

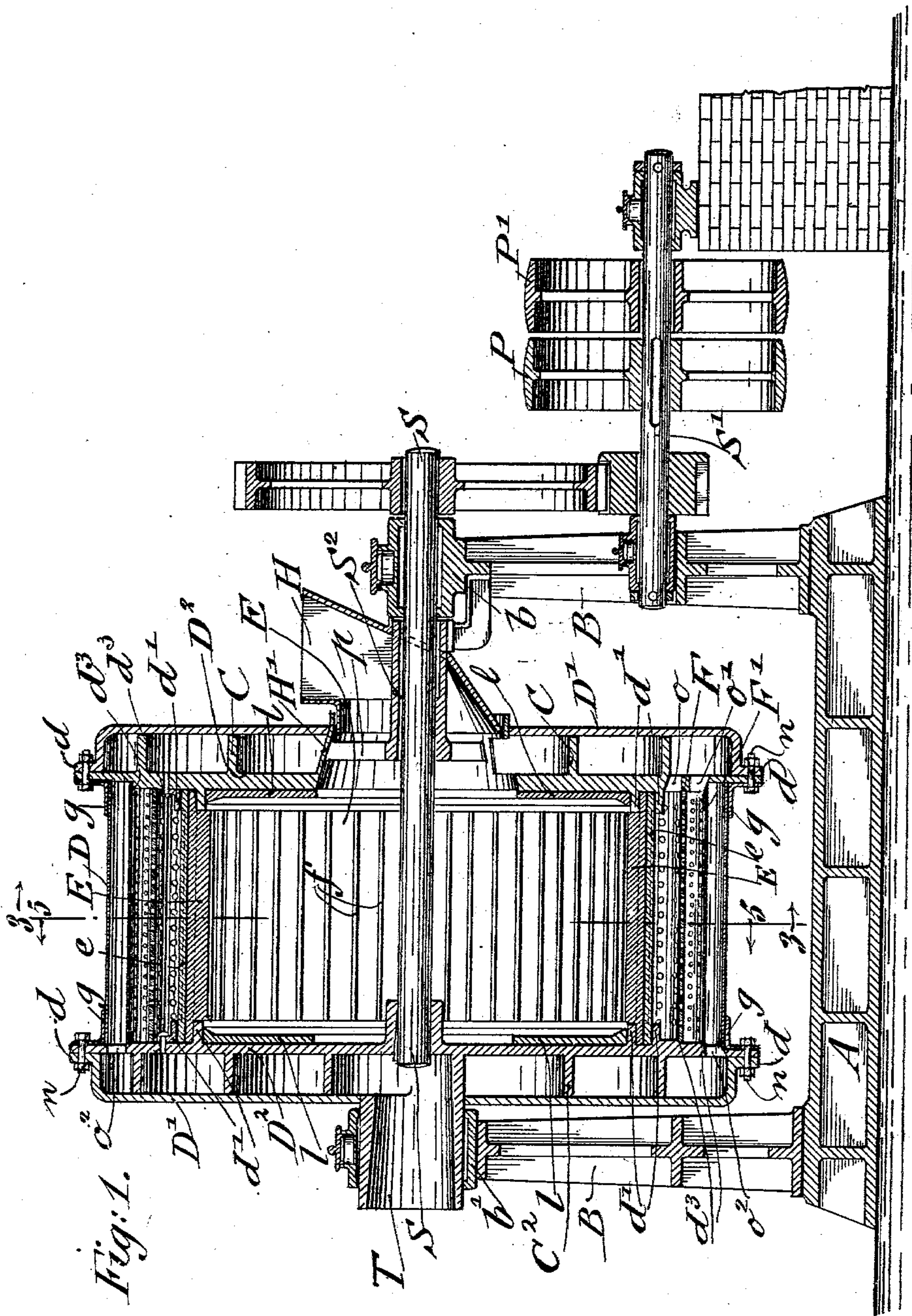
No. 743,791.

PATENTED NOV. 10, 1903.

