No. 862,702. PATENTED AUG. 6, 1907.

H. F. BROADHURST.

WHEEL.

APPLICATION FILED NOV. 17, 1906.

4 SHEETS—SHEET 1.

Fig. 1.

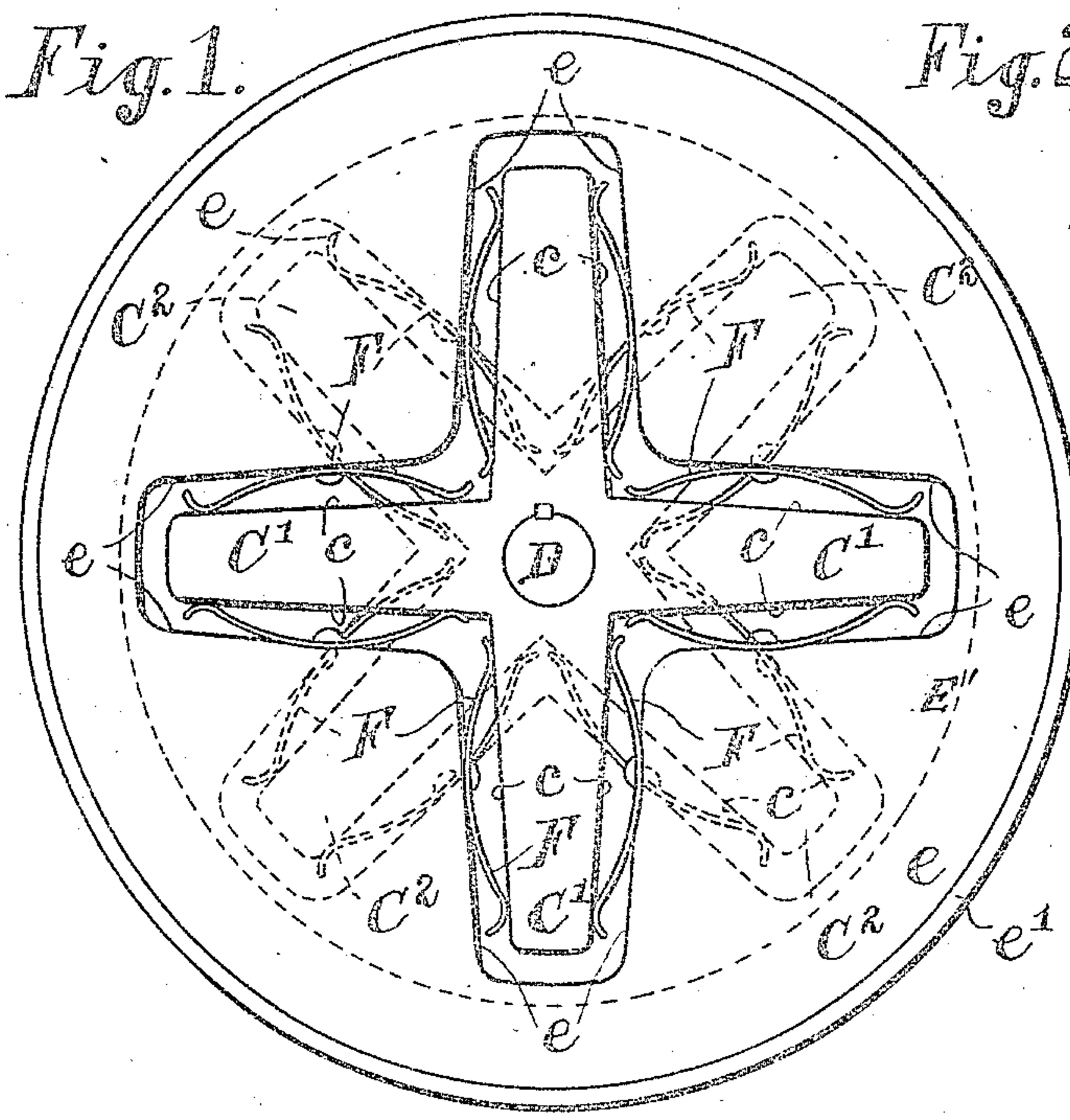


Fig. 2.

