No. 622,915. Patented Apr. 11, 1899.

W. F. DAVIS & T. CASCADEN, JR.

GRINDING MILL.

(Application filed Nov. 25, 1898.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

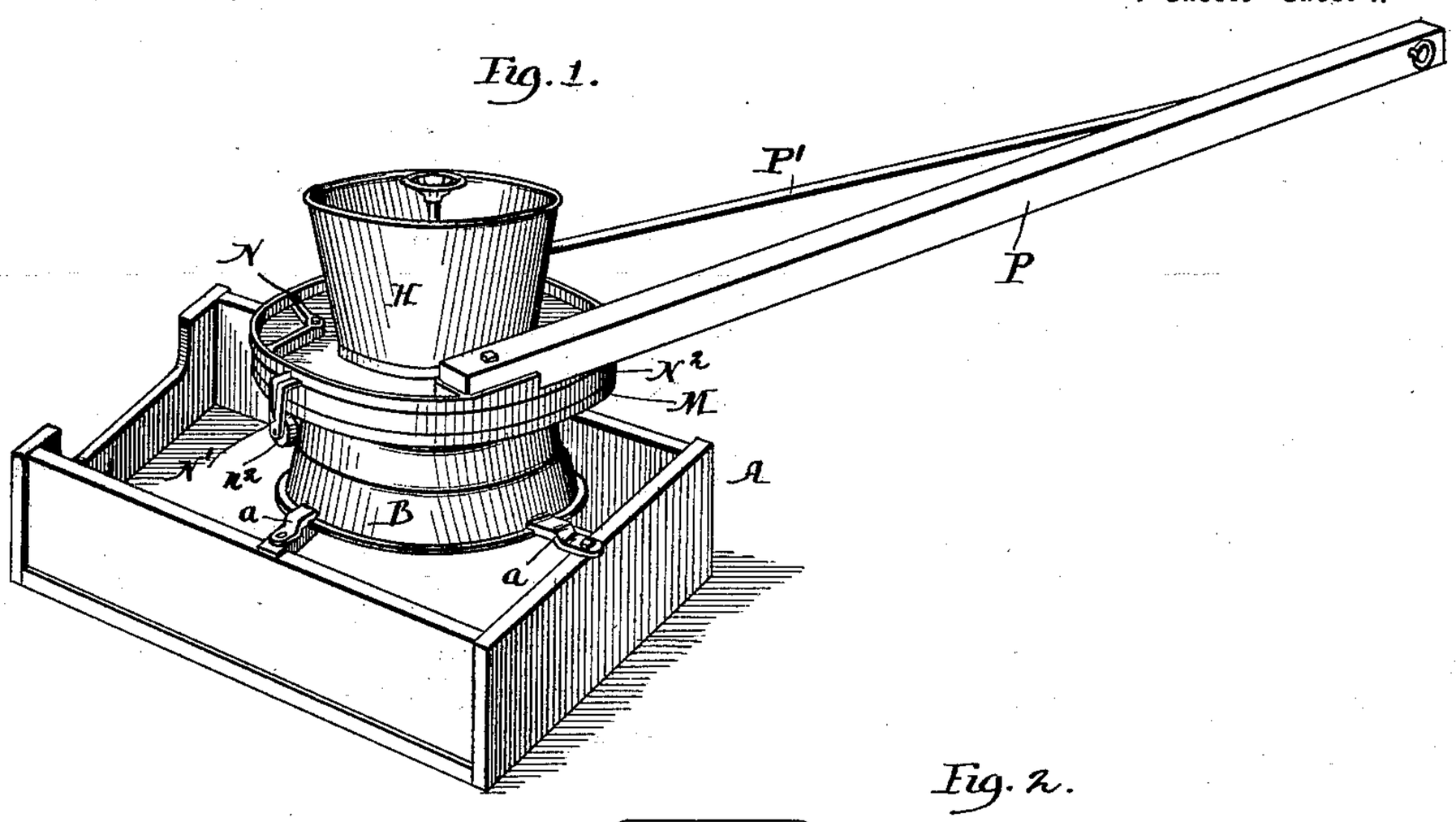
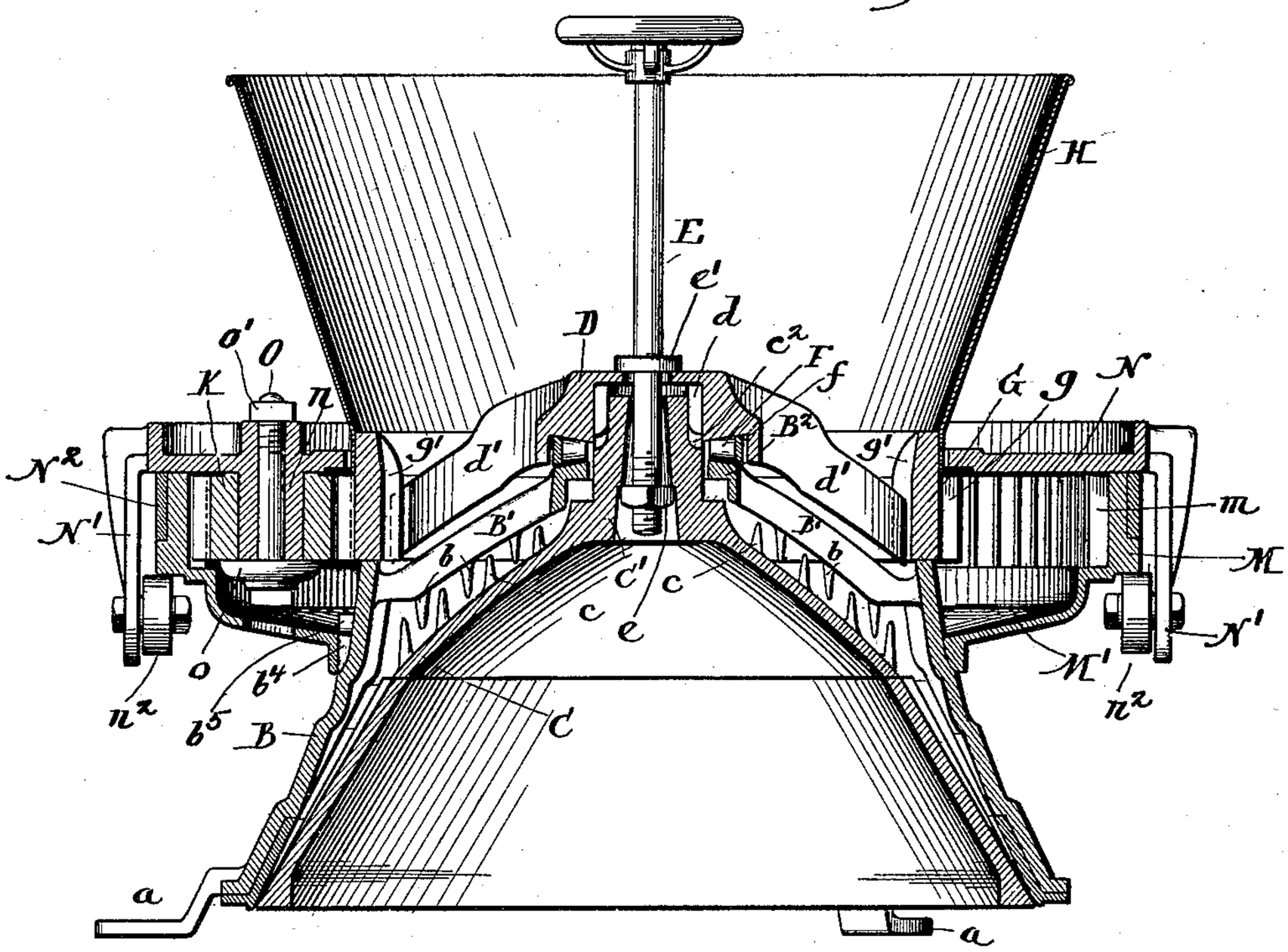