M. F. ABBE.
BALL GRINDING MILL.
APPLICATION FILED APR. 11, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



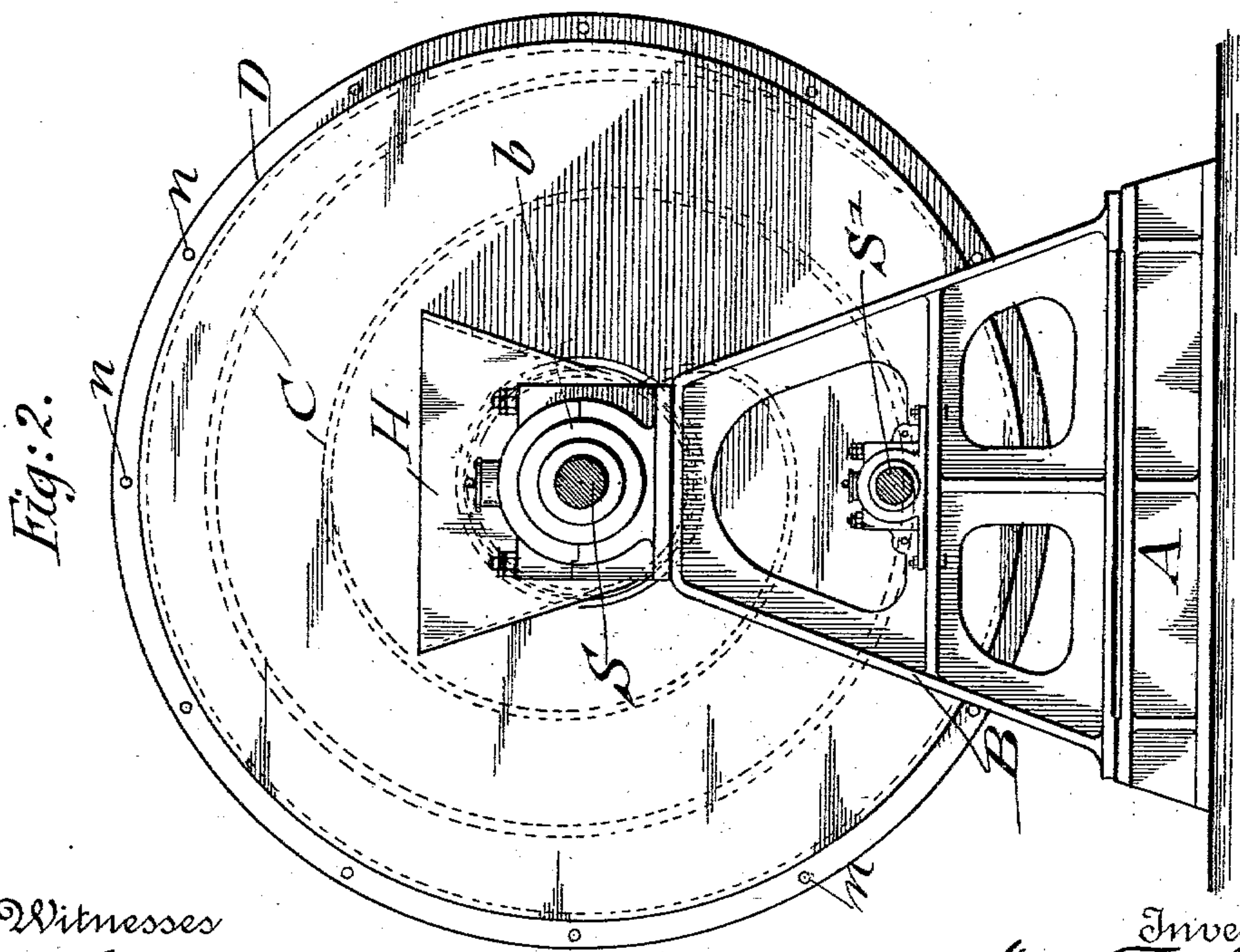
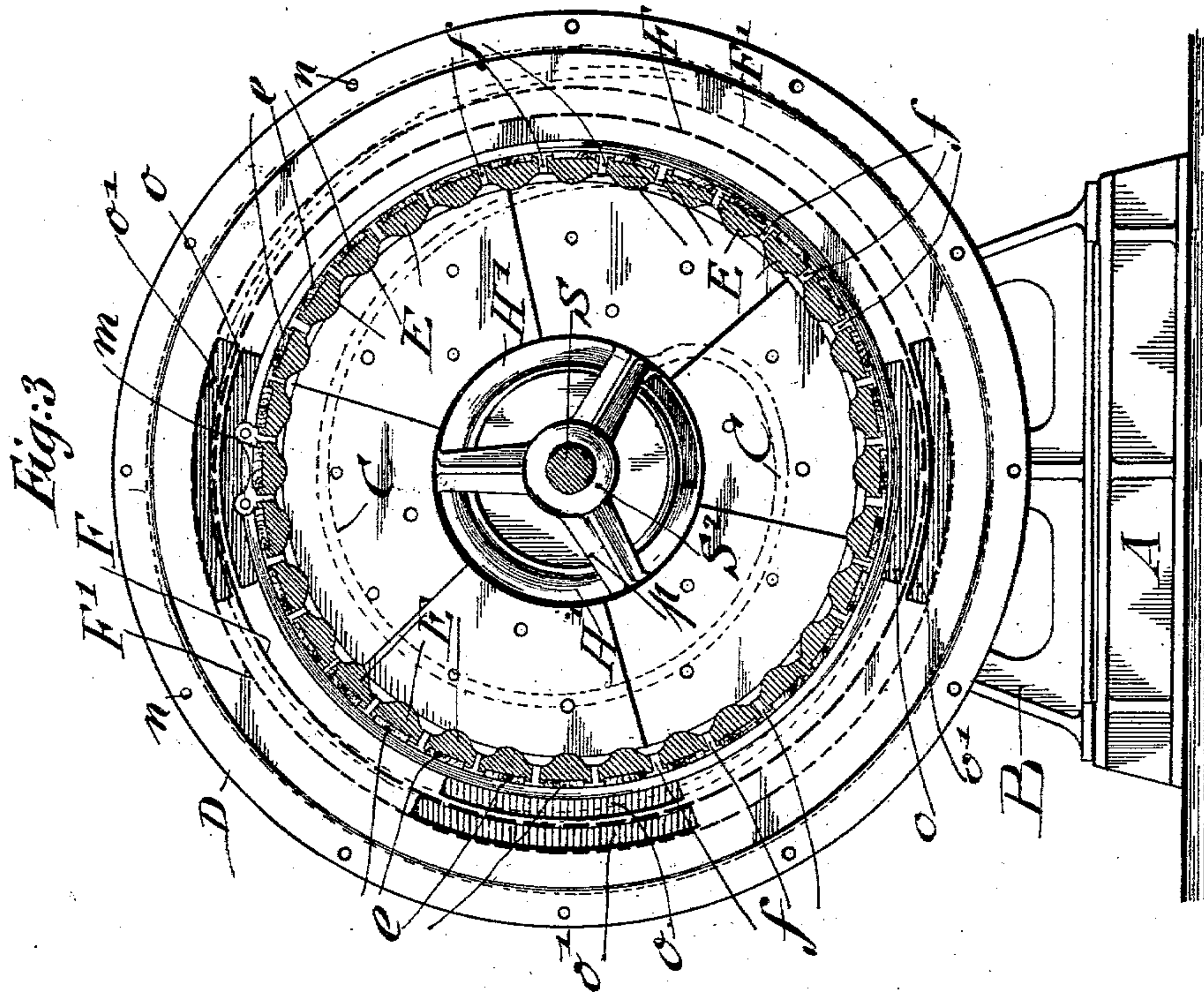
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NO MODEL.

