

(Model.)

4 Sheets—Sheet 1.

F. N. GARDNER.
GRINDING AND POLISHING WHEEL AND ART OF MANUFACTURING SAME.
No. 494,471. Patented Mar. 28, 1893.

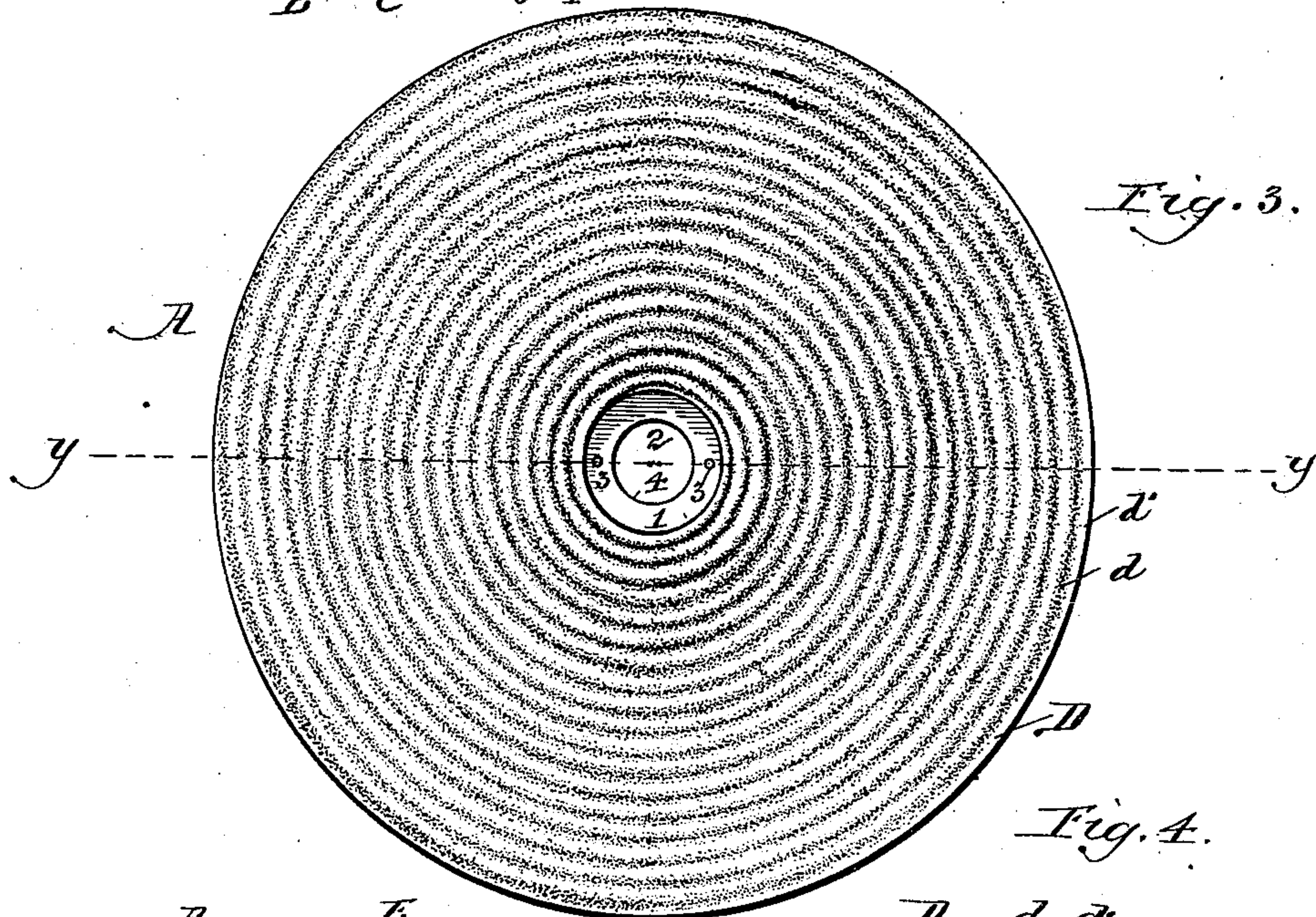
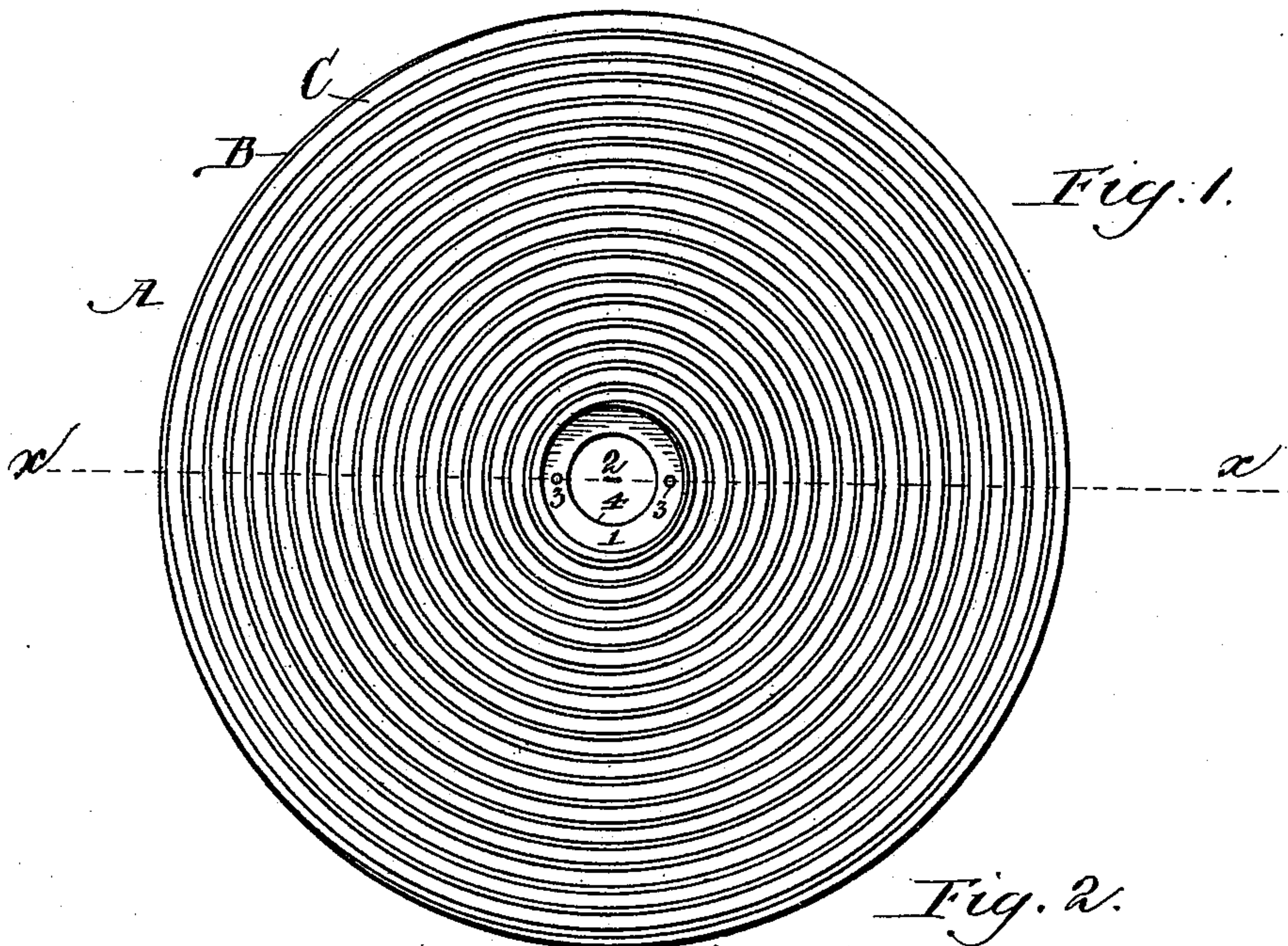


