

No. 730,355.

PATENTED JUNE 9, 1903.

H. EHRHARDT.  
PROCESS OF MANUFACTURING WHEELS.  
APPLICATION FILED SEPT. 8, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

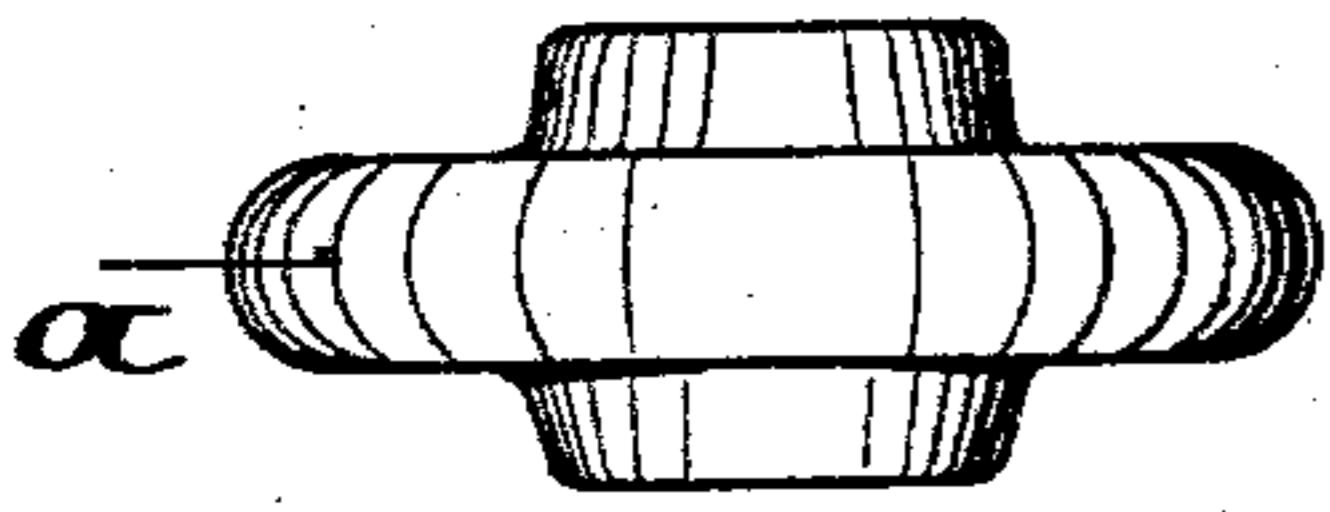


Fig. 1.

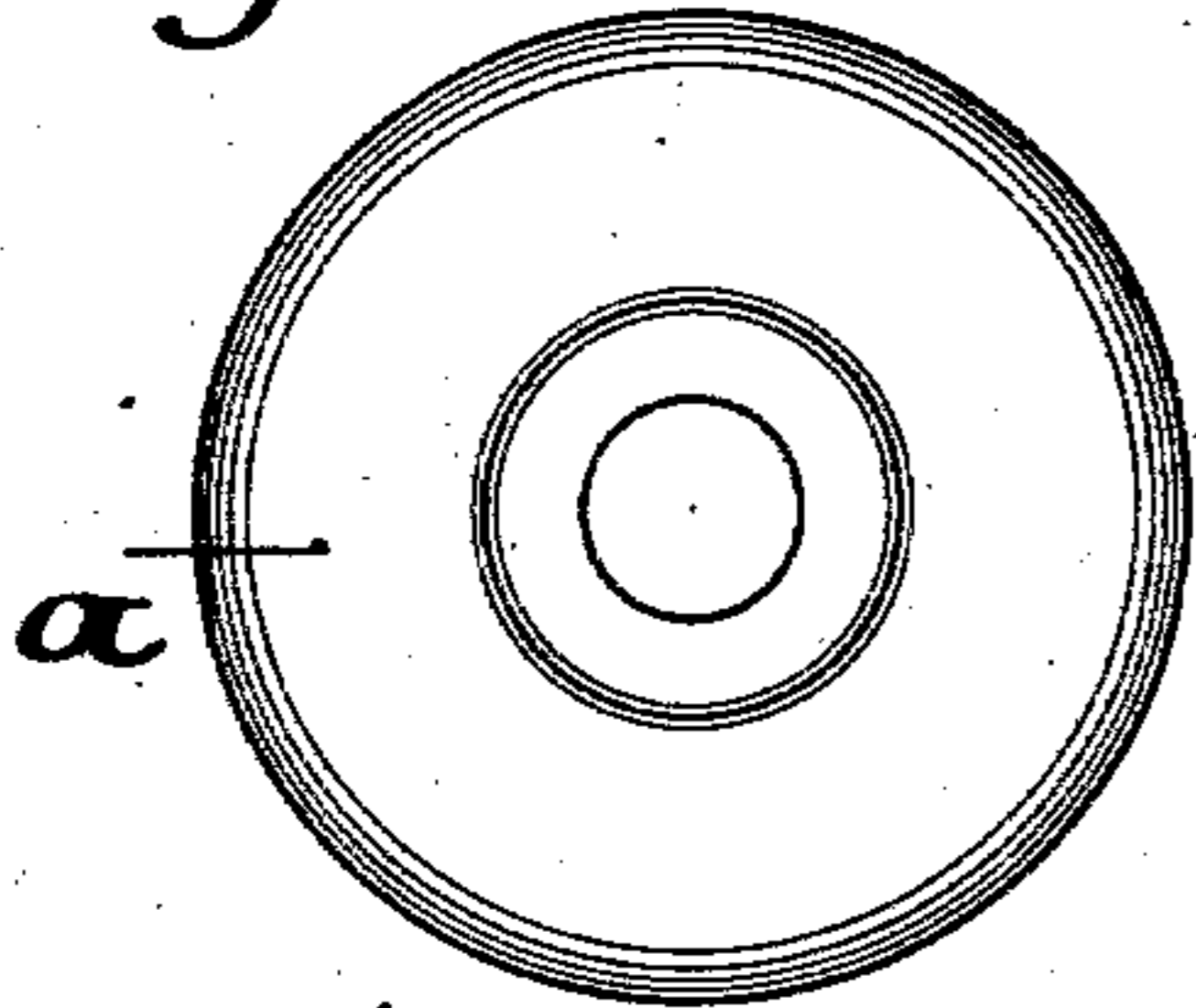


Fig. 2.