3 SHEETS—SHEET 2.



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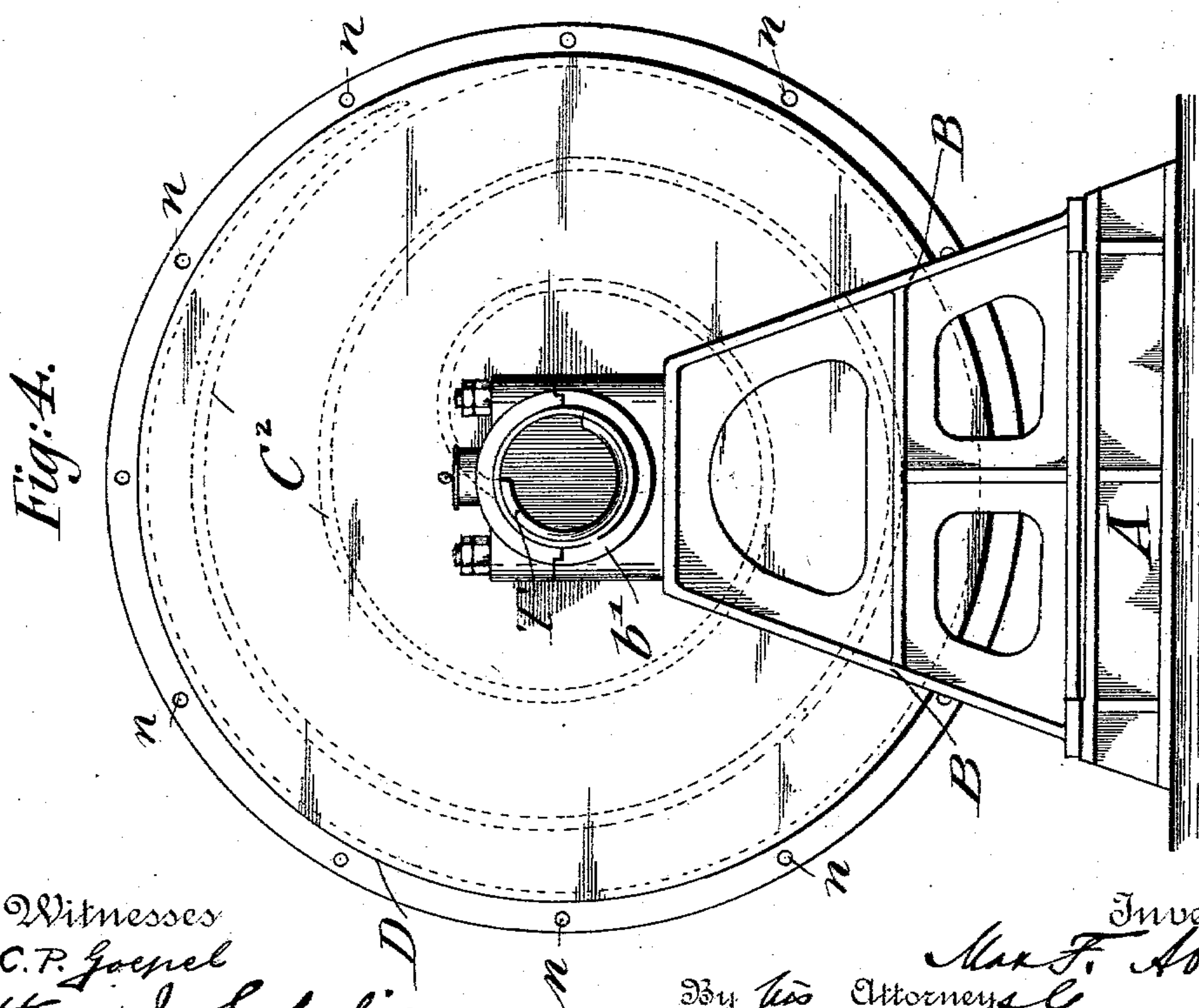
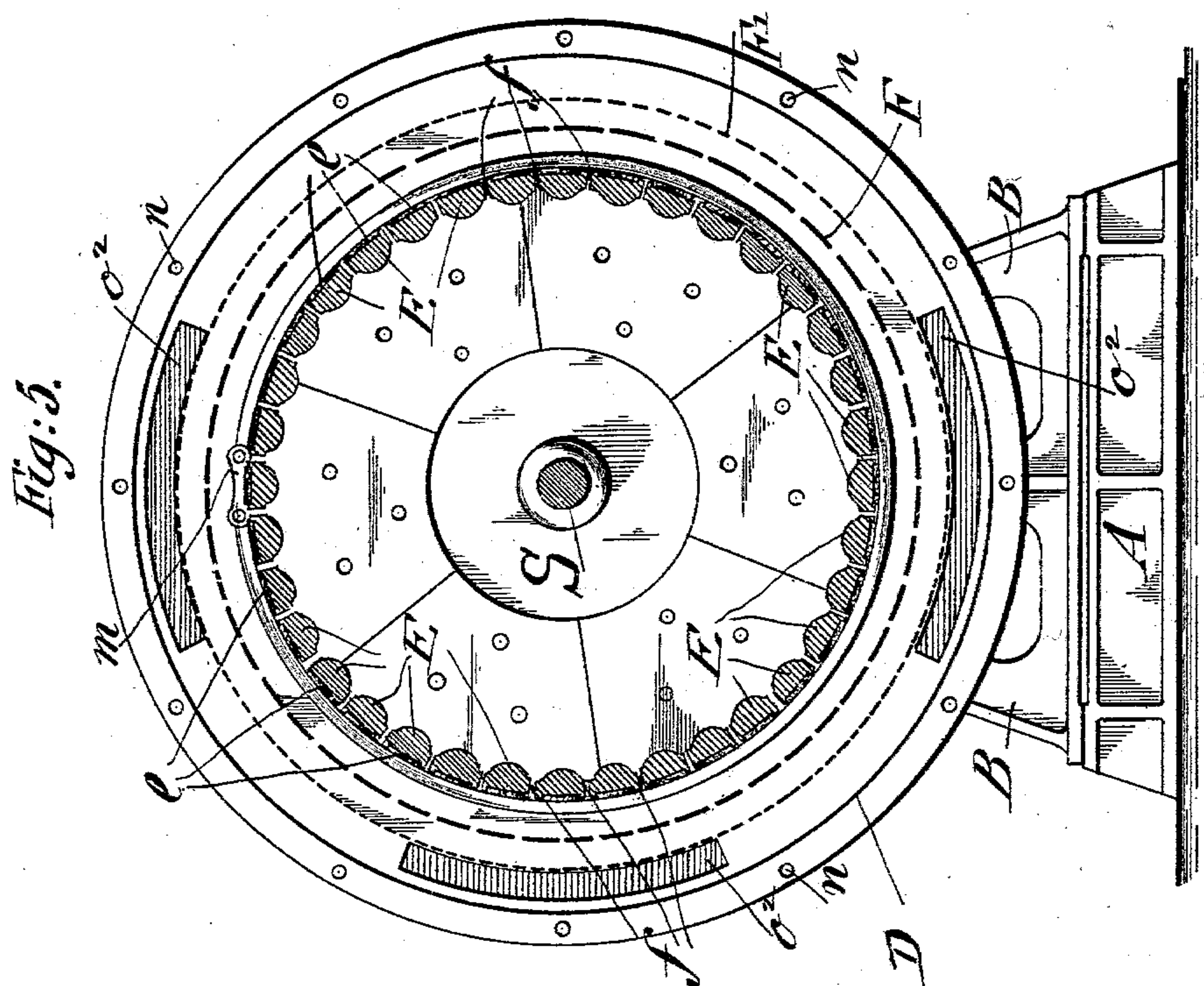
M. F. ABBÉ.