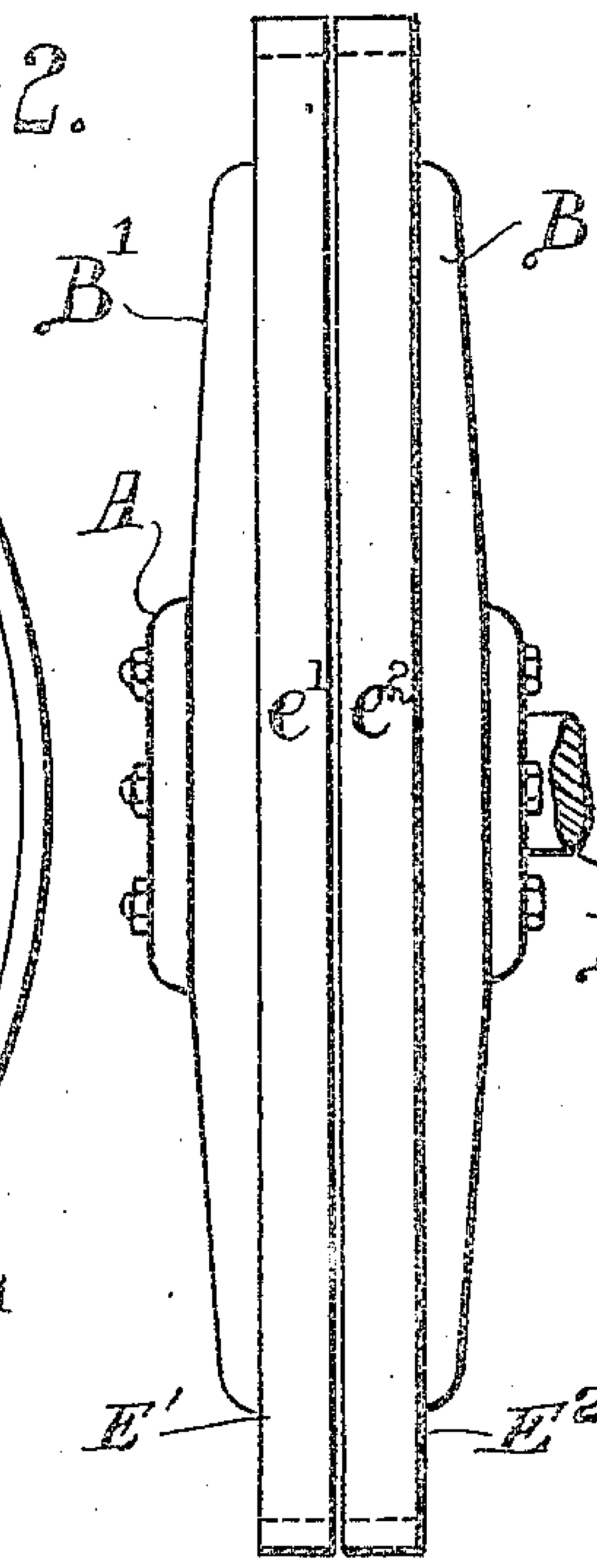


Fig. 3.