Fig. 4. A cross-sectional view of the wheel, showing the internal structure. It is a horizontal rectangle with a central hub. The hub is divided into sections labeled '1', '2', '3', and '4'. The outer layers are labeled 'D' and 'd'. The label 'Fig. 4.' is written to the right of the cross-section.

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(Model.)

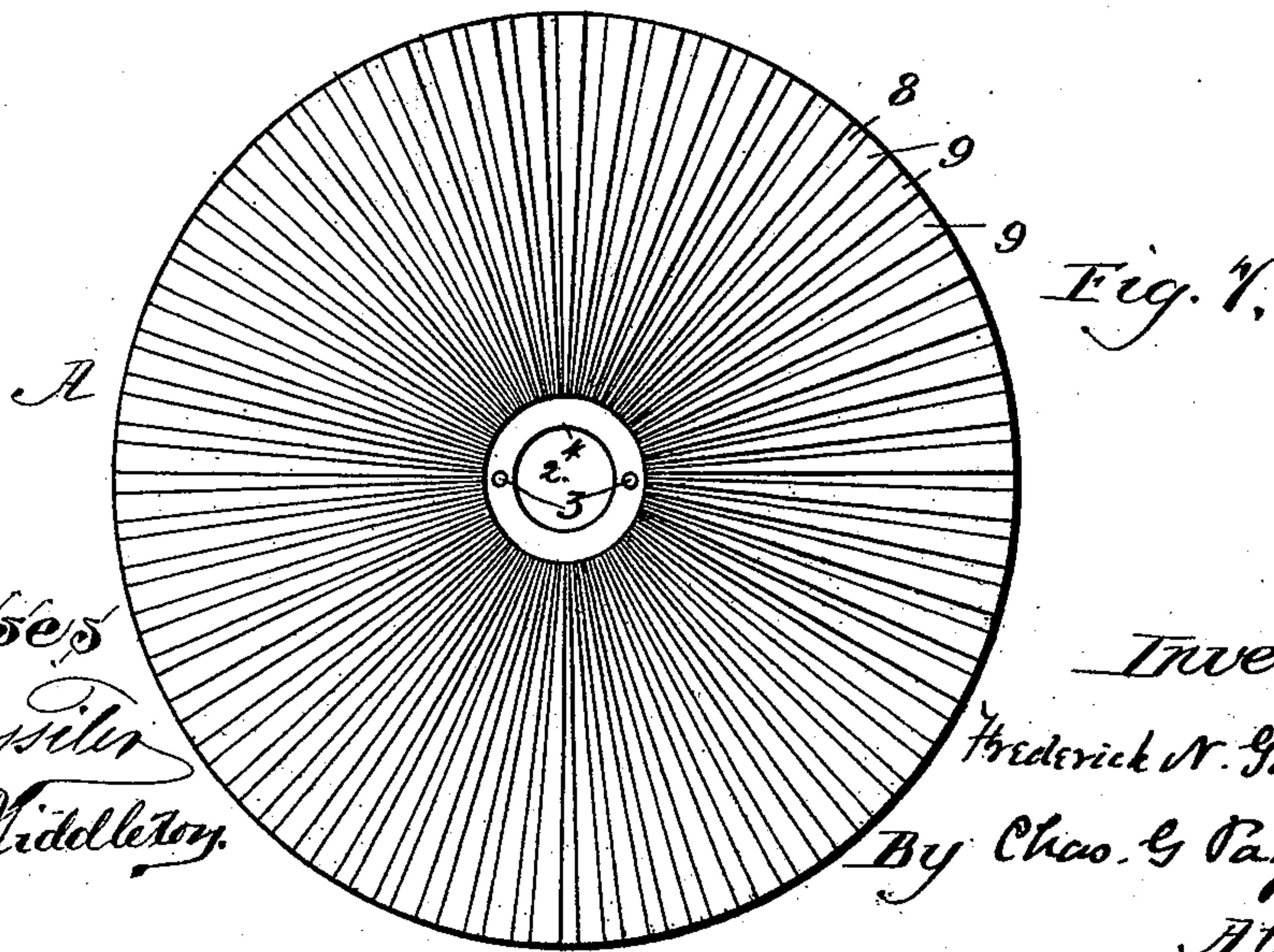
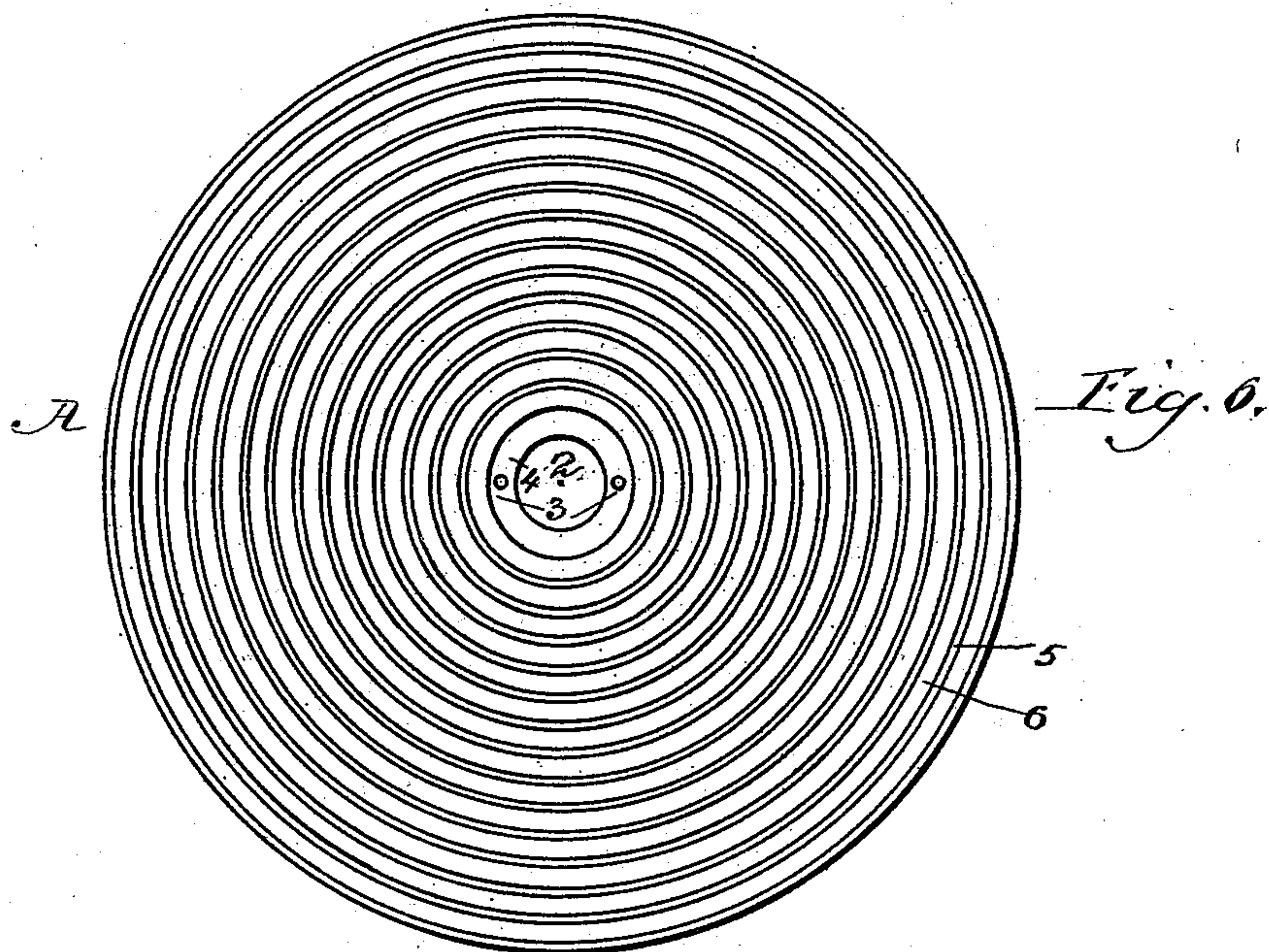
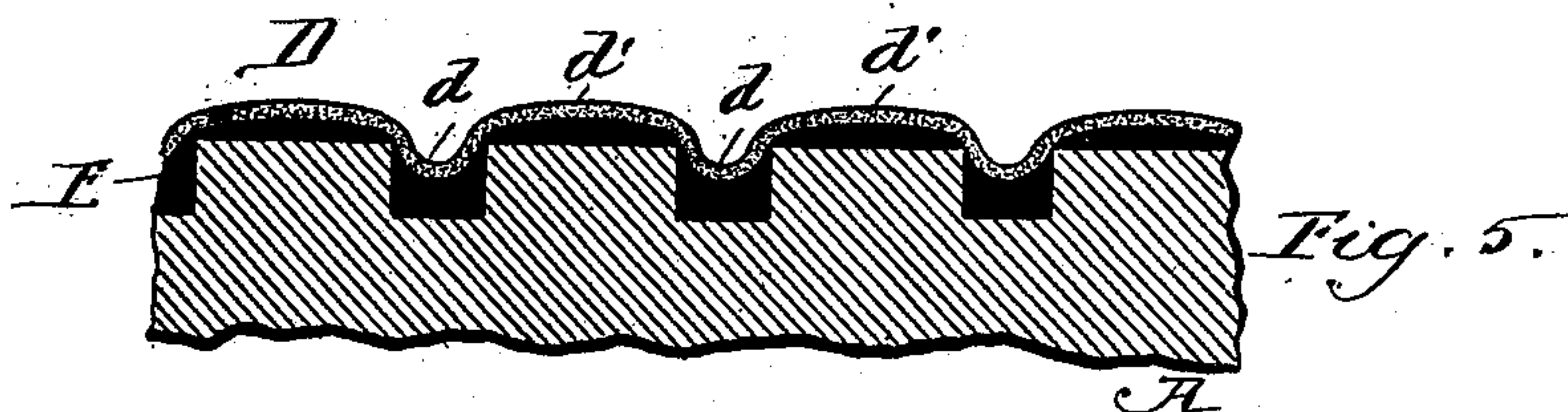
4 Sheets—Sheet 2.