BALL GRINDING MILL.

APPLICATION FILED APR. 11, 1903.

NO MODEL.

3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

MAX F. ABBÉ, OF NEW YORK, N. Y.

BALL GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 743,791, dated November 10, 1903.

Application filed April 11, 1903. Serial No. 152,137. (No model.)

To all whom it may concern:

Be it known that I, MAX F. ABBÉ, a citizen of the United States, residing in New York, borough of Manhattan, and State of New York, have invented certain new and useful Improvements in Ball Grinding-Mills, of which the following is a specification.

This invention relates to improvements in ball grinding-mills in which the coarser particles which cannot pass through the concentric screens of the mill are returned to the feed-entrance of the drum by a spiral conveyor in the head of the drum, so as to be subjected again to the grinding action of the balls until the parts are fine enough to pass through the concentric screen and then out at the opposite end of the mill through a spiral conveyor to the delivery end of the mill.

For this purpose the invention consists of a ball grinding-mill, which comprises a rotary drum provided with interior convex bars having wooden cushions and passages between said bars and cushions, screens concentric with the drum, said screens being of coarser and finer mesh, openings in the feed-end head of the drum for delivering the coarser particles not passing through the screens by a spiral conveyor again to the feed-entrance of the drum, openings in the discharge-end head of the drum, and a spiral conveyor for conducting the ground material which passed through the screens to the discharge end of the mill; and the invention consists of certain details of construction and combinations of parts, which will be fully described hereinafter, and finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section through my improved ball grinding-mill. Fig. 2 is an end elevation of the ingoing end of the mill. Fig. 3 is a vertical transverse section on line 3 3, Fig. 1, taken in the direction of the arrows 3 3. Fig. 4 is an elevation of the mill taken from the discharge end of the same; and Fig. 5 is a vertical transverse section also on line 3 3, Fig. 1, but taken in the direction of the arrows 5 5.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the bed-plate of my improved ball grinding-mill, and B the upright standards supported on the