Fig. 2.



Witnesses:
Fred Gerlach
Alberta Adamick

Inventors:
W. F. Davis & T. Cascaden Jr.
By Prin & Fisher
Attorneys.

No. 622,915. Patented Apr. 11, 1899.

W. F. DAVIS & T. CASCADEN, JR.

GRINDING MILL.

(No Model.) (Application filed Nov. 25, 1898.) 4 Sheets—Sheet 2.

Fig. 3.

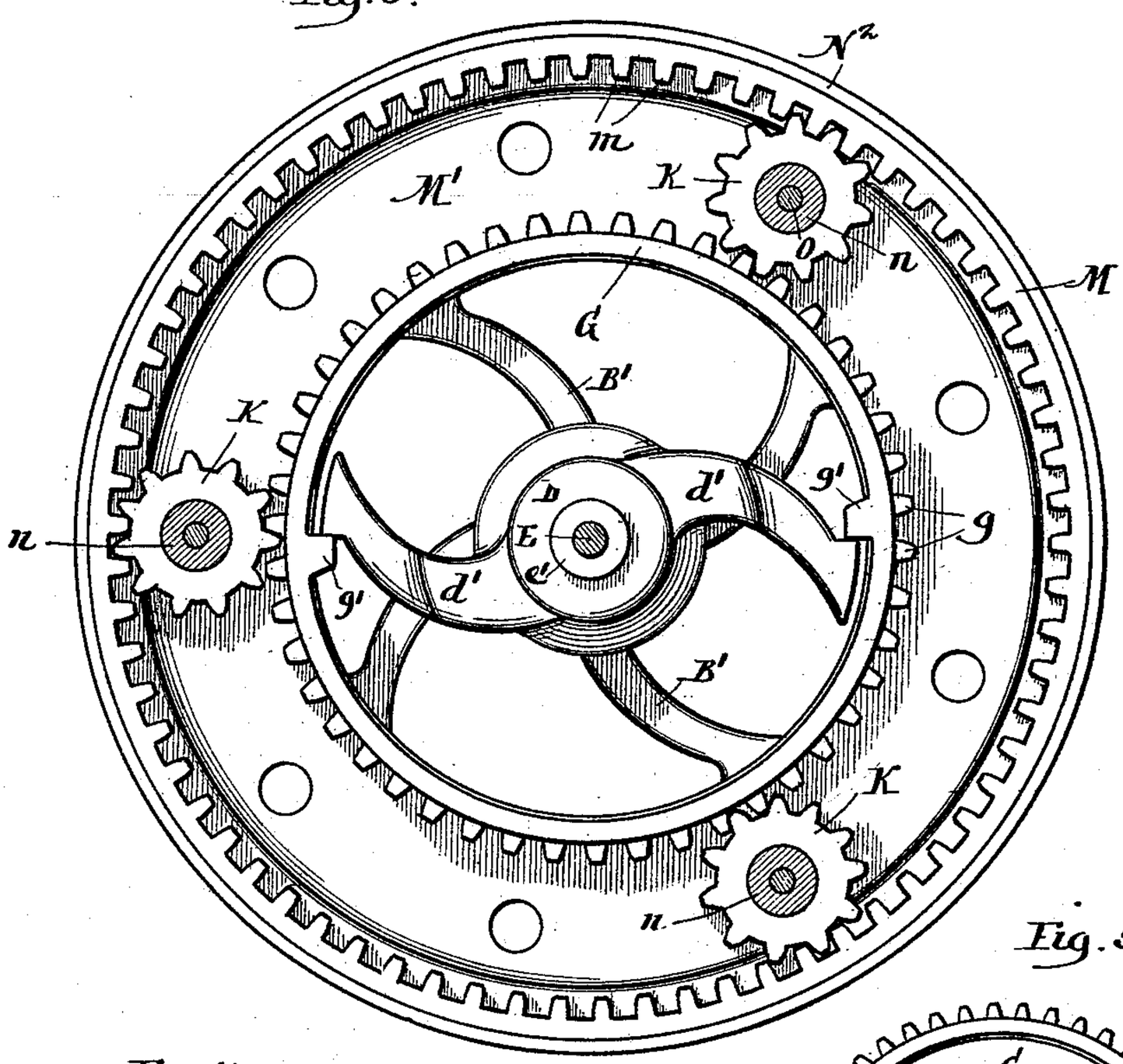


Fig. 5.