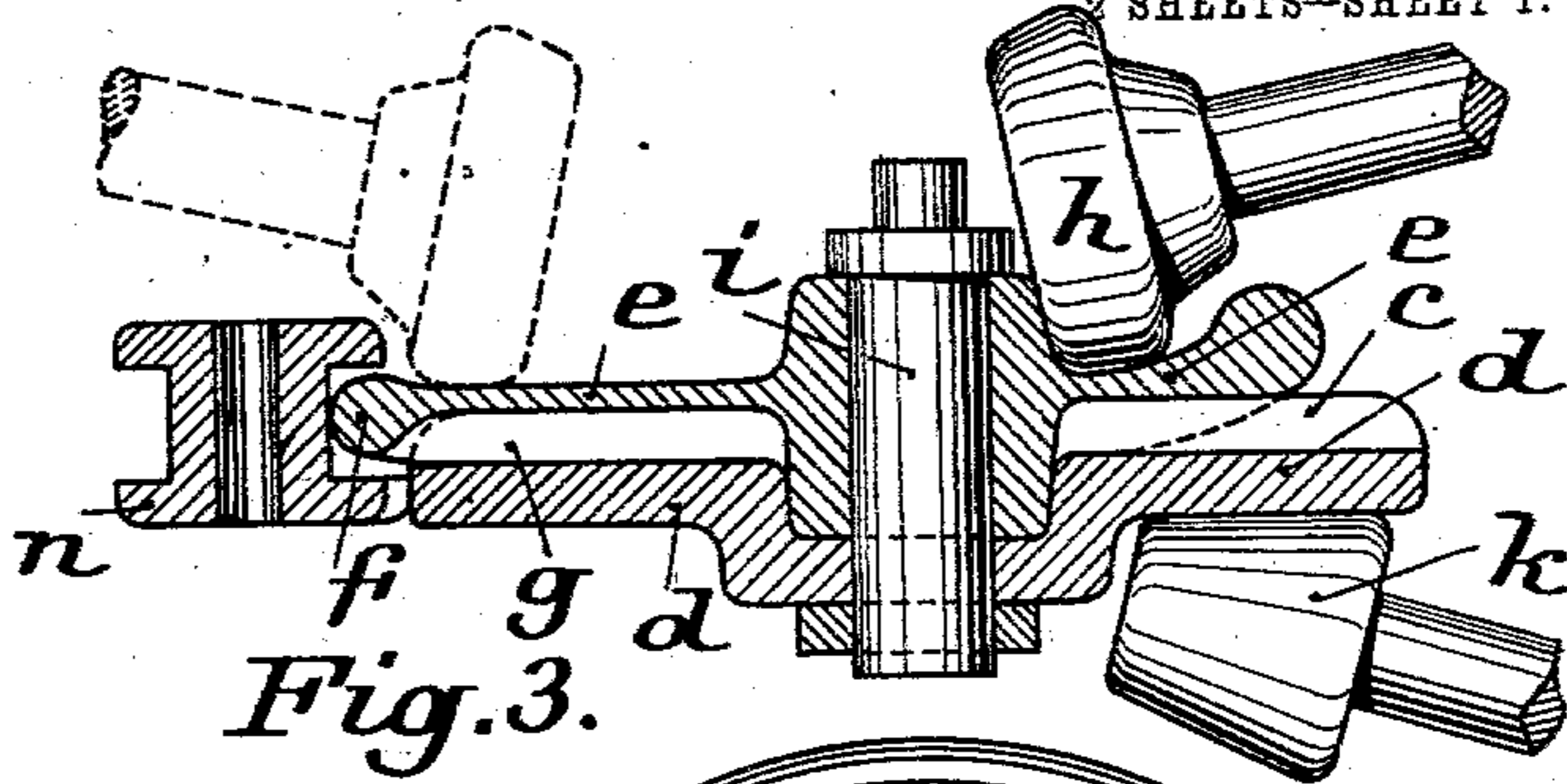
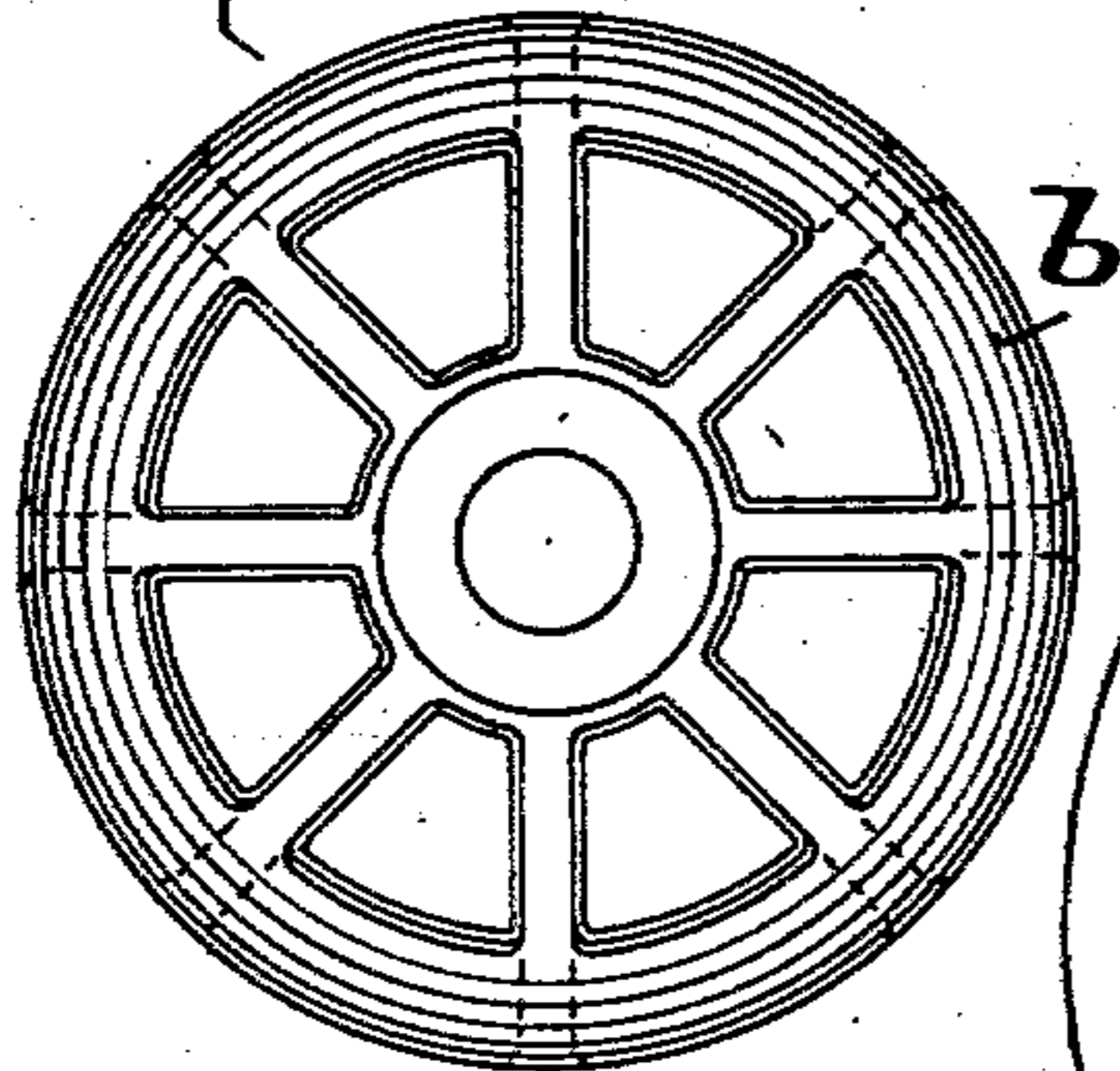
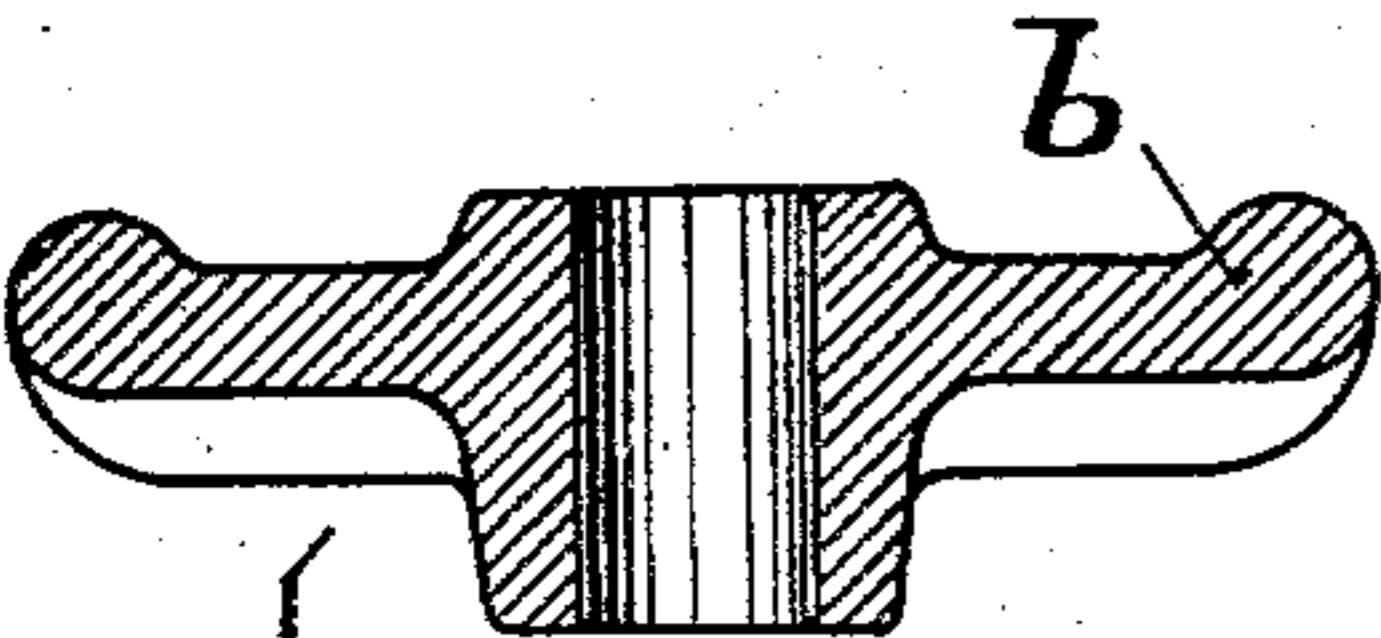