same. The standard B at the feed end is provided with a journal-bearing *b* for the shaft S of the grinding-mill and the standard B at the discharge end of the mill with a bearing *b'* for the discharge-trunnion T of the mill. To the shaft S is keyed a drum, which is composed of a cylinder D, which is provided with heads *D*² and with heads *D'* exterior to and at some distance from the cylinder-heads *D*². Between the heads *D*² of the cylinder and head *D'* of the drum are arranged spiral conveyers C and C². The flanges *d* of the exterior heads *D'* are fastened by bolts *n* to the cylinder-heads *D*², and the cylinder D is fastened to the cylinder-heads *D*² by angle-irons *g*. The cylinder-heads *D*² are provided with interiorly-extending flanges *d'*, forming annular grooves, in which are fastened transverse steel bars E, having interior convex faces and having wooden transverse cushions *e*. The cushions *e* take up to a considerable extent the pounding action of the grinding-balls and of the falling material, and so insure a high efficiency and long life to the mill. The bars E, with the cushions *e*, are so arranged as to leave between each individual bar an outwardly-flaring interstice or slot *f* to permit the passage of the ground material through the same. These slots *f* are preferable to holes, which easily clog, while the slots cannot clog, as the same are of larger size at their outer circumference than at their inner. The convex bars E form a wave-shaped circumference at the interior of the mill, over which the grinding-balls roll as the mill is turned for grinding the material. As these bars E fit into the turned grooves between the flanges *d'*, the bolting of the bars to the cylinder-heads *D*² is avoided. These flanges *d'*, forming the annular grooves, are interrupted at a point of their circumference equal to a space corresponding to the width of one of the bars E, so as to permit the insertion and removal of the individual bars. When all the bars E, with the cushions *e*, have been inserted, the opening is closed by a cap *m*.

The cylinder-heads *D*² are provided with an interior steel lining *l*.

The feed-end exterior cover *D'*, cylinder-head *D*², and the lining *l* are each provided with a central opening, which is lined with a conically-flaring feed-ring *H'*, into which the

lower end of the stationary hopper H terminates. The feed-ring H' is provided with radial spokes *p*, which support the same and connect it with the sleeve S². Motion is imparted to the driving-shaft S by a suitable mechanical transmission, as gearing, which is connected with the counter-shaft S', provided with fast and loose pulleys P P' and a suitable power-belt.

The material to be ground passes from the feed-hopper H through the feed-ring H' to the interior of the drum, where it is subjected to the grinding action of the balls passing over the cushioned bars E. The ground material is conducted through the outwardly-tapering slots *f* between the individual cushion-bars E to a coarse screen F concentric with the drum. The ground particles, passing through coarse-meshed screens F, are discharged through the same to a second screen F' of finer mesh, which is also concentric with the drum. The coarse particles which cannot pass through the screens F are conducted in lateral direction to the side openings *o* in the feed-end cylinder-head D² and conducted by the spiral conveyor C, located between the cylinder-head D² and the exterior head D', back to the conical feed-ring H' and from the same again into the drum, while the somewhat smaller particles which passed through the screen F, but are too coarse to pass through the screen F' of somewhat finer mesh, are conducted in lateral direction to the side openings *o'* in the feed-end cylinder-head D² and conducted by the spiral conveyor C back to the conical feed-ring H' and from the same into the drum. The screens are preferably inclined from the discharge end to the face end of the mill, so that the inclination facilitates the return of the coarser particles through the openings *o* and *o'* to the spiral conveyor C. The screens are supported on shoulders *d*³ of the cylinder-heads D² and are arranged in position without being interrupted by cross-bars used in the grinding-mills heretofore to deliver the larger particles to the mill again. The finer particles which have passed through the fine-meshed screen F' are collected in the cylinder, which is made of sheet metal and which has preferably a slight inclination from the feed end toward the discharge end of the mill. The discharge-end cylinder-head D² is provided with discharge-openings *o*², through which the ground material is discharged to a spiral conveyor C², which is arranged between the exterior head D' and the cylinder-head D² of the mill, as shown clearly in Fig. 1. The spiral conveyor C² connects at its inner end with an opening in the tubular trunnion T, provided with a conical interior, which discharges the ground material to a suitable conveyor or to vessels placed underneath the same. By the return of the coarser particles through the spiral conveyor at the feed-end cylinder and the discharge of the finely-ground particles through the spiral conveyor at the dis-

charge or delivery head of the cylinder to the discharge-trunnion of the same the mill can be supported close to its bed without being elevated to any great extent for leaving the discharge end free, as was necessary heretofore, while at the same time the grinding of the material is accomplished in a uniform and effective manner by the use of the spiral conveyers, as described.