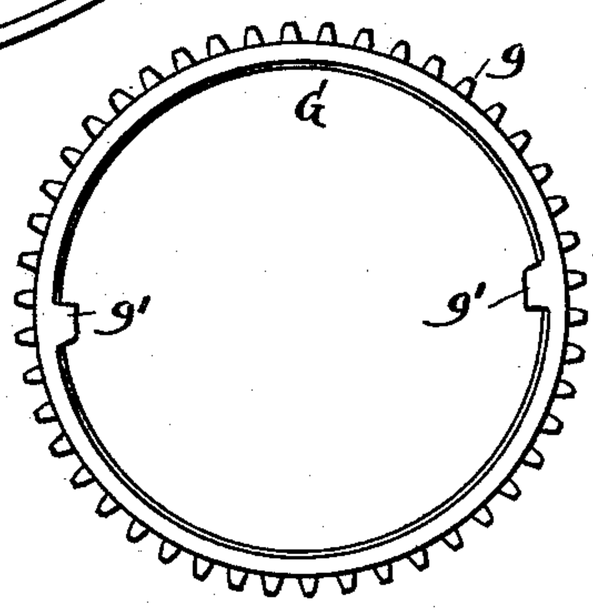


Fig. 4.

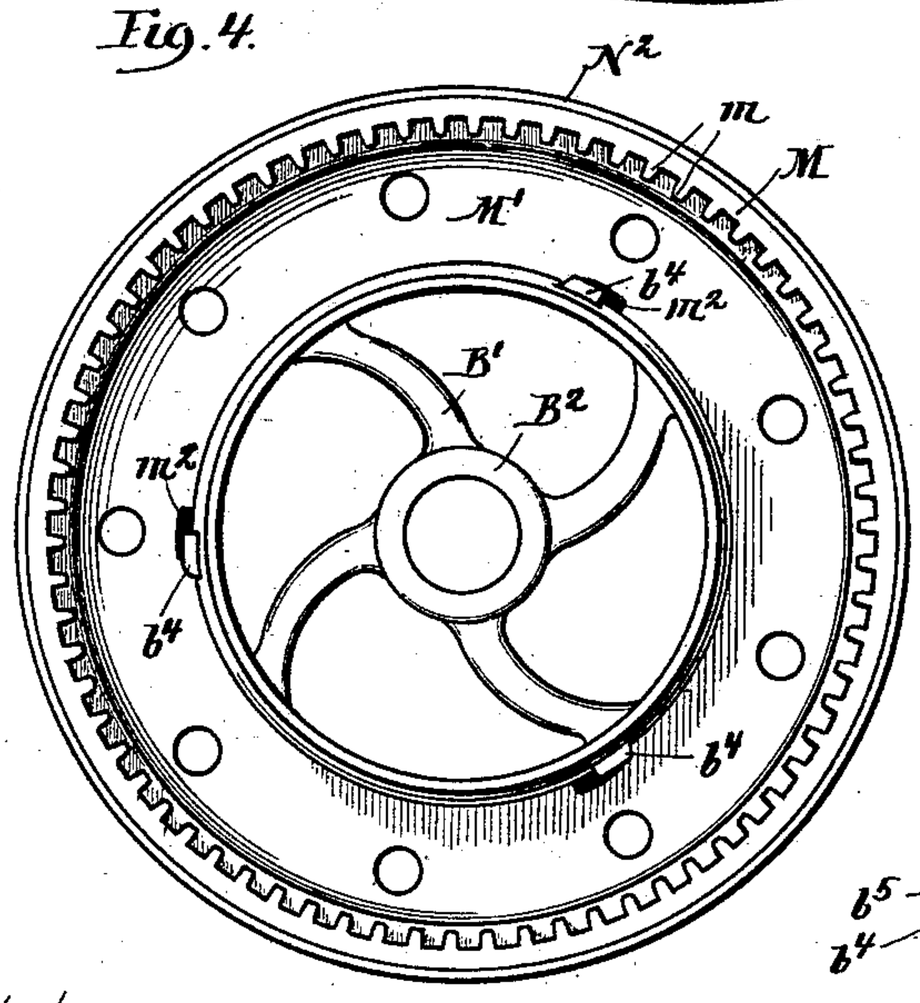
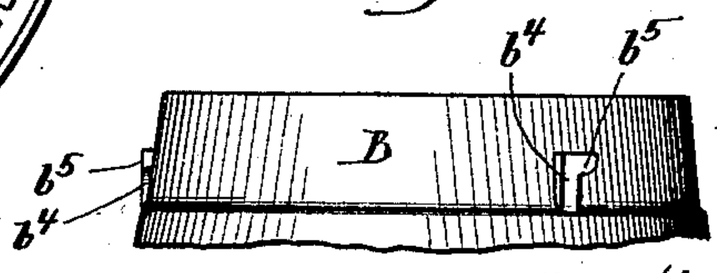


Fig. 6.



Witnesses:
Fred Gerlach
Alberta Adamick

Inventors:
W. F. Davis and T. Cascaden Jr.
By Rice & Fisher
Attorneys.

No. 622,915. Patented Apr. 11, 1899.

W. F. DAVIS & T. CASCADEN, JR.

GRINDING MILL.

(Application filed Nov. 25, 1898.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 8.