Fig. 3.

Fig. 3a.

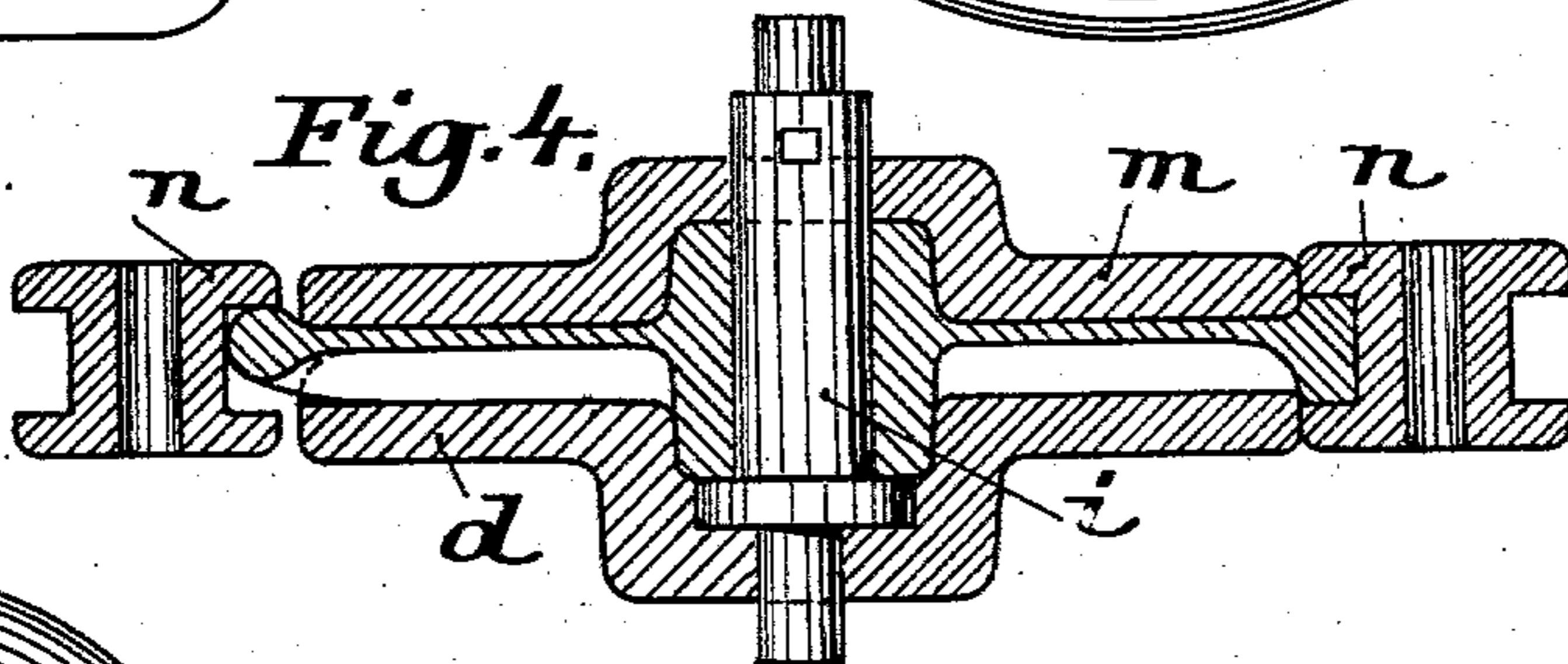
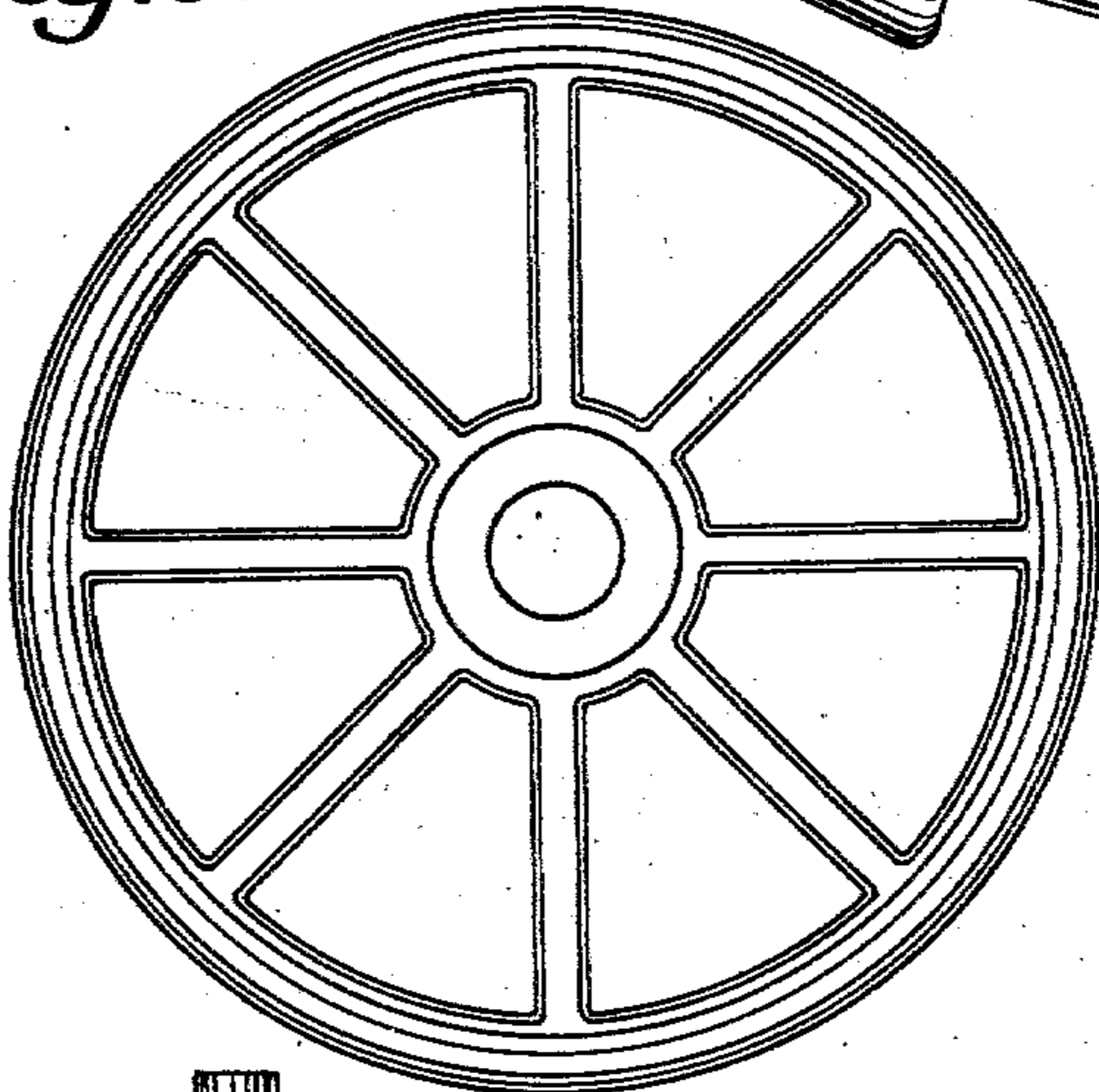