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Fig. 8.

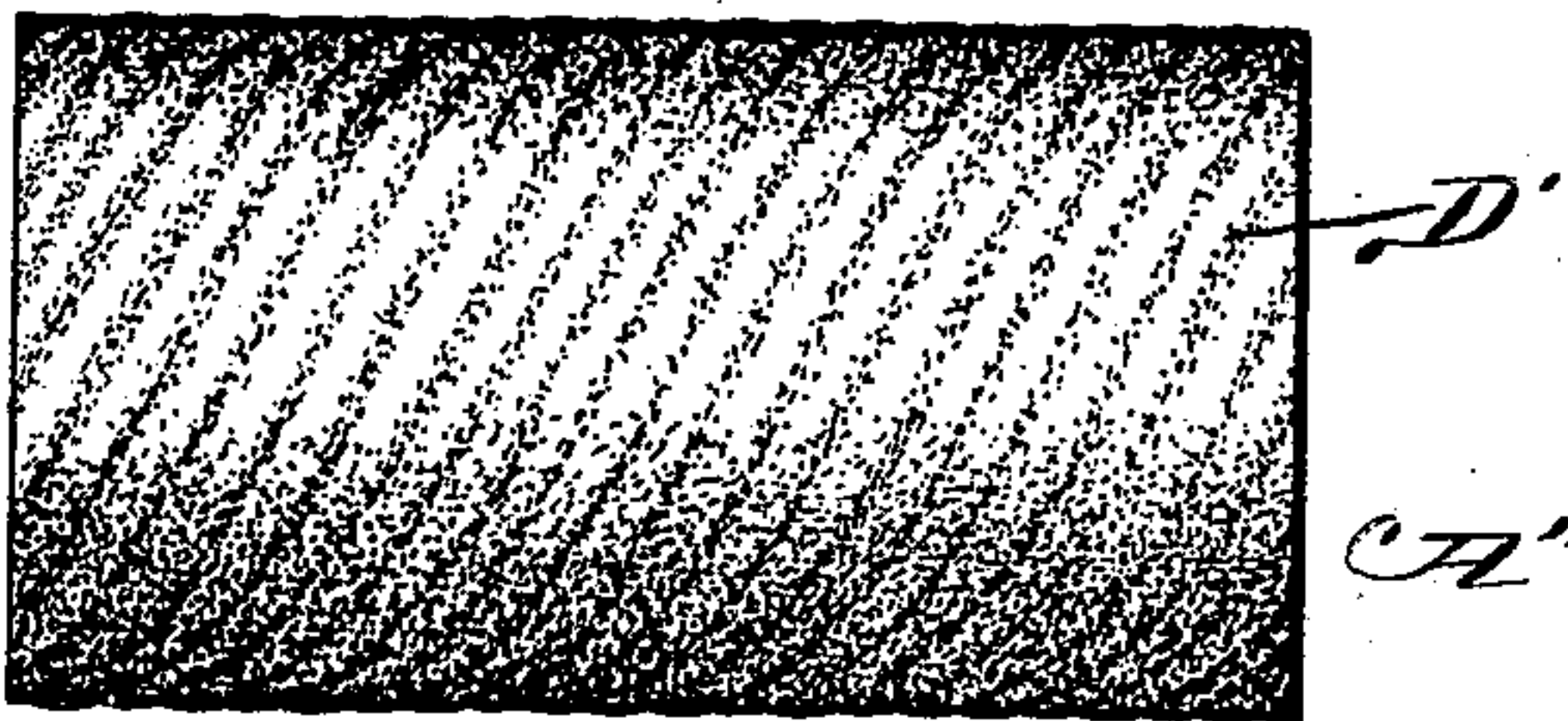
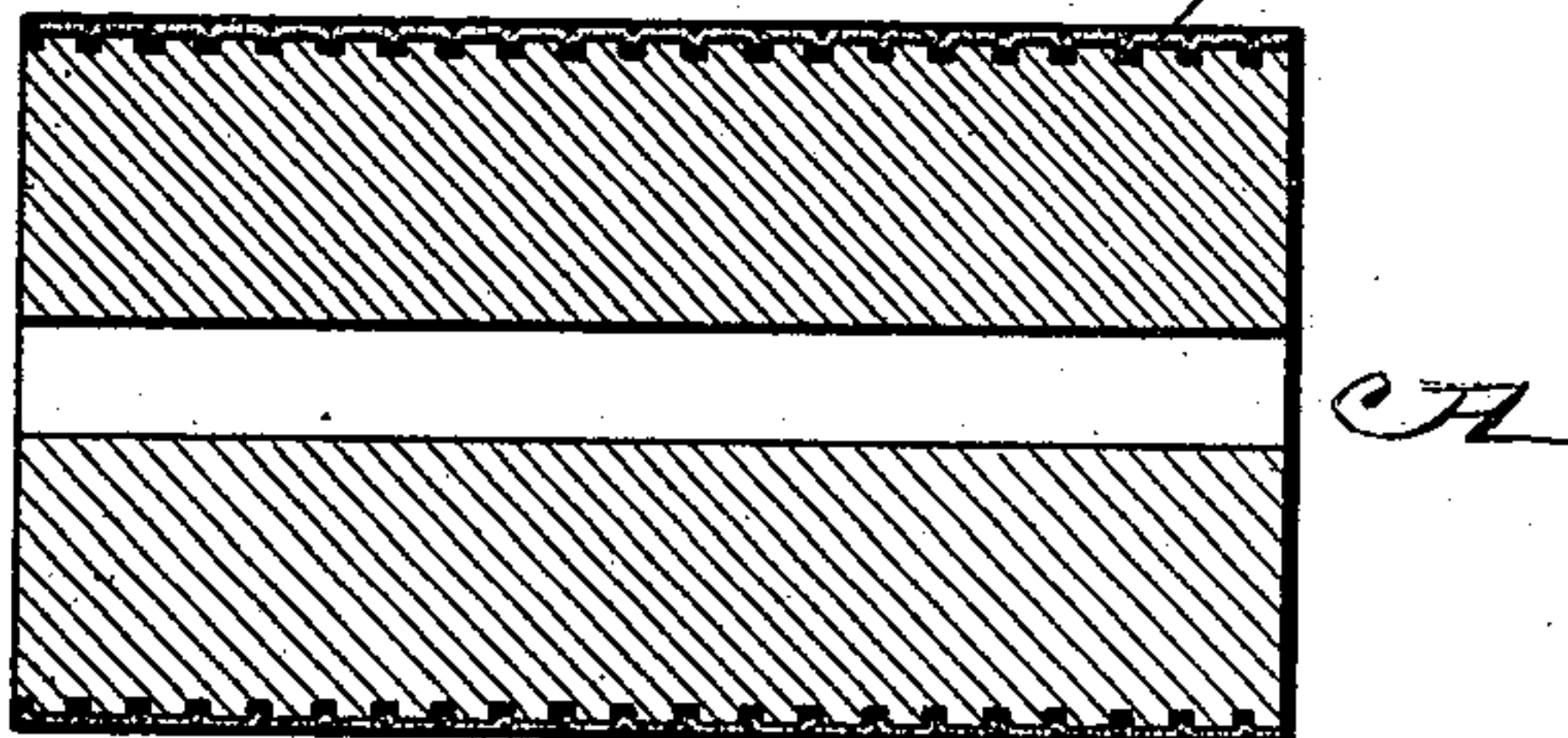