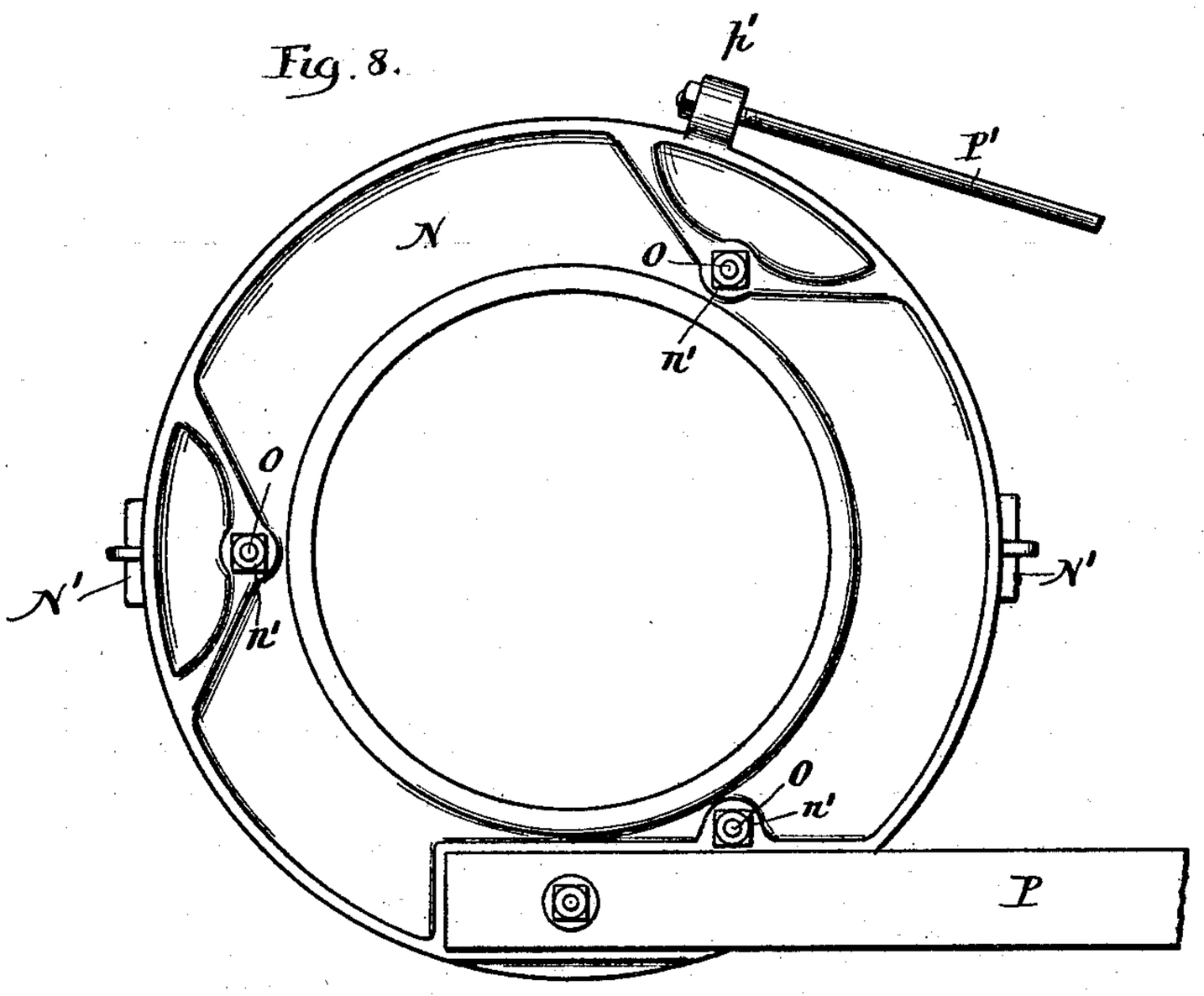
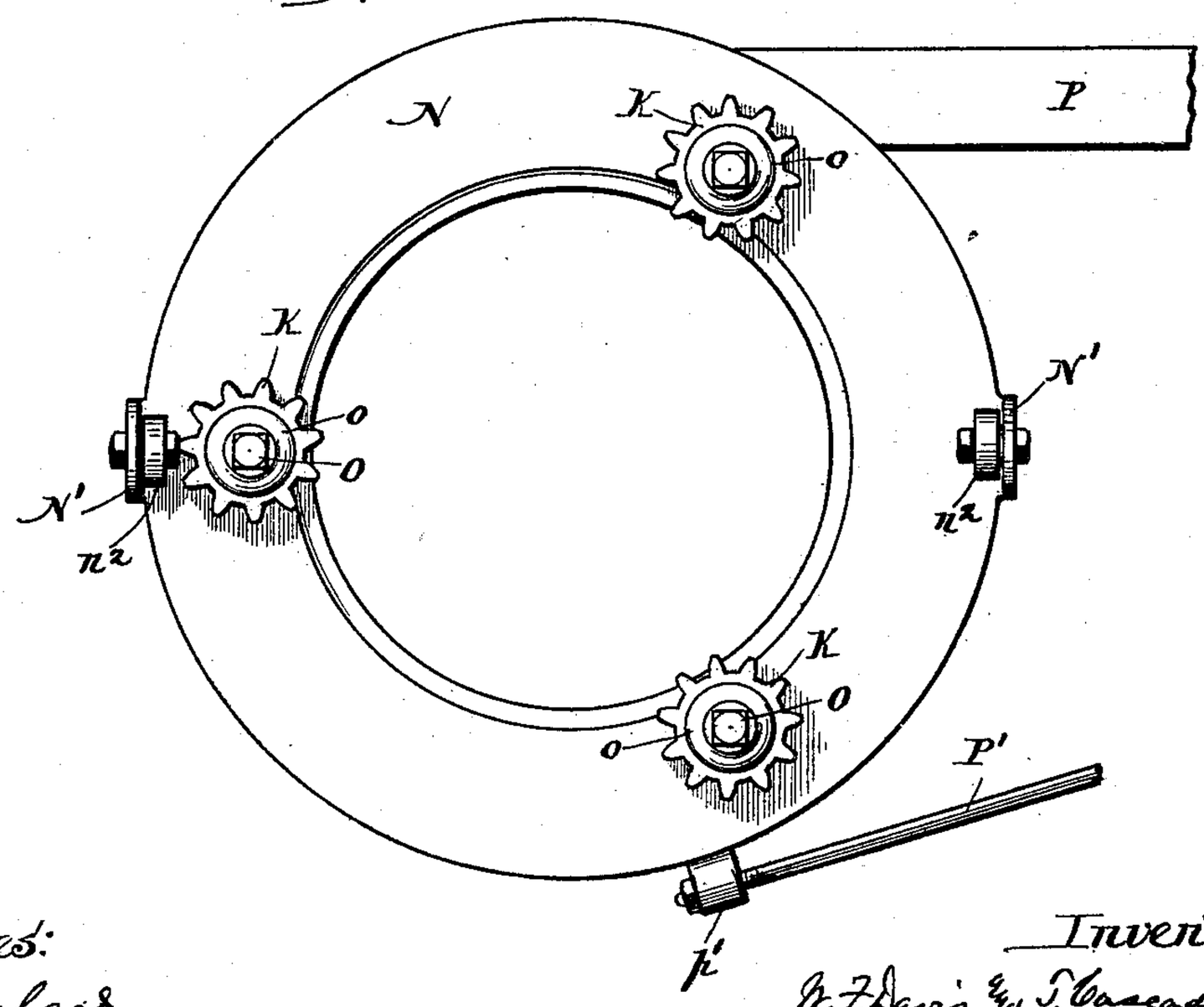


Fig. 7.