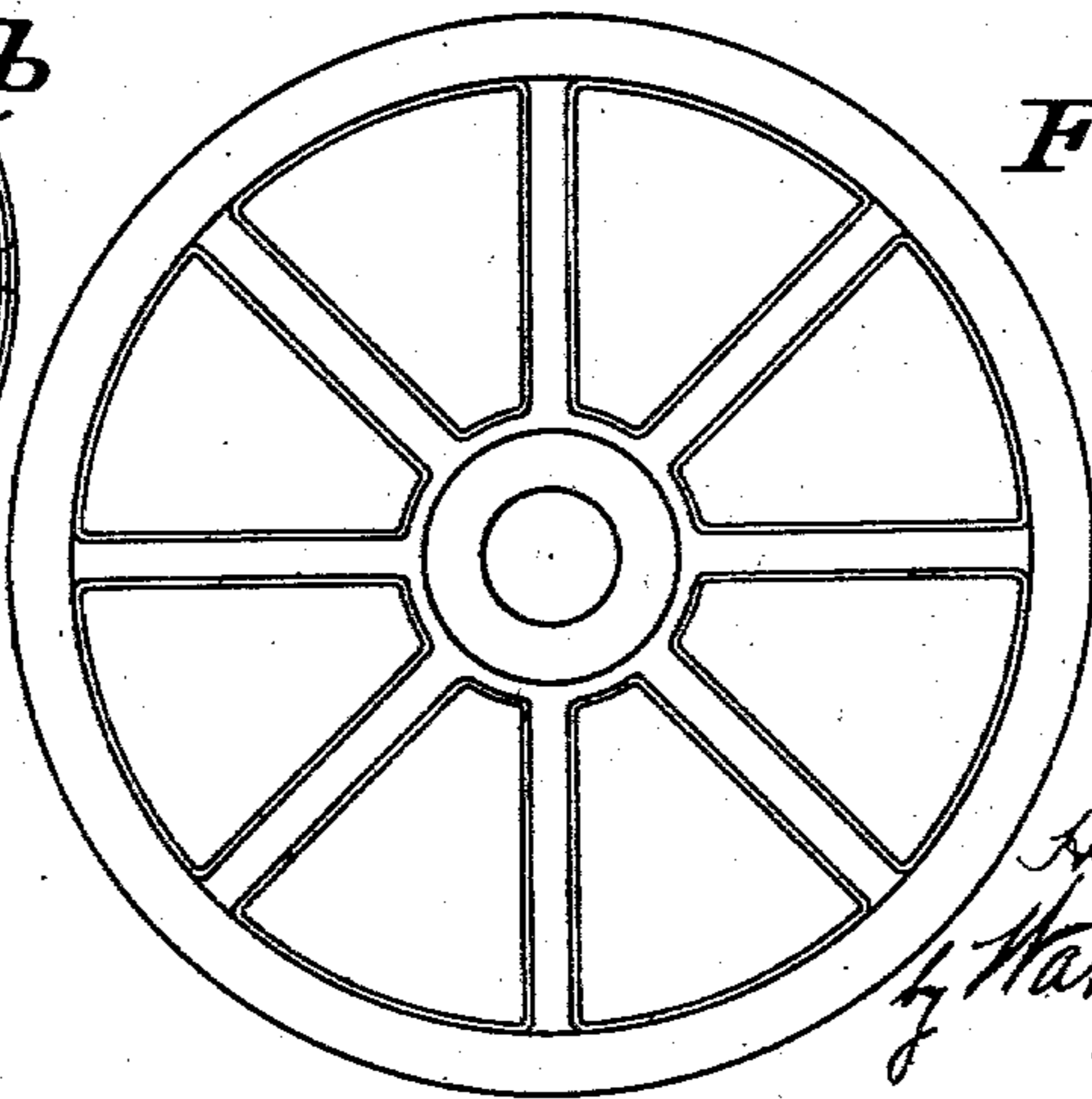


Fig. 4.

Fig. 4a.