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

1. A ball grinding-mill, comprising a drum composed of a cylinder having heads, and provided with heads exterior to and at some distance from the cylinder-heads, a hopper in the feed-end heads of the cylinder, a plurality of transverse steel bars arranged between the heads of the cylinder concentric to the cylinder, screens between the bars and the cylinder, openings in the feed-end head of the cylinder at the inner side of the screens, a spiral conveyor between the feed-end cylinder-head and exterior head, openings in the discharge-end head between the outer screen and cylinder, a spiral conveyor between the discharge-end cylinder and exterior heads, and means for discharging the ground material at the inner end of the discharge-end spiral conveyor, substantially as set forth.

2. A ball grinding-mill, consisting of a drum composed of a cylinder provided with heads having interiorly-extending flanges forming annular grooves, and heads exterior to and at some distance from the heads of the cylinder, spiral conveyers between the cylinder-heads and the exterior heads, steel bars having convex faces arranged in said annular grooves, concentric screens of gradually-decreasing mesh encircling said bars, a stationary feed-hopper at the feed end of the mill, openings in the feed-end head of the cylinder between the steel bars and the screen, and between the screens themselves, openings in the discharge-end cylinder-head between the outer screen and the cylinder, and a discharge-trunnion at the discharge end of the mill, substantially as set forth.

3. A ball grinding-mill, consisting of a drum composed of a cylinder provided with heads, having interiorly-extending flanges forming annular grooves, and heads exterior to and at some distance from the cylinder-heads, spiral conveyers between the cylinder-heads and the exterior heads, steel bars having convex faces arranged in said annular grooves, a steel lining at the interior sides of the cylinder-heads, screens concentric to said bars, a supply-hopper at the feed end of the mill, slots between the bars larger at their outer ends than at their inner, openings in the feed-end cylinder-head between the steel bars and the screens and between the screens themselves, openings in the discharge-end cylinder-head between the outer screen and the

cylinder, and a tubular trunnion at the discharge end of the mill, substantially as set forth.

4. A ball grinding-mill, consisting of a drum
5 composed of a cylinder provided with heads,
having interiorly - extending flanges, and
heads exterior to and at some distance from
the cylinder-heads, steel bars arranged be-
tween the flanges, one next to the other and
10 provided with cushions, concentric screens
of gradually-decreasing mesh encircling said
bars, a stationary feed-hopper at the feed end
of the mill, openings in the feed-end cylin-
der-head between the bars and the screen,
15 and between the screens themselves, a spiral
conveyer between the feed-end cylinder-head
and the feed-end exterior head, openings in
the discharge-end cylinder-head between the
outer screen and the cylinder, a spiral con-
20 veyer between the discharge-end cylinder-
head and the discharge-end exterior head, and
a tubular trunnion for discharging the mate-
rial passing from the spiral conveyer into the
same, substantially as set forth.

25 5. A ball grinding-mill, consisting of a cyl-
inder provided with heads having exteriorly-
extending flanges, and heads exterior to and
at some distance from the cylinder-heads,
steel bars between said flanges, screens of
30 gradually-increasing mesh concentric to said
bars, a sleeve at the feed end of the mill pro-

vided with radial spokes, a conically-flaring
feed-ring supported by said spokes and joined
to the feed-end cylinder-head, a stationary
hopper terminating in said feed-ring, open- 35
ings in the feed-end cylinder-head between
the bars and the adjacent screen, and be-
tween the screens themselves, a conveyer be-
tween the feed-end cylinder-head and the
feed-end exterior head, openings in the dis- 40
charge-end cylinder-head and the discharge-
end exterior head, and a tubular trunnion
for discharging the material fed into the same
by the discharge-end spiral conveyer, sub-
stantially as set forth. 45

6. In a ball grinding-mill, consisting of a
cylinder having steel-lined heads, and heads
exterior to the cylinder and at some distance
from the same, transverse steel bars having
convex faces arranged concentrically to said 50
cylinder between the heads of the cylinder,
and wooden cushions for said bars, which are
arranged one next to the other, so as to leave
outwardly-flaring slots between the same, sub-
stantially as set forth. 55

In testimony that I claim the foregoing as
my invention I have signed my name in pres-
ence of two subscribing witnesses.

MAX F. ABBÉ.

Witnesses:

PAUL GOEPEL,
HENRY J. SUHRBIER.