Witnesses:
Fred Gulack
Alberta Adamick

Inventors:
W. F. Davis & T. Cascaden Jr.
By Penn & Fisher
Attorneys.

No. 622,915. Patented Apr. 11, 1899.

W. F. DAVIS & T. CASCADEN, JR.

GRINDING MILL.

(Application filed Nov. 25, 1898.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 9.

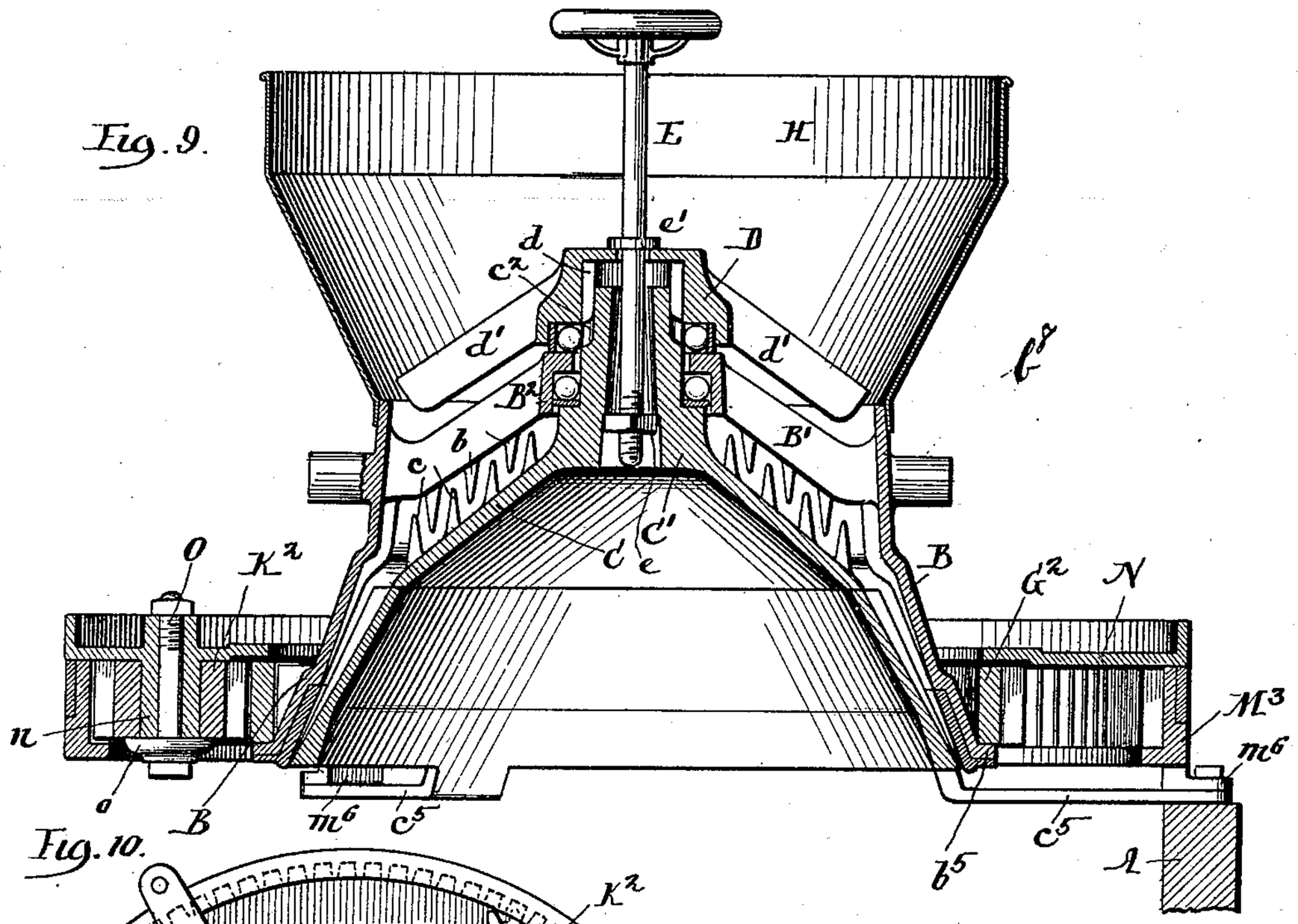


Fig. 10.