WITNESSES

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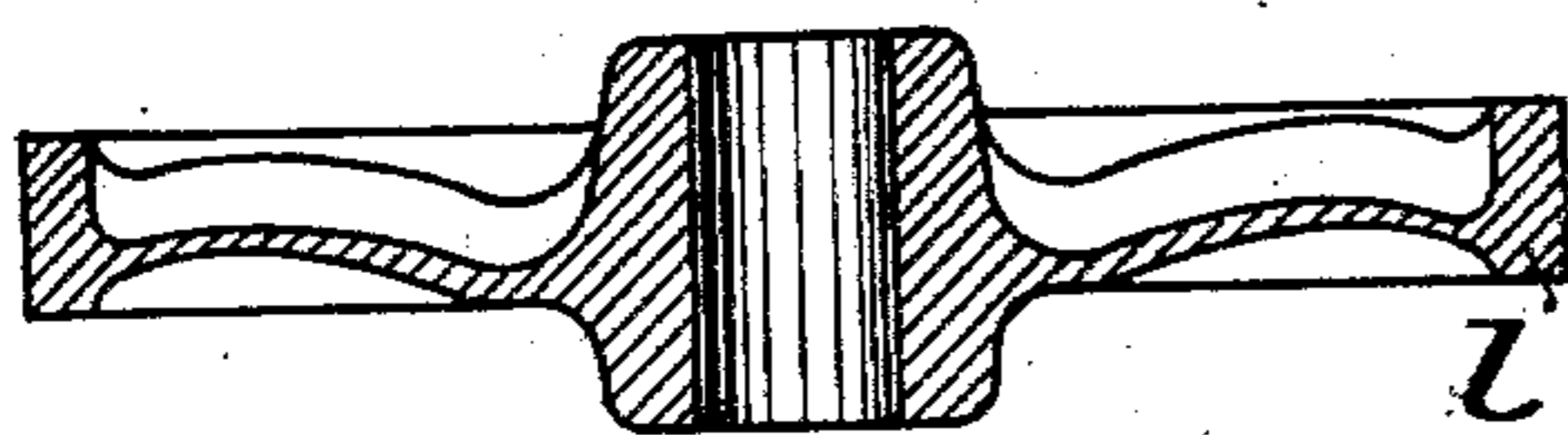
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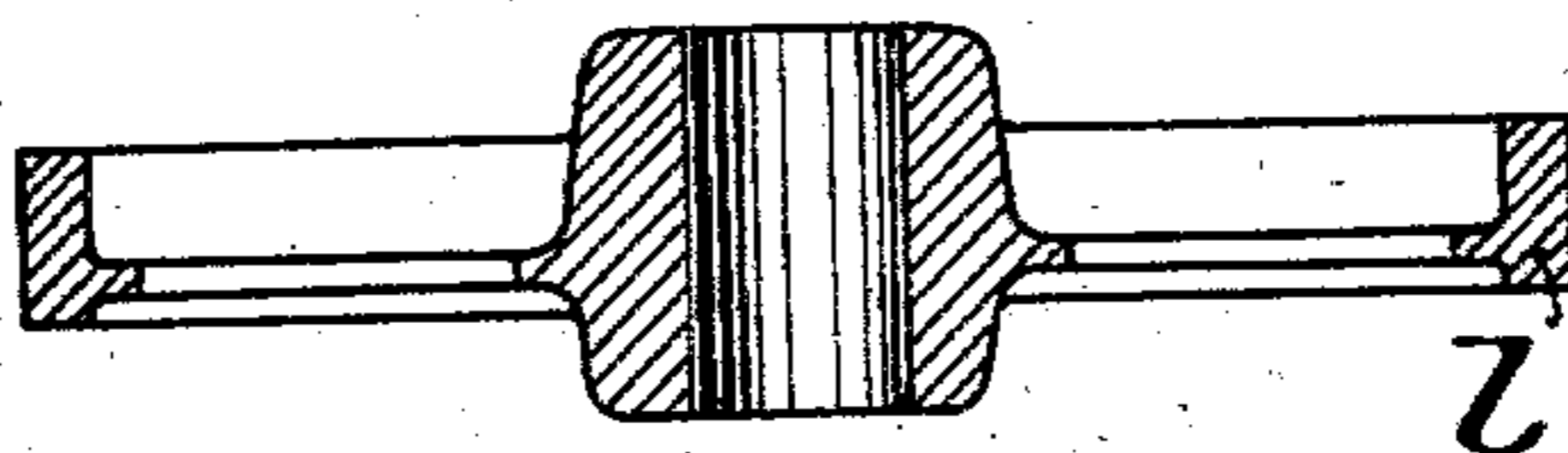
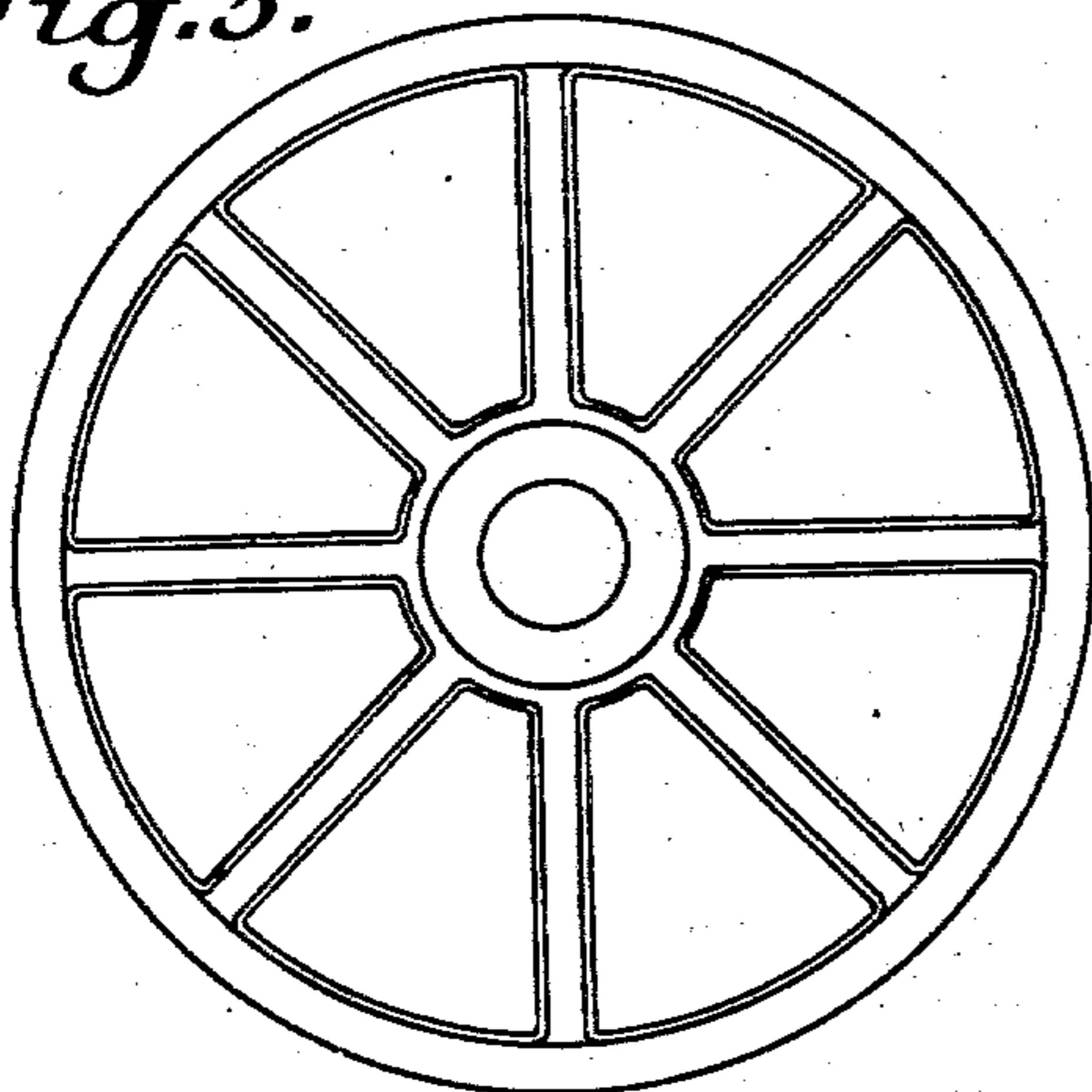
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2 SHEETS—SHEET 2.