Fig. 9.



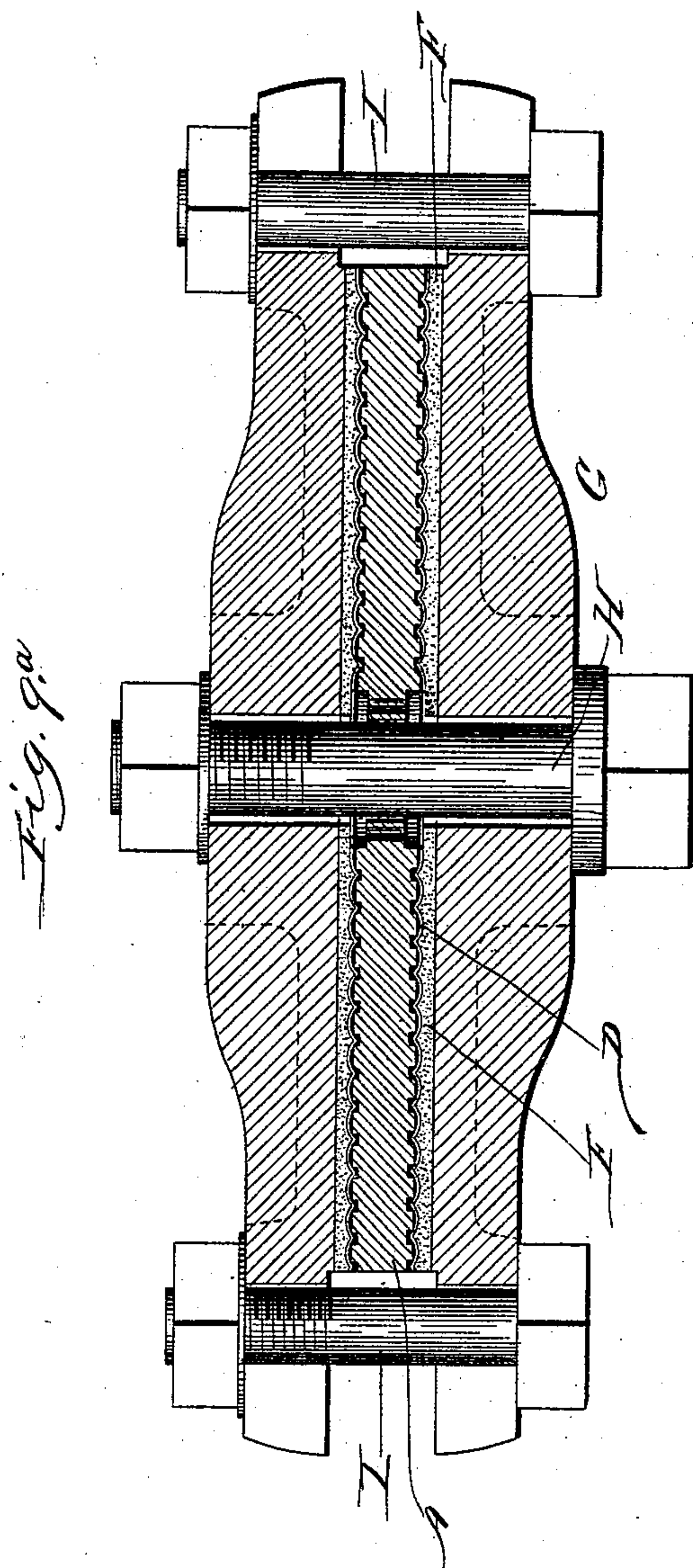
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(Model.)