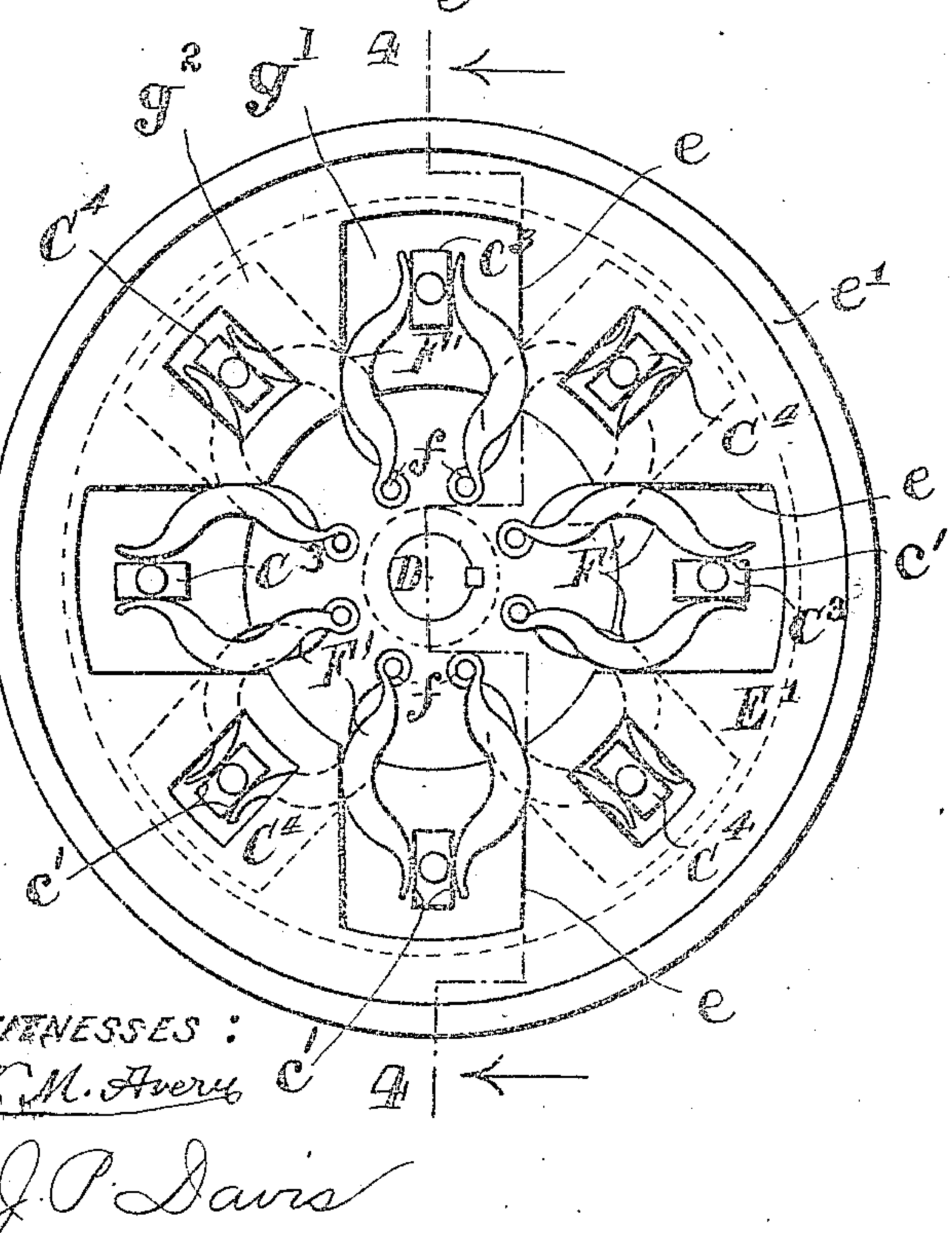
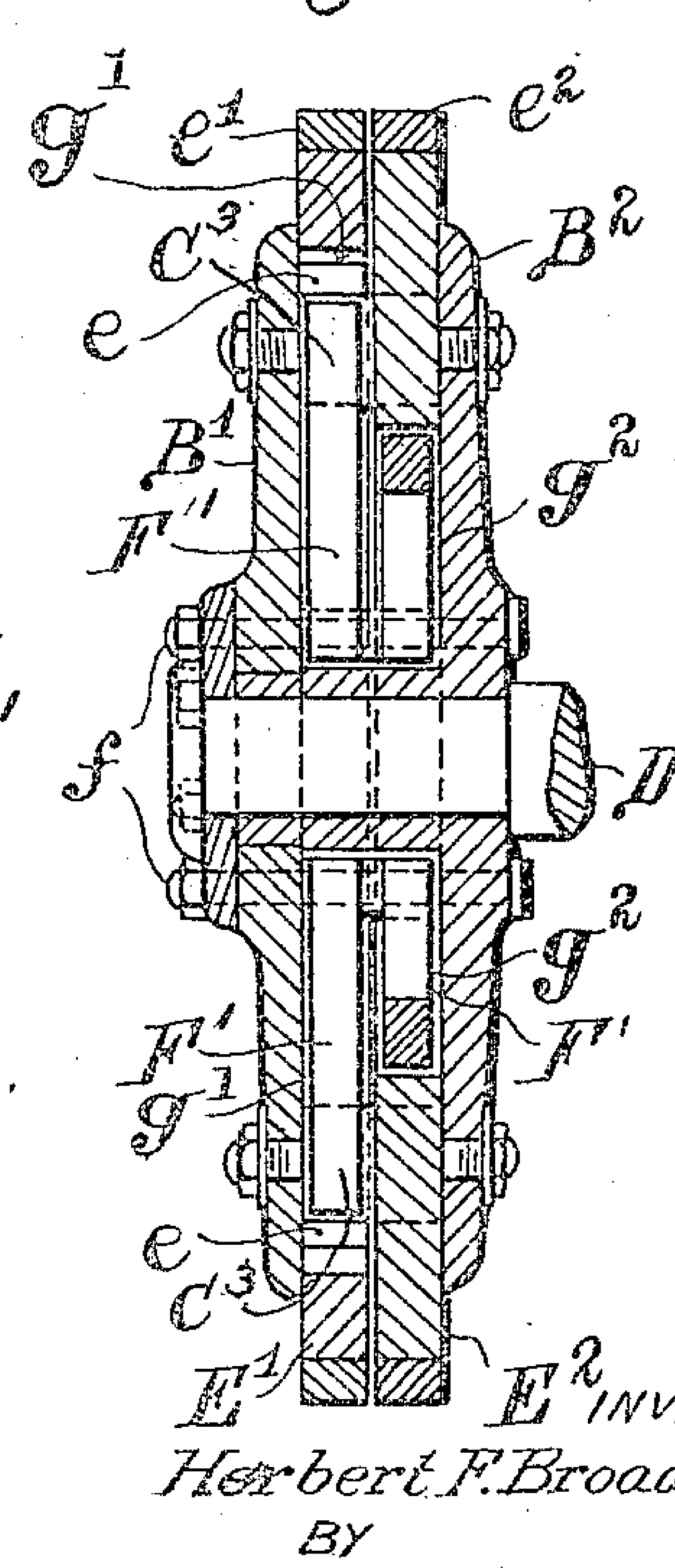