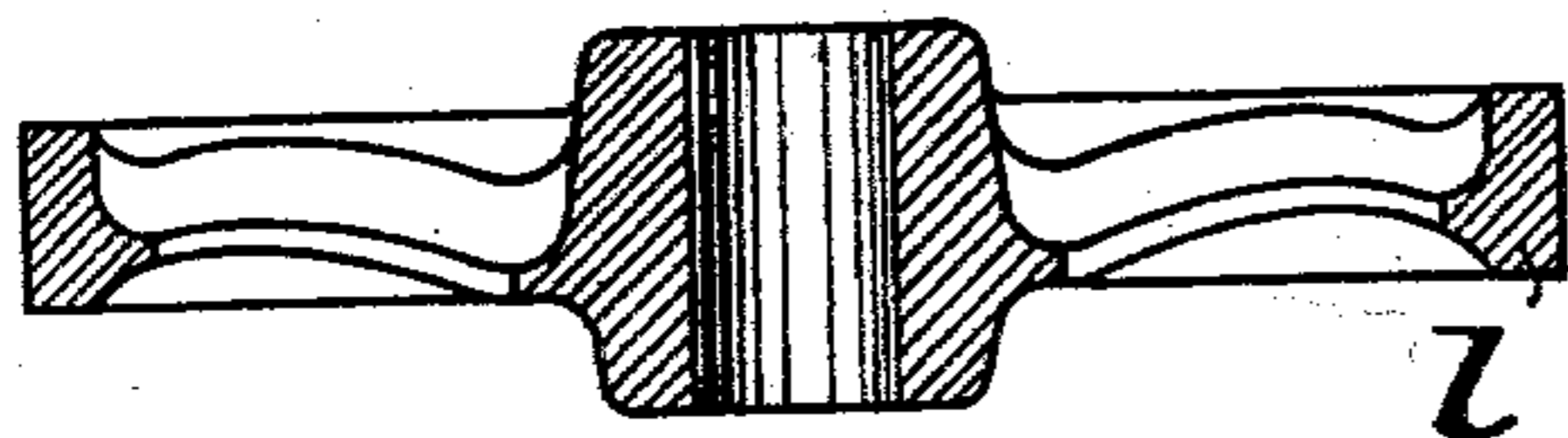
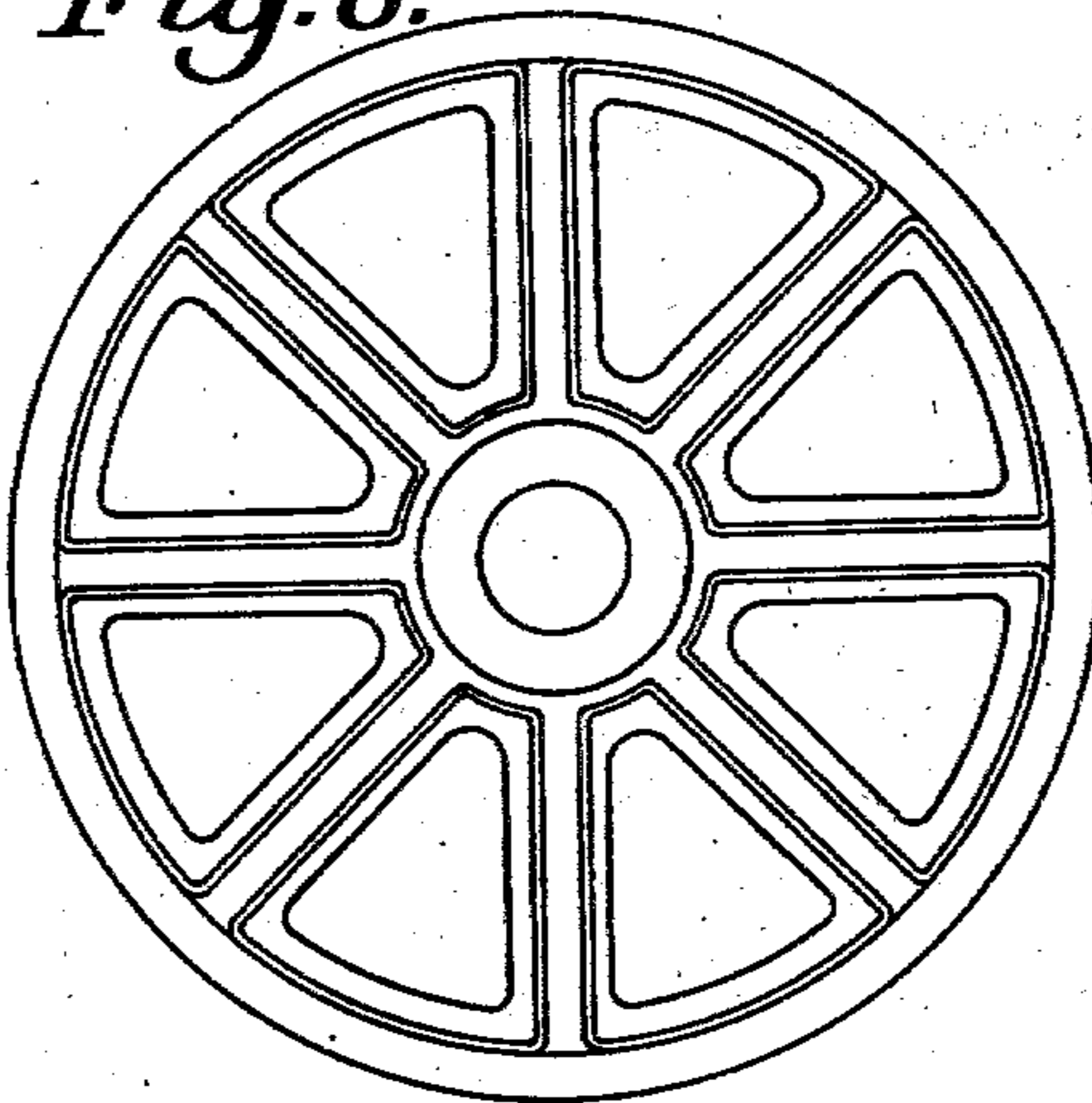
NO MODEL.