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UNITED STATES PATENT OFFICE.

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GRINDING OR POLISHING WHEEL AND THE ART OF MANUFACTURING SAME.

SPECIFICATION forming part of Letters Patent No. 494,471, dated March 28, 1893.

Application filed October 26, 1891. Serial No. 409,903. (Model.)

To all whom it may concern:

Be it known that I, FREDERICK N. GARDNER, a citizen of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Grinding or Polishing Wheels and the Art of Manufacturing the Same, of which the following is a specification.

This application is filed in continuation of and as a substitute for my application for Letters Patent filed on or about October 27, 1888, and serially numbered 289,283.

The object of my invention, generally stated, is to provide a simple, economical, and highly efficient construction of grinding or polishing wheel, having an abrading surface which can be graded with reference to the work for which it is produced, and which, when worn, can, at comparatively small cost, be removed and replaced by a new abrading surface, either of the same or of a different grade.

Certain further objects and ends sought and attained by my invention, and more particularly specified as follows, to wit: first, the convenient, economical, and commercially practical production of an abrading wheel having a separately formed abrading face or surface, which, for the purposes of its allotted use is practically rigid or solid, and in effect integral with the body of the wheel, but at the same time capable of being removed therefrom with comparative ease by properly directed efforts, so that the wheel can be used for effective work, such as grinding, or polishing, or grinding and polishing, until its abrading surface becomes too much worn for such purpose, whereupon its said abrading surface can be removed and replaced by a new one; second, the provision of a grinding or polishing wheel having a removable corrugated abrading face, generally rigid with the wheel and for purpose of use, in effect integral with the same, but so secured or united to the wheel as to avoid all necessity of strips or wires laid within the grooves as a means for securing the removable abrading face or facing in place, and thereby, 1,—permit the abrading face to do more rapid and effective work; 2,—leave the grooves open to receive loose particles resulting from the work of grinding or polishing; 3,—permit the practi-

cal and economical use of a metal or other like hard and sufficiently heavy wheel as a backing for the removable abrading facing; 4,—permit the convenient and practical formation of ribs and grooves either spiral or in concentric circles without fastening strips; third, the provision of a grinding or polishing wheel having a peculiarly grooved and ribbed abrading face, whereby during operation the grinding action upon the work shall be uniformly distributed and have a sort of shearing action, serving to rapidly, thoroughly and effectively accomplish the desired results; fourth, the provision of a grinding or polishing wheel having an abrading facing rigid with the wheel and characterized by the surface of the same, but having ribbed portions formed more or less crowning in cross-section, so as to wear from the highest middle line toward the next adjacent bordering lines of grooves or grooving.

To the attainment of the foregoing and other useful ends my invention consists in matters hereinafter set forth.

In carrying out my invention I provide a grinding or polishing wheel having an abrading face or surface formed by a sheet or facing of some suitable abradant such as emery or corundum cloth, or emery or corundum paper, which is united to the wheel by a backing of glue or cement, and caused, by suitably applied pressure, to conform to the configuration of the portion of the wheel to which it is applied. The wheel can be shaped in any desired way, as for example, it can be made in the form of a cylindric roll and have its cylindric perimeter faced with the said abradant, or it can be made as a disk and have one or both of its sides provided with such abrading facing.

For certain purposes the wheel can be made of various materials, but as a special and preferred construction and matter of further improvement, it is made of metal. Other dense and sufficiently heavy materials could be used, but I prefer a metal or metallic wheel, since first, it can be economically produced and provided with a grooved and ribbed surface; secondly, its said face will be durable and preserve its distinctive form; thirdly, the wheel can be conveniently made in disk form

and at the same time will be of sufficient weight to insure proper momentum when started up; and, fourthly, while the abrading facing can be rigidly glued onto the metal or metallic wheel so as to resist all disposition on the part of the work to rub it loose, it can be nevertheless stripped from the wheel when it is desired to provide a new abrading facing.