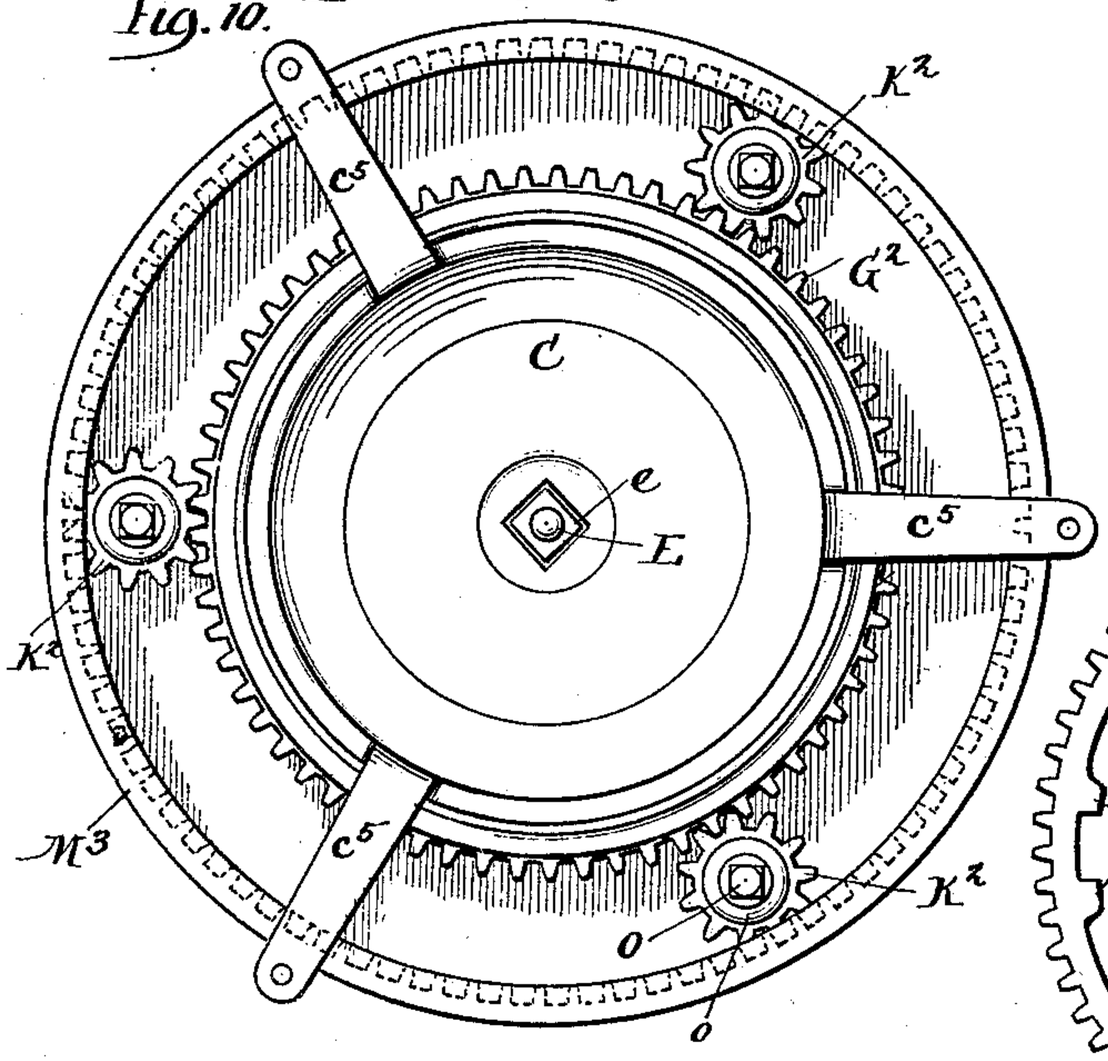
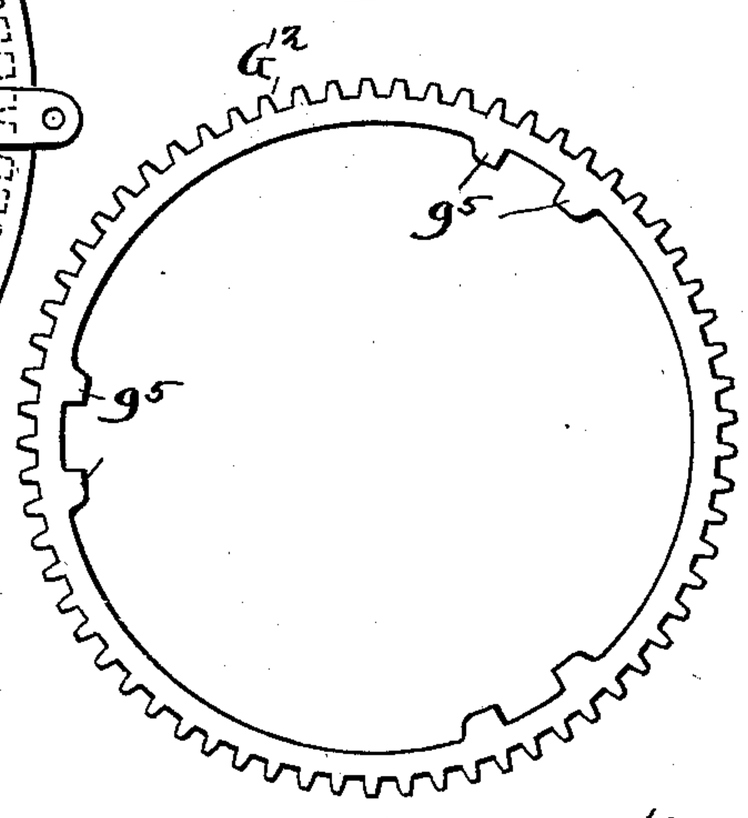


Fig. 11.



Witnesses:
Fred Gerlach
Alberta Adamcak

Inventors
W. F. Davis & T. Cascaden Jr.
By Prindle & Fisher
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM F. DAVIS AND THOMAS CASCADEN, JR., OF WATERLOO, IOWA, ASSIGNORS TO THE DAVIS GASOLINE ENGINE WORKS COMPANY, OF SAME PLACE.

GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 622,915, dated April 11, 1899.

Application filed November 25, 1898. Serial No. 697,382. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM F. DAVIS and THOMAS CASCADEN, Jr., residents of Waterloo, in the county of Black Hawk, State of Iowa, have invented certain new and useful Improvements in Grinding-Mills, of which we do declare the following to be a full, clear, and exact description.

This invention relates more particularly to the class of grinding-mills that are adapted more particularly for the grinding of corn or other grain to be used as food for stock. In this class of feed-mills there is employed at least one pair of grinders, one of these grinders being stationary, while the other is revoluble, and motion is usually imparted to the revoluble grinder by means of a sweep, to which one or more draft-horses are attached. In order to impart an increased speed of revolution to the revoluble grinder or grinders, it has been heretofore proposed to employ multiplying-gear of various kinds, one familiar type of such gear being what is commonly known in the art as an "orbital" gear.

The invention has for one of its objects to provide a multiplying-gearing for grinding-mills that can be formed separate from the mill and readily attached thereto, and this object the invention accomplishes by providing a gearing comprising annular racks formed separate from but adapted to encircle the mill in combination with orbitally-movable pinions arranged between the racks and provided with suitable means whereby the pinions can be driven.