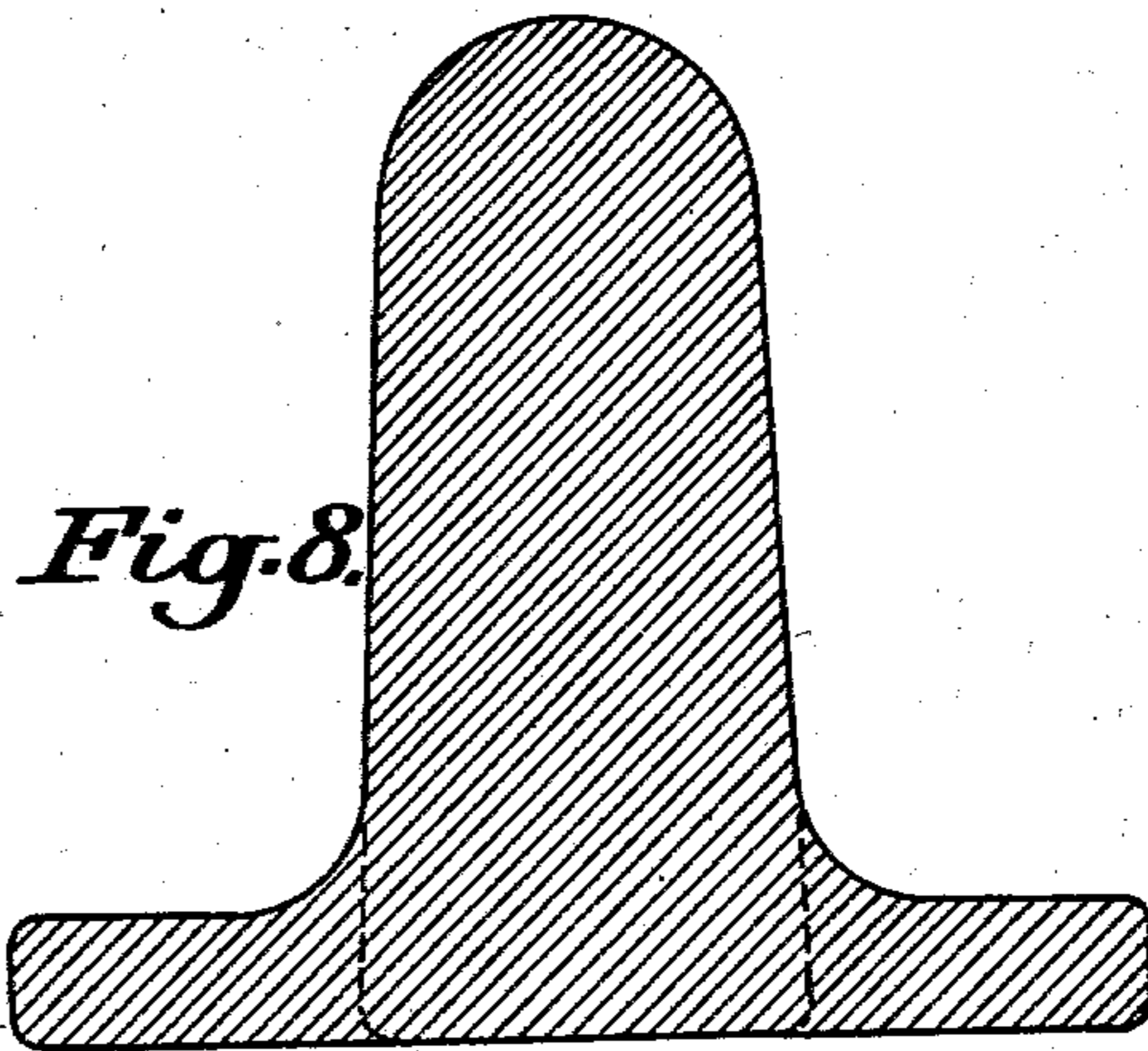
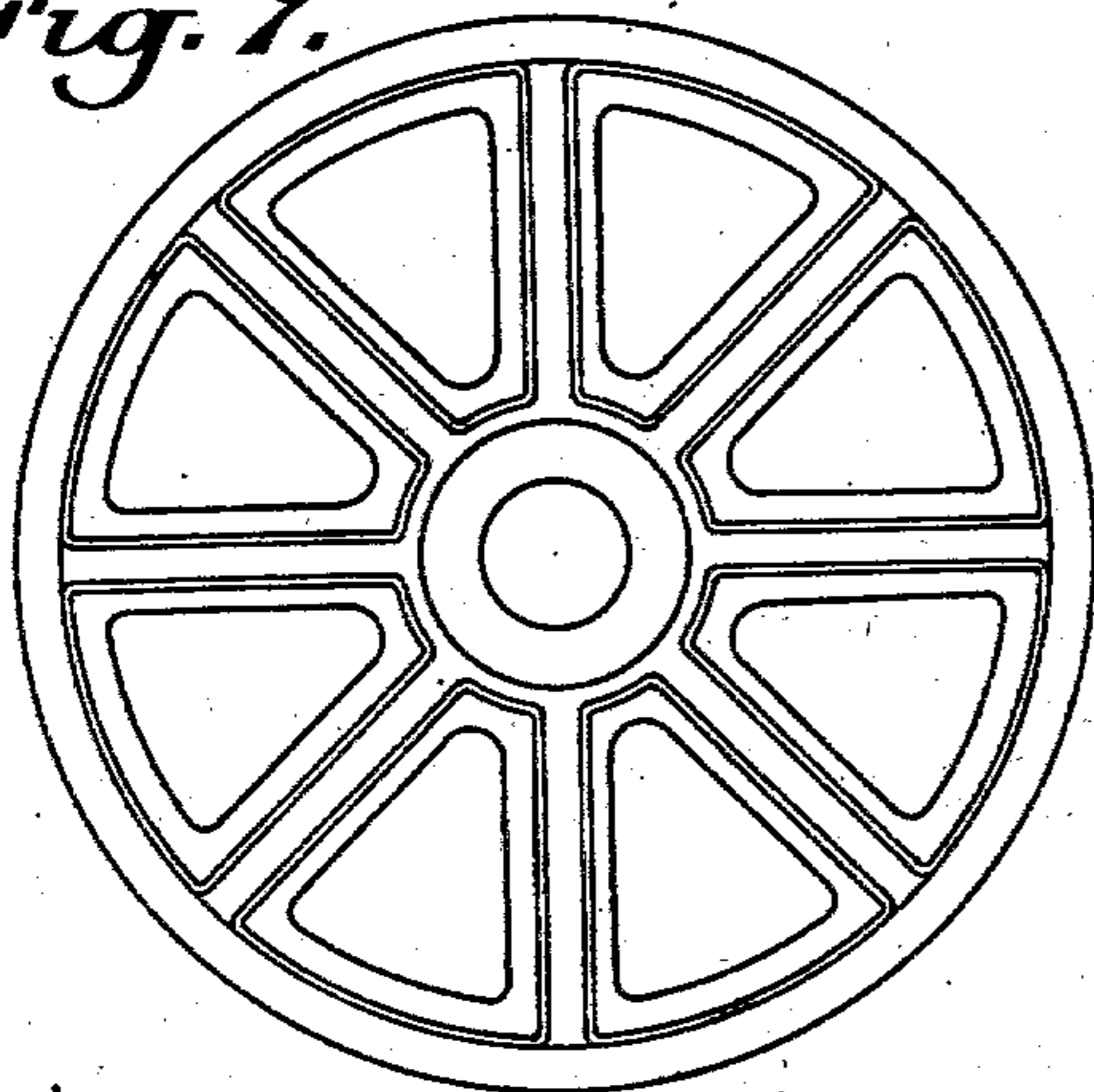
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



*Fig. 8.*

WITNESSES

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# UNITED STATES PATENT OFFICE.