Fig. 4.



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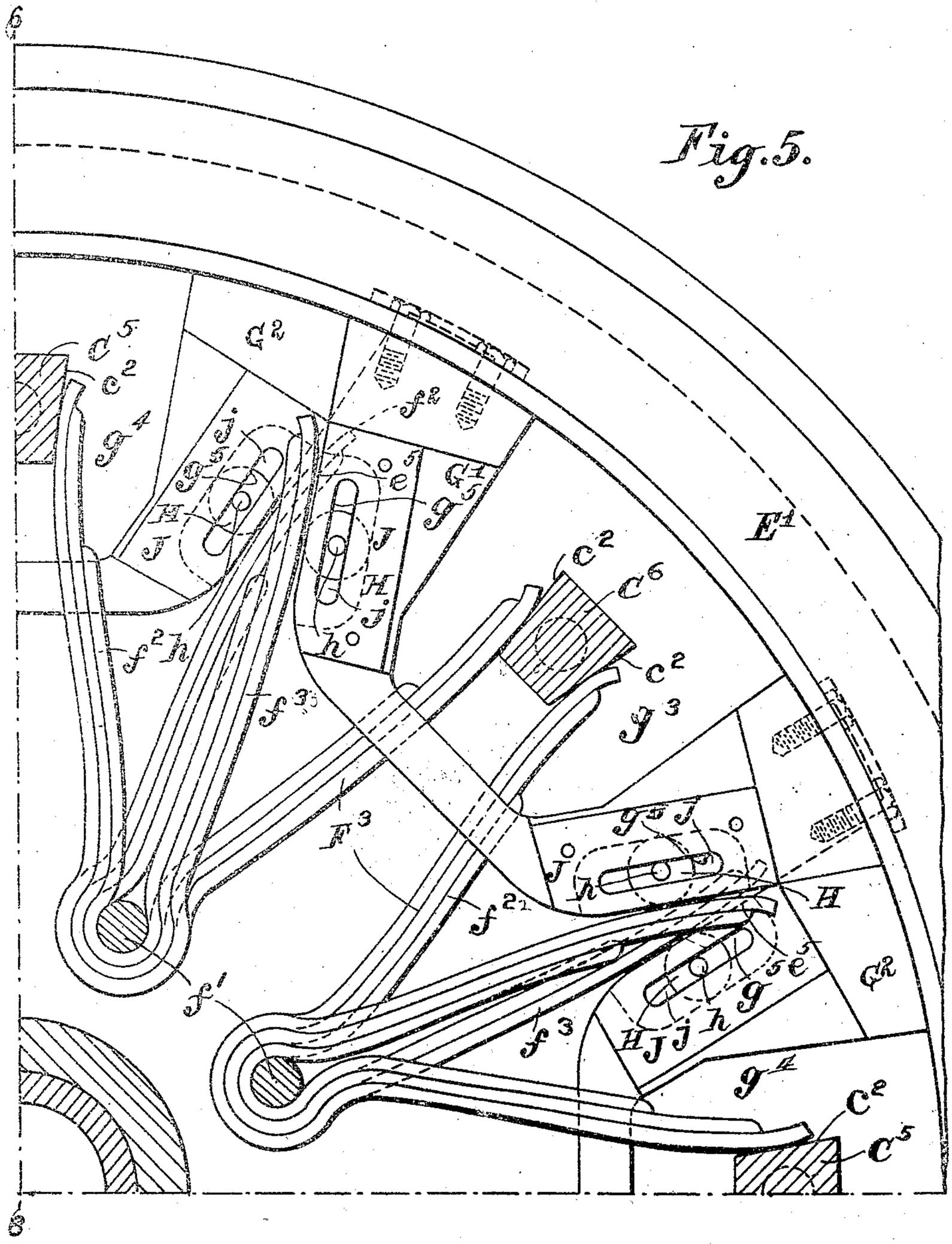
4 SHEETS—SHEET 2.