A further object of the invention is to provide a multiplying-gearing comprising annular racks and interposed orbitally-movable pinions, the movable rack being so connected with the revoluble grinder that such grinder can move in vertical direction during the grinding operation independently of the movable rack.

A further object of the invention is to provide a feed-mill with an improved construction of multiplying-gear, whereby greater speed may be imparted to the revoluble grinder of the mill, and this object is accomplished by forming the gear of two annular racks with intermediate orbitally-movable pinions, the stationary rack being of larger diameter and having a greater number of teeth than the movable rack and being arranged to encircle said movable rack.

Figure 1 is a perspective view of the sweep-mill embodying the invention. Fig. 2 is a view in central vertical section through a mill having the invention applied thereto. Fig. 3 is a plan view with the hopper and pinion-supporting ring removed, the journals of the pinions being shown in section. Fig. 4 is a detail plan view, upon a reduced scale, of the outer annular rack in position upon the outer shell. Fig. 5 is a detail plan view of the inner annular rack. Fig. 6 is a detail view, in side elevation, of the upper part of the outer shell of the mill. Fig. 7 is an inverted plan view of the ring whereby the pinions are supported. Fig. 8 is a plan view of the ring shown in Fig. 7. Fig. 9 is a view in central vertical section through a mill embodying a modified form of the invention. Fig. 10 is an inverted plan view, upon a reduced scale, of the mill shown in Fig. 9. Fig. 11 is a detail plan view of the inner annular rack shown in Figs. 9 and 10.

Grinding-mills of this character are usually mounted upon a suitable box A, and, as shown, the shell that carries the stationary grinder is sustained upon the box by suitable feet *a*. In the form of the invention illustrated in Figs. 1 to 8 of the drawings the outer shell B of the mill is stationary, while the inner shell C is revoluble. The outer shell B is provided upon its inner face with a suitable grinding-surface, and a corresponding grinding-surface is formed upon the outer face of the base portion of the inner shell C. The upper portion of the inner shell or cone C is furnished with suitable crushing-teeth *c*, that coöperate with corresponding teeth *b*, projecting downward from the arms B′, that extend between the top of the outer shell B and the hub B^2, whereby such shell is sustained. This hub B^2 encircles the central post C′, that rises from the top of the inner shell or cone C. The construction of the grinding-surfaces between the outer and inner shells B and C will be readily understood by those familiar with this class of mills and need not be particularly de-

scribed, as it forms no part of the present invention.

The upper part of the cone-post C′ is formed with vertical grooves c^2, (see Figs. 2 and 4,) adapted to receive corresponding lugs d, projecting inward from the hub D of the cob-breaker, and from this hub D extend the radial arms d', as clearly shown in Figs. 2 and 3 of the drawings. Through the cone-post C′ extends the temper-screw E, upon the lower end of which is fitted a threaded nut e, and a fixed collar e' on the screw E bears against the inwardly-extending portion of the cob-breaker hub D. Between the hub D of the cob-breaker and the hub B^2 beneath it are interposed suitable roller-bearings F of conical shape and held in place by an encircling ring f, as shown in Fig. 2.

Upon the upper edge of the outer shell B rests the inner annular rack G, having gear-teeth g upon its outer surface and having its inner surface provided with lugs g', adapted to be engaged by the arms d' of the cob-breaker. To the upper part of the annular rack is suitably connected the lower end of the hopper H, into which the grain to be ground will be placed. With the teeth g of the inner annular rack G mesh the teeth of the pinions K, and these pinions also engage the teeth m of the outer annular rack M. Preferably the outer annular rack M has cast integral therewith an annular depending part M′, that extends inward and bears against the outer shell B, and in order to securely retain the outer annular rack in position the shell B is formed with lugs b^4, that enter corresponding openings m^2, (see Fig. 4,) formed in the edge of the depending portion M′. The lugs b^4 are preferably formed with the offset portions b^5, (see Fig. 6,) so that after the depending part M′ is set over the lugs b^4 and given a partial turn the offset portion b^5 of the lug b^4 will interlock the part M′ with the outer shell and prevent its accidental movement.

The pinions K are mounted upon the under side of an annular plate or ring N, that is preferably cast with axles n for the pinions, and the pinions are retained in place upon the axles n by the washers o at the lower ends of the screw-rods O, the upper threaded ends of these rods being provided with nuts o', that bear against the raised portions of the axles n. As shown, the annular plate or ring N is provided with depending arms N′, carrying rollers n^2, that travel beneath the lower edge of the outer annular rack M and prevent the lifting of the plate N. Preferably also the outer annular rack M is encircled by a wrought-iron band N^2, that serves to strengthen the rack. To the plate N will be connected the usual sweep P and stay-rod P′, (see Figs. 7 and 8,) and preferably the upper face of the plate N is formed with a socket to receive the inner end of the sweep P and with the perforated offset lug p', to which the inner end of the stay-rod P′ will be fastened.

From the foregoing description it will be seen that when revolution is imparted by the sweep P to the annular plate N a corresponding motion of translation will be imparted to the pinions K, and inasmuch as these pinions mesh with the teeth of the inner rack G and with the teeth of the fixed outer rack M an increased speed of revolution will be given to the inner rack, because of the motion of translation of the pinions K and because of the revolution of these pinions as they travel around the outer rack. If the racks G and M were of like diameter, the speed of the rack G would obviously be twice that of the rack M; but inasmuch as the rack M is of considerably greater diameter than the rack G it follows that the speed of revolution of the rack G will be correspondingly increased. As the rack G by its lug g' engages with the arms d' of the cob-breaker, it will be seen that revolution will be imparted from the rack and through the cob-breaker to the inner shell C and the grinding-surface carried thereby. It will thus be seen that each revolution of the sweep P serves to effect more than two revolutions of the inner shell C and of the movable grinding-surface.

There are numerous other advantages incident to the present invention when adopted as an entirety, and it will be obvious that certain of these advantages may be attained when corresponding features only of the invention are employed. Thus it will be seen that the parts are of simple construction, can be easily put together, and that relative movements of the inner and outer grinders will not affect the action of the gearing. Again, the arrangement of the gearing with inner and outer racks and intermediate pinions insures the accurate centering of the racks by the pinions and the maintenance of the parts in proper relative position during the operation of the mill.