HEINRICH EHRHARDT, OF DÜSSELDORF, GERMANY.

## PROCESS OF MANUFACTURING WHEELS.

SPECIFICATION forming part of Letters Patent No. 730,355, dated June 9, 1903.

Application filed September 8, 1902. Serial No. 122,550. (No model.)

*To all whom it may concern:*

Be it known that I, HEINRICH EHRHARDT, engineer, a subject of the German Emperor, residing at 20 Reichsstrasse, Düsseldorf, Germany, have invented certain new and useful Improvements in the Manufacture of Wheels, of which the following is a specification.

This invention relates to a wheel especially applicable as a railway-wheel, combining the advantages of a spoke-wheel with those of a disk-wheel.

The wheel is made as a disk-wheel with ribs resembling spokes on one side or as a spoke-wheel with a disk on one side, so that it is indeed a compound wheel. The parts of the disk between the spokes may be cut away if desired. A wheel of this kind may be made from a cast, wrought, or pressed block of disk form, having an essentially smaller diameter than that of the finished wheel, by pressing, hammering, or rolling it on a disk having radial grooves of spoke form in such manner that the pressure is applied progressively from the center to the circumference and the material is made to flow in the spoke-grooves from the center outward, while there remains a flat disk above the spokes having a circular swelling which may be fashioned to a rim in the ordinary manner. Thus the manufacture of the wheel differs from those already practiced by the fact that the pressure applied to a substantially smooth disk acts to force material at one side thereof into spoke-grooves, while extending the diameter of said disk, and there is formed a disk having ribs on one side, it being a matter of indifference whether the pressure is applied by hammering, pressing, or rolling.

The accompanying diagrams illustrate the invention.

Figure 1 is a side elevation and a plan of one form of the blank for the wheel. Fig. 2 shows a cross-section and a plan of another form. Fig. 3 is a cross-section of a wheel undergoing the rolling operation in the process of manufacture, and Fig. 3<sup>A</sup> is a plan of the wheel at this stage. Fig. 4 is a cross-section of a wheel undergoing the operation of forming the rim, and Fig. 4<sup>A</sup> is a plan thereof at this stage. Fig. 5 is a cross-section and plan of the finished wheel in which the disk has an undulation. Fig. 6 shows

similar views of a wheel wherein the disk has no undulation and the pieces between the spokes are cut away. Fig. 7 shows similar views of a wheel having both undulations and pieces cut out. Fig. 8 is a cross-section through a spoke, drawn to an enlarged scale.

The blank may be either a disk *a*, having a nave, but no ribs, as in Fig. 1, or a disk *b*, having radial ribs, as in Fig. 2. Such a blank is laid upon a disk-shaped die *d*, Fig. 3, having radial grooves *c* for forming the spokes. As indicated in Fig. 3, the blank is rolled into this die, the pressure beginning at the nave and being gradually carried to the circumference. In this manner the blank is rolled into the grooves and a disk *e* is formed above them. As the die *d* has a considerably-smaller diameter than that of the finished wheel there is formed by this method of pushing the material from the nave to the circumference a swelling *f*, of pear-shaped or drop-shaped cross-section, which protrudes over the edge of the die *d*. The rolling is effected between the roller *h* and the die *d*, which turns on its axle *i*. Either both the rolling parts *h* and *d* may be driven or only one, and both may be driven in the same direction. For taking the pressure of the roller *h* the roller *k* may be used. In starting from the blank *a* or *b*, Figs. 1 and 2, the roller *h* begins to work at the nave, as shown at the right of Fig. 3, and gradually advances toward the circumference, as shown in dotted lines at the left of Fig. 3. In this manner the material is pressed into the spoke-grooves and at the same time extended toward the rim, forming the swelling *f*, while on the spokes *g* remains a disk *e*. The system of rolling shown on the left of Fig. 3 can also be applied when the disk-wheel has been made by hammering or pressing by means of a top die in steps from the nave to the circumference. In this case the roller *h* is only arranged to form the swelling *f* on the circumference. The swelling *f* is formed into a rim, as shown on the right of Fig. 4, and lettered *l* in Figs. 5 and 7. This is done by use of the grooved die *d* by circumferentially rolling, pressing, or hammering the rim, as is already known in wheels of other kind. In Fig. 4 is shown, for example, a wheel being pressed between the disk *d* and a plate *m*, and by means of the roller *n* the profile of the tire is rolled. This

can also be done without the plate at the conclusion of the work of the roller *h*, as shown at the left of Fig. 3.

Fig. 5 shows a compound wheel in which the wheel-disk with its spoke-ribs are of undulating form. Figs. 6 and 7 illustrate a wheel similarly produced, but converted into a simple spoke-wheel by cutting out the disk in the parts between the spokes. In this case the spokes may have the cross-section shown in full lines in Fig. 8, in which a piece of the disk is left as a flange on either side; but it may also have the form shown in dotted lines in Fig. 8, the disk being cut away close to the spoke.

Having thus described the nature of my said invention and the best means I know of carrying the same into practical effect, I claim—

1. The herein-described method of manufacturing wheels, consisting in arranging a suitable blank upon a die having a series of radial grooves in the face thereof against which the blank bears, and in applying pressure progressively from the hub outward to the opposite face or side of the blank to simultaneously gradually increase the diameter of the disk and force material from one side thereof into said radial grooves, to form a series of radial projections on one face of the disk.

2. The herein-described method of manufacturing wheels, consisting in arranging a suitable blank upon a die having a series of radial grooves in the face thereof against

which the blank bears, then applying pressure progressively from the hub outward to the opposite face or side of the blank to simultaneously expand the blank and force portions thereof into the radial grooves in the die, and continuing the application of such pressure until the periphery of the blank extends beyond the die, and a series of radial ribs are formed on one face of the blank, and then forming such projecting periphery of the blank into a rim.

3. The herein-described method of manufacturing wheels, consisting in arranging a suitable blank upon a die having a series of radial grooves in the face thereof against which the blank bears, then applying pressure progressively from the hub outward to the opposite face or side of the blank to simultaneously expand the blank and force portions thereof into the radial grooves in the die, and continuing the application of such pressure until the periphery of the blank extends beyond the die, and a series of radial ribs are formed on one face of the blank, then forming such projecting periphery of the blank into a rim, and finally removing portions of the body of the blank between the projecting spoke-sections thereof.

In testimony whereof I have affixed my signature in presence of two witnesses.

HEINRICH EHRHARDT.

Witnesses:

P. LIEBER,

WILLIAM ESSENWEIN.