Fig. 5.



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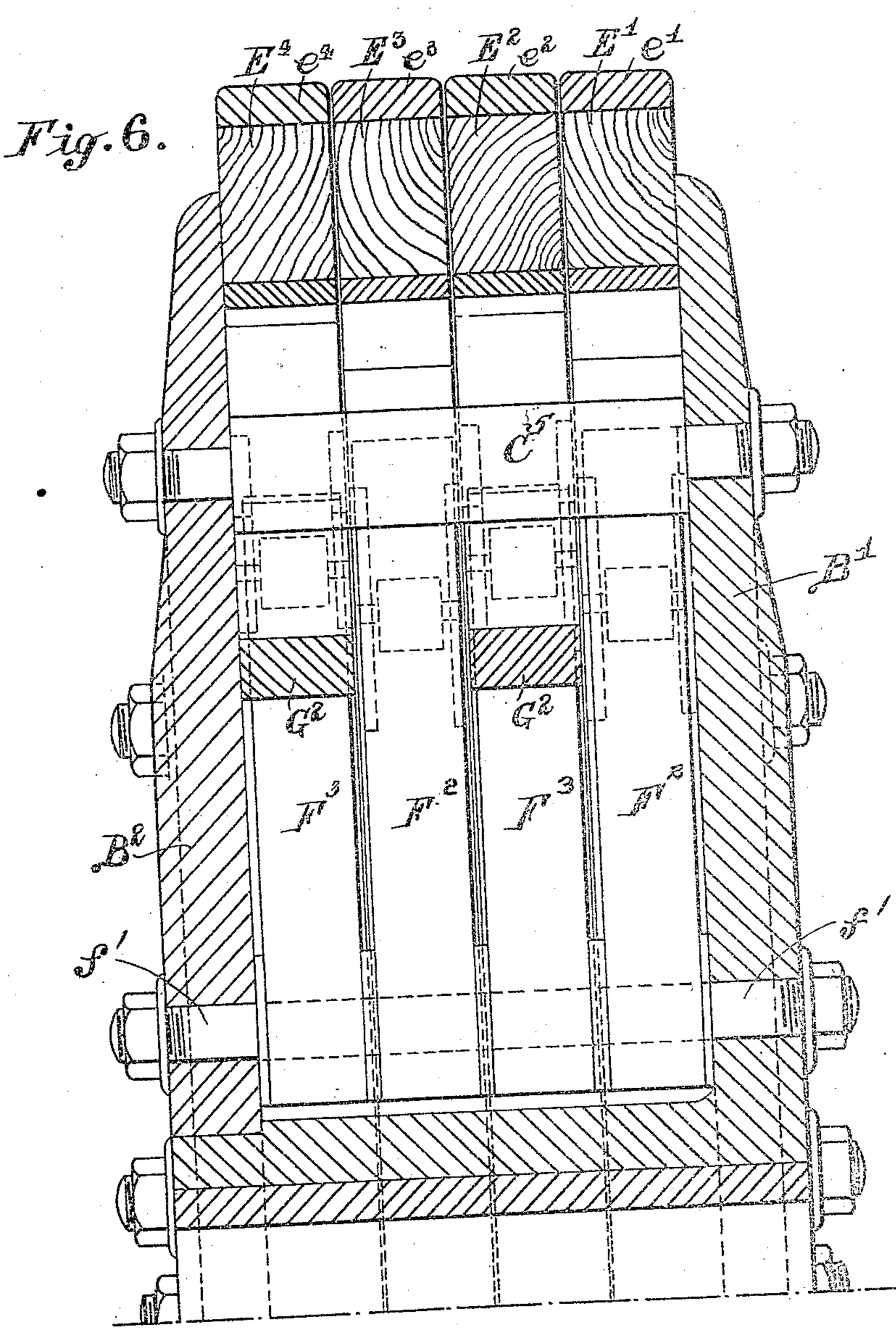
4 SHEETS—SHEET 3