For certain purposes of my invention the wheel can be provided with variously formed or arranged grooving or depressions arranged to leave ribs or high portions alternating with the same, but as a preferred arrangement I channel or groove the wheel so as to provide it with a surface or surface portion composed of ribs alternating with the grooves or channels, and apply to the surface of the wheel thus formed, a layer of glue or cement, and a sheet of abrading material such as emery or corundum cloth or paper which is backed and held by the glue or cement in suitably firm connection with the grooved or channeled wheel. The glue or cement can be first applied to the wheel and the abrading sheet can then be placed upon the glue or cement-covered surface of the wheel, or the glue or cement can be applied to the back of the abrading sheet and the same then applied to the wheel. By placing a flexible or elastic pad upon the abrading sheet thus applied to the wheel, and applying suitable pressure upon said pad by a clamp or press, the abrading sheet will be depressed into the grooves or channels which will be otherwise filled with glue or cement as a backing for the abrading sheet. The glue or cement upon hardening will of course adhere with considerable tenacity to the wheel, and by thus grooving the latter, a more extended area of surface is provided for the glue or cement to adhere to. It will also be observed that the glue or cement adheres to the sheet of abrading material so as to be practically or in effect integral with or incorporated into the same, and hence that the sheet is in effect provided with a backing having projections or ribs formed by the glue or cement and tightly fitting in depressions or grooves in the wheel, and hence, that the sheet is rigidly united to the wheel and held against all disposition to rub off, shift, or rub up or pucker while an article is being ground or polished. This stable connection between the sheet of abrading material and the wheel is also obviously assisted by the fact that the sheet is depressed within the grooves or channels.

While the wheel may be made of various forms for the broader purposes of my invention, I prefer as a special form and matter of further improvement to employ as a wheel, a metal or metallic disk having both of its oppositely arranged sides formed with ribs and grooves or channels as hereinbefore set forth, and while for certain purposes of my invention the grooves or channels can be variously arranged, I prefer, as a further matter of im-

provement to provide the finished wheel with a spirally grooved and ribbed abrading face so as to insure more rapid, uniform and thorough action.

In the accompanying drawings: Figure 1 represents what may be termed a side or face view of a disk which forms a preferred construction of wheel and shows the same provided on one side with a geometric spiral groove and rib, it being herein understood that the portion termed its sides when the wheel is made in disk-form, might be termed its ends, if the wheel were made in the form of a roll, in which latter case, however, the perimeter of the wheel or roll would be the most desirable portion to provide with an abrading surface. The opposite side or face of the disk or wheel is desirably correspondingly grooved and is so understood in Fig. 2, which is a section on line $x-x$ in Fig. 1. Fig. 3, is a view similar to Fig. 1, but shows the wheel provided with an abrading facing. Fig. 4 is a section on line $y-y$ in Fig. 3, and illustrates abrading facings applied to opposite sides of the wheel or disk. Fig. 5 represents on an exaggerated scale a portion of the wheel, abrading facing and backing of glue or cement interposed between the abrading facing and wheel. Fig. 6 is a side view of the disk-shaped wheel having its side provided with ribs and grooves in concentric circles, and Fig. 7, is a like view showing the wheel provided with radial grooves and ribs. Fig. 8 illustrates the wheel shaped as a cylindric roll and having the abrading facing applied to its perimeter. Fig. 9 is a central longitudinal section through the form of wheel illustrated in Fig. 8. Fig. 9^a is a section taken vertically and centrally through a press, and illustrates a mode of preparing the abrading wheel.

The wheel, A, is preferably made of metal, or some metallic composition, and when so made (that is to say made either of metal or some metallic composition) it may be termed a metallic wheel. The wheel is also preferably solid, although of course it could be formed with a body of any suitable material provided a metallic side or sides could be grooved or corrugated prior to or after their securement to said body. Reasons for employing metal as a preferred body for the wheel are hereinbefore given. It may however, be further mentioned, that material such as wood is objectionable because but little profit and satisfaction could be derived from an attempt to remove an abrading facing glued to a wooden wheel, and also that wood is liable to warp, crack and wear.

The wheel can be adapted for securement to an arbor or spindle in any suitable way, as for example, it can be provided with annular offsets, 1, about a centrally arranged opening, 2, so as to receive a shouldered spindle to which the wheel could be secured by bolts applied through bolt-holes, 3, in its web-portion, 4, formed between the two offsets. The sides

of the wheel or disk shown in Fig. 1 are each provided with a spirally arranged groove, B, (one of said sides being illustrated in said Fig. 1 and both of said sides being illustrated in Fig. 2) and a spirally arranged rib, C, formed as a result of the said groove or channel. Each side thus grooved and ribbed is provided with an abrading facing, D, consisting of emery, corundum, or analogous abrading cloth or paper, which said facing is united with the wheel by a layer or backing, E, of glue or cement as best illustrated by Fig. 5, in which the parts are somewhat exaggerated for the purpose of illustration, and the glue or cement represented in solid black, while in Fig. 4 the glue or cement is shown in white so as to avoid confusion with the line representing the abrading facing.