It is manifest that features of the invention may be employed without its adoption as an entirety and that modifications may be made within wide limits without departing from the spirit of the invention. Thus, for example, in Figs. 9 to 11 of the drawings one simple modification of the invention is illustrated. In this form of the invention the inner shell C is stationary, being provided with suitable feet c^5, whereby the mill will be supported. Upon the central post C′ of the inner shell or cone C is supported the hub D of the cob-breaker, as in the construction hereinbefore described, this hub being provided with a series of radial arms d'. The lower portion of the cone-post C′ is encircled by the hub B^2 of the outer shell or grinder B, the outer shell being connected to the hub B^2 by the arms B′. In this form of the invention the outer shell B is revoluble and at its base is preferably formed with a flange b^5, whereon rests the in-

ner rack G^2, this rack being provided with lugs g^5, that engage corresponding lugs formed upon the outer surface of the shell B adjacent its base. Outside the inner rovoluble rack G^2 is placed the outer stationary rack M^3, and with the teeth of the inner and outer racks G^2 and M^3 engage the teeth of the pinions K^2, that are carried by the annular plate N. The plate N is similar in construction to the annular plate hereinbefore described, and the pinions K^2 are supported thereby, as in the hereinbefore-described form of the invention. The plate N will be furnished with suitable means for convenient attachment thereto of a sweep and stay-rod, as hereinbefore set forth. The annular rack M^3 is provided with feet m^6, that rest upon and are bolted to the outwardly-projecting feet c^5 of the inner shell. The hopper H in the form of the invention illustrated in Fig. 9 is attached to the top of the outer shell B. In this last-described embodiment of the invention when revolution is imparted to the annular plate N increased speed of revolution will be transmitted from said plate by the pinions K to the inner annular rack G^2 and to the revoluble shell B.

One advantage incident to the present invention is that it can be readily applied to ordinary sweep-mills, it being simply necessary to locate the inner and outer racks G^2 and M^3, the plate N, and the pinions about the base of the mill. If for any reason it is desired to use the mill last described as a plain sweep-mill, these parts can be removed and the sweep can be attached in the usual manner to the offset lugs b^8 of the outer shell B.

It is believed that this invention presents the first instance of a grinding-mill having annular rack-bars formed separate from the inner and outer shells of the mill and adapted to be connected therewith, and it is to be understood, therefore, that the invention is not intended to be restricted to the precise details of construction hereinbefore set forth, since obviously these may be modified by the skilled mechanic without departure from the spirit of the invention.

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

1. A multiplying-gearing for feed-mills comprising two annular racks formed separate from and adapted to encircle the mill in combination with orbitally-movable pinions arranged between the racks and provided with suitable means whereby the pinions can be driven.

2. A multiplying-gearing for feed-mills comprising a revoluble spokeless inner annular rack, an outer stationary annular rack encircling both the body of the mill and the inner rack, and a revoluble ring or support provided with a plurality of pinions in fixed relation upon said ring or support and serving to center the inner rack.

3. The combination with the body of a grinding-mill provided with inner and outer grinders, one of which is revolubly mounted with respect to the other, of driving mechanism comprising annular racks, one stationary and the other revoluble, and encircling the mill, and interposed orbitally-movable pinions, the revoluble rack being so connected with the revoluble grinder that such grinder can move in vertical direction during the grinding operation independently of the revoluble rack.

4. The combination with the body of a grinding-mill provided with inner and outer grinders, one of which is revolubly mounted with respect to the other, of driving mechanism comprising two annular spokeless racks encircling the mill, one stationary and the other revoluble, the stationary rack having a greater number of teeth than the revoluble rack and orbitally-movable pinions interposed between said racks.

5. The combination with the body of a grinding-mill provided with inner and outer grinders, one of which is revolubly mounted with respect to the other, of driving mechanism comprising an inner annular rack and an outer annular rack that encircles both the body of the mill and the inner rack, a revoluble ring or support provided with a plurality of pinions that are interposed between said inner and outer racks, and suitable means for imparting revolution to said pinion support or ring.

6. The combination with the body of a grinding-mill provided with an inner and an outer grinder, one of which is revolubly mounted with respect to the other, of driving mechanism comprising an inner annular rack, an outer annular rack encircling both the body of the mill and the inner rack, and a revoluble ring or support provided with a plurality of pinions that are interposed between said inner and outer racks, said ring or support being mounted above the racks and means connected to said ring or support for imparting revolution thereto.

7. The combination with the body of a grinding-mill comprising an inner and an outer grinder, one of which is revolubly mounted with respect to the other, of driving mechanism comprising an inner annular rack, an outer annular rack encircling the body of the mill and the inner rack, a revoluble ring or support provided with at least three pinions interposed between said inner and outer racks and serving to center the inner rack and suitable means for imparting revolution to said pinion support or ring.

8. The combination with the body of a grinding-mill comprising an inner and an outer grinder, one of which is revolubly mounted with respect to the other, of driving mechanism comprising an inner annular rack, an outer annular rack encircling the body of the mill and the inner rack, a revoluble ring

or support provided with a plurality of pinions interposed between said inner and outer racks and provided with depending arms having rollers adapted to engage the stationary rack or part and prevent the lifting of the pinion support or ring.

9. The combination with the body of a grinding-mill comprising an inner and an outer grinder, one of which is revolubly mounted with respect to the other, of driving mechanism comprising an inner annular rack, an outer annular rack encircling the body of the mill and the inner rack, a revoluble ring or support provided with a plurality of pinions interposed between said inner and outer racks, said ring or support being horizontally arranged above the racks and being provided with means for attachment thereto of a sweep whereby revolution may be imparted to said pinion support or ring.

10. A grinding-mill comprising an inner revoluble shell or cone having a post at its top, an outer shell encircling said inner shell and centered around said cone-post, a cob-breaker connected to said cone-post and having one or more arms extending therefrom, an inner annular rack detachably engaging said cob-breaker, an outer rack encircling said inner rack, and a revoluble ring or support provided with pinions arranged between said inner and outer racks.

WILLIAM F. DAVIS.
THOMAS CASCADEN, JR.

Witnesses:
JOS. L. LEAVITT,
W. C. LOGAN.