Fig. 6.



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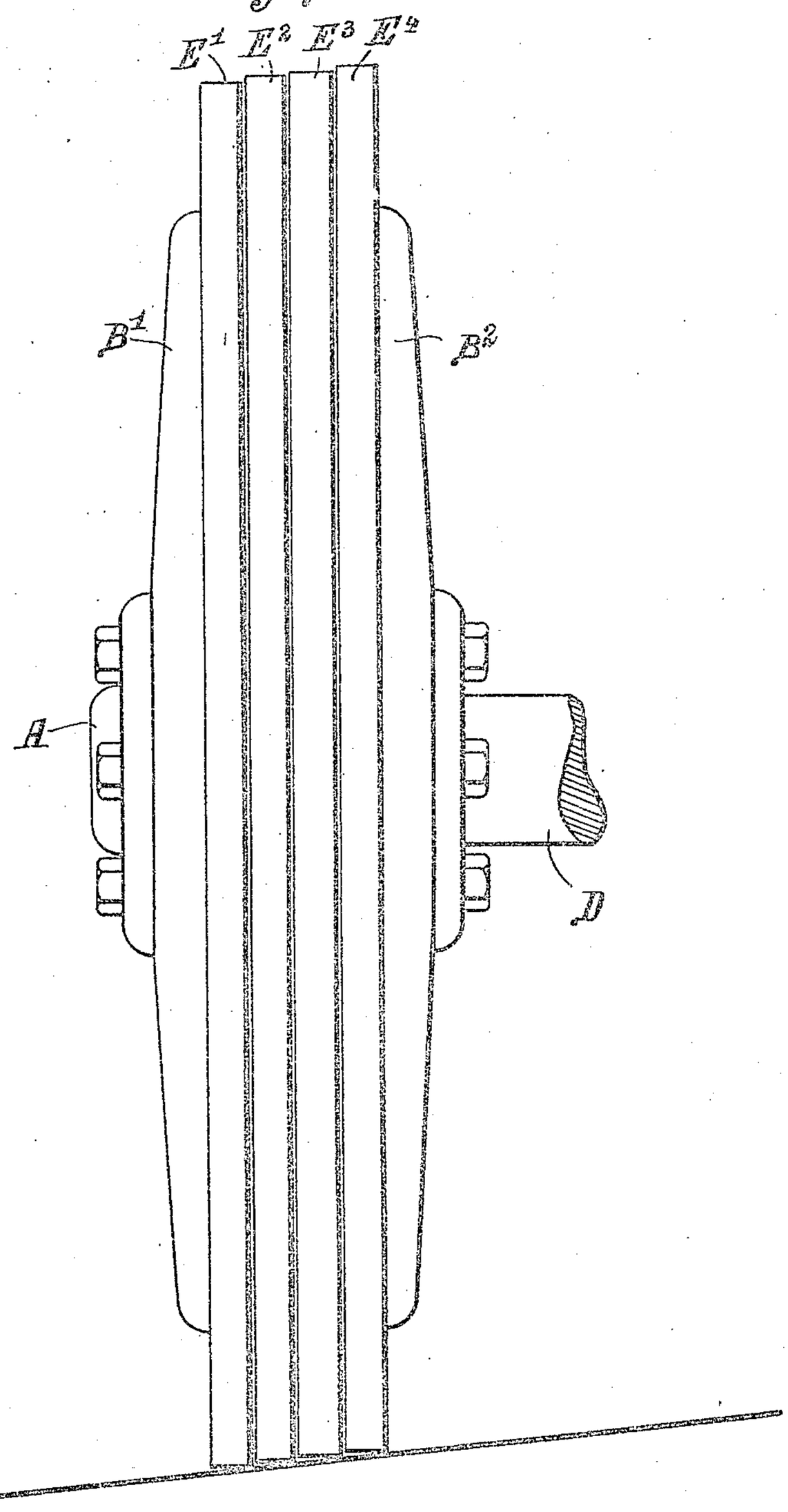
4 SHEETS—SHEET 4.

