stop-block, an indicating-arm secured to the last aforesaid shaft, a gear also secured to this shaft, an auxiliary shaft, bearings for the same, a gear mounted on said auxiliary shaft and meshing with the aforesaid gear, a sprocket on said auxiliary shaft, a chain passing around this sprocket and also the said sprocket mounted loosely on the first aforesaid shaft, and means for equalizing the pressure within the cylindrical casing and caisson.

22. In an air-lock and in combination, a cylindrical casing composed of a plurality of sections, an upper gate, a seat for the same on the top of the upper section of said cylindrical casing, means for seating and unseating said gate, an elliptical plate having an opening therein and adapted to fit over the lower end of one of the sections of said cylindrical casing, a second elliptical plate having a similar and corresponding opening therein adapted to fit over the upper end of another of the sections of said cylindrical casing, an elliptical peripheral spacing member intervening between the said elliptical plates, a lower gate, means for swinging said lower gate within the casing formed by said elliptical plates and intervening member, and means for equalizing the pressure in the cylindrical casing and caisson.

23. In an air-lock and in combination, a cylindrical casing composed of a plurality of sections, an upper gate, a seat for the same on the top of the upper section of said cylindrical casing, means for seating and unseating said gate, an elliptical plate having an opening therein and adapted to fit over the lower end of one of the sections of said cylindrical casing, a second elliptical plate having a similar and corresponding opening therein adapted to fit over the upper end of another of the sections of said cylindrical casing, an elliptical peripheral spacing member intervening between the said elliptical plates, a lower gate, a gasket set in the lower end of that section of the cylindrical casing around which the first aforesaid elliptical plate fits and forming a seat for the said lower gate, means for swinging said lower gate within the casing formed by said elliptical plates and intervening member, and means for equalizing the pressure in the cylindrical casing and caisson.

24. In an air-lock and in combination, a longitudinal casing, a casing in a plane at right angles to the longitudinal casing or transversely thereof, a gate within said transverse casing movable in a plane at right angles to the longitudinal casing, means for moving said gate to and from its seated position, a second gate at a point spaced apart from the aforesaid gate, a seat for the same, and means for actuating said second gate.

25. In an air-lock and in combination, a longitudinal casing, a casing in a plane at right angles to the longitudinal casing or trans-



versely thereof, a gate within said transverse casing movable in a plane at right angles to the longitudinal casing, means for moving said gate to and from its seated position, a second gate at a point spaced apart from the afore-  
5 said gate, a seat for the same, means for actuating said second gate, and means for equalizing pressure in the air-lock and caisson.

26. In an air-lock and in combination, a longitudinal cylindrical casing, an elliptical casing transversely thereof and in a plane at right angles thereto, a gate within said transverse elliptical casing, a seat for the same, a block  
5 revolubly mounted in the said elliptical casing, a connection between the said block and the said gate, means for turning said block to swing said gate to and from its seated position within the elliptical casing, a second gate, a seat for the same, and devices for operating  
the second gate.

27. In an air-lock, and in combination, a longitudinal cylindrical casing, an elliptical casing transversely thereof and in a plane at right angles thereto, a gate within said transverse elliptical casing, a seat for the same, a block  
25 revolubly mounted in the said elliptical casing, a connection between the said block and the said gate, means for turning said block to swing said gate to and from its seated position within the elliptical casing, means for indicating  
30 the position of the said gate within the elliptical casing, a second gate, a seat for the same and devices for operating the second gate.

Signed by me this 17th day of November, 1904.

CESARE CAMPUS.

Witnesses:

GEO. T. PINCKNEY,  
S. T. HAVILAND.