Referring more particularly to Fig. 5, it will be noted that the sheet of abrading material is in the nature of a corrugated sheet, and that its spiral groove or depression, d , (see also Fig. 3,) and spiral rib, d' , respectively correspond with the spiral groove and rib of the wheel. The portion of the abrading sheet which is depressed to form its groove or gutter, d , is thus depressed by placing the abrading sheet upon the wheel with a suitable quantity of glue or cement distributed between them, and then applying pressure,—preferably by pressing an elastic or flexible pad upon the abrading sheet so as to crowd down a portion of the latter in the groove. The portion of the abrading sheet over the rib will slope somewhat toward the groove portions between which it lies, and hence in grinding or polishing an article, the wear will commence along the middle line of the rib and gradually work laterally toward the groove portions. This slope or inclination along what may be termed the edge portion of the rib is somewhat exaggerated in Fig. 5 in order to illustrate the same, it being observed that by reason of such slope the abrading rib is made somewhat crowning, that is to say higher along its longitudinal middle portion. In practice this crowning shape of the rib is hardly apparent upon a mere inspection of the grinding wheel, but is plainly noticeable upon inspection of the wheel at different periods of its service, such inspection showing that the abrading rib first wears along its longitudinal middle line. The grooves or gutters are free from any and all fastening devices and hence while comparatively narrow and shallow are nevertheless of sufficient depth for receiving loose particles of sand, emery, corundum, and matters torn from the work. The backing, E, of glue or cement is rigid with the abrading cloth or paper and practically provides the same with a grooved and ribbed backing fitted to the grooved and ribbed wheel and adhering to the latter to an extent to produce the practical result of an abrading sheet incorporated with the body of the wheel. Obviously the spiral form of groove and rib allows the spirally grooved and rib abrading

face of the wheel to have a shearing action upon the work and to grind the same rapidly, evenly, and over every point presented to the wheel.

In Fig. 6 the wheel is shown provided with concentric annular grooves, 5, alternating with annular ribs, 6, and in Fig. 7 the wheel is provided with radial grooves, 8, alternating with radial ribs, 9, it being understood that sheets of abrading material can be secured to such surface as described in connection with preceding figures.

The wheel could be made with various forms or arrangements of depressions to receive and hold the backing of glue or cement and hence I desire to broadly cover the same, but as special and preferred arrangement I provide the wheel with a ribbed and grooved surface portion, and as a further improvement arrange the groove and rib in spiral form.

The process of preparing said abrading wheel consists in uniting a sheet of emery or analogous cloth or paper to the wheel by glue or cement and subjecting the abrading facing formed by such sheet to the pressure of a body preferably elastic or flexible so as to cause the facing not only to adhere firmly to the wheel, but also to partake of the irregular surface of the same. By such process I produce a grinding or polishing wheel consisting of a body, an abrading facing, and an intervening strata of glue or cement, all pressed together, with the facing conforming to the surface of the wheel, whether the same be grooved or provided with any other form of depression, or projections which as a matter of course, necessitate intervening spaces constituting depressions.

In Figs. 8 and 9 I have represented the wheel shaped as a cylindric roll A' and having its perimeter grooved and covered with a facing D' as hereinbefore described in connection with the disk-shaped wheel having the facing applied to opposite sides. The grooves can also be spirally arranged on said roll-shaped wheel, so as to attain the effect of the spiral grooving in the disk.

While I may employ any suitable elastic or yielding body which, when pressed upon the abrading sheet will depress the same within the depressions in the body of the wheel so as to compact the glue or cement and cause the abrading sheet to partake of the character of the aforesaid face portion of the body of the wheel, I provide as a matter of further improvement for such purpose an elastic pad F, which can be used as illustrated in Fig. 9^a wherein the body of the wheel with a sheet of emery or analogous abrading cloth or paper on each side and a layer of glue or cement between each sheet and the body of the wheel, is placed within a press G and an elastic pad F also placed between each abrading sheet and the press. By such arrangement the matters within the press can be firmly clamped together and thus held until the glue or cement becomes hardened. The pressure

applied causes the elastic pads to force the abrading sheet within the grooving or depressions in the body of the wheel and hence to cause said sheet to partake of the general character of the body of the wheel and unite therewith so as to provide the wheel with an abrading surface which is rigid therewith and well adapted as a substitute for emery or corundum wheels as a means for grinding or polishing metal work. The press may be of any suitable construction, the one herein shown being provided with a centrally arranged bolt H and bolts I at its margin, all of said bolts being provided with tightening nuts.

What I claim as my invention is—

1. A grinding or polishing wheel comprising a body portion having its surface provided with grooving or depressions and an abrading facing formed by a sheet of emery or analogous abrading cloth or paper secured to said surface by an intervening stratum of glue or cement and depressed within the grooving or depressions thereof so as to provide an abrading facing corresponding with the surface to which it is united substantially as and for the purpose described.

2. A grinding or polishing wheel comprising a disk of metal or analogous dense material having a grooved side, and an abrading facing formed by a sheet of emery or analogous abrading cloth or paper secured to the grooved side of the disk by an intervening stratum of glue or cement and depressed within the grooving thereof so as to correspond

with the grooved surface to which it is united, substantially as and for the purpose described.

3. A grinding or polishing wheel comprising a body portion having a spirally grooved surface, and an abrading facing united to said surface by glue or cement and depressed within the grooving thereof, so as to provide the wheel with a spirally grooved abrading facing, substantially as described.

4. The within described improvement in the preparation of grinding or polishing wheels consisting in applying an abrading sheet to the surface of a wheel provided with grooving or recesses with an intervening stratum of glue or cement, and shaping and giving to such abrading sheet a permanent set in conformity with the grooved or recessed surface of the wheel, by pressure applied to depress the abrading sheet within the grooving or recesses in the wheel.

5. The within described improvement in the preparation of grinding or polishing wheels, consisting in applying an abrading sheet of emery or analogous abrading cloth, paper or like material to the surface of a wheel provided with grooving or depressions, applying a flexible or elastic pad upon said sheet, and applying pressure so as to cause the pad to compress the abrading sheet in conformity with the surface of the wheel.

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