Fig. 7.



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WHEEL.

No. 862,702. Specification of Letters Patent. Patented Aug. 6, 1907.

Application filed November 17, 1906. Serial No. 343,859.

To all whom it may concern:

Be it known that I, HERBERT FREDERICK BROADHURST, a subject of the King of Great Britain, residing at 7 Barnstaple Mansions, Rosebery avenue, London, E. C., England, engineer, have invented certain new and useful Improvements in Wheels for Common Road-Vehicles, of which the following is a specification.

The object of this invention is to provide an improved spring road-wheel for vehicles, the invention being specially (although not exclusively) designed to provide a construction whereby a wheel having a broad tread may be rendered capable of always maintaining contact with the roadway across virtually the entire width of the tread of the wheel, notwithstanding that (owing to the camber of the road or other circumstances) the plane of the wheel-rim may not be perpendicular to the surface of the roadway.

The distinguishing feature of the invention is the fact that the springs act in all cases tangentially and never radially to the wheel as in the usual constructions of spring wheel, that is to say, the springs which are confined between radially extending guides provided on those portions of the wheel whose relative displacement the springs are employed to oppose, are each adapted on the one hand to slide so as to offer no resistance to stresses transmitted (in the plane of the wheel) in a direction parallel to the respective guides, and on the other hand to offer yielding resistance to stresses transmitted (in the plane of the wheel) in a direction not parallel to the respective guides. Hence the springs whatever their actual form, are never, according to the present invention, subject to stresses such as would be thrown upon a helical spring whose ends are attached to parts moving in opposite directions transversely to the axis of the spring.

According to the present invention the wheel is composed of three main portions, whereof two are integral (or virtually integral) with the hub and rim of the wheel respectively, while the third consists of the springs, which are interposed in pairs between the other two portions and serve to normally hold the rim portion concentric with the axle and at the same time transmit rotary movement in either direction from the hub to the rim of the wheel or vice versa. The rim portion may be constituted either by a single element displaceable as a whole (in opposition to the springs) in a plane perpendicular to the axle, or (in the case of a wheel having a broad tread) by a plurality of similar elements juxtaposed side by side and all adapted to contact with the ground simultaneously, each element carrying a separate tire and each being independently displaceable in a plane perpendicular to the axle.

That portion of the wheel which is integral with the hub comprises a pair of lateral guides (in the form of cheek plates or their equivalents) between which the rim portion (whether composed of one element or of a plurality of independent elements as already mentioned) is constrained to move perpendicularly to the axle; and sets of guides which extend radially (or approximately radially) to the axle and serve, in conjunction with corresponding guides on each element of the rim portion of the wheel and with the springs (for which said guides constitute abutments), to limit the displacement of the respective elements of the rim portion both transversely to the axle and angularly in relation to the hub.

The guides constitute abutments for the springs, which make sliding contact with the respective guides on the rim portion, or with those on the hub portion, or with both, so that the springs are relieved of all torsional stress.

In its most rudimentary form the improved spring wheel may be regarded as comprising a set of radial arms carried by the hub; a disk disposed in the plane of said arms and apertured to accommodate the hub and arms, the periphery of the disk serving to carry the tire; cushion springs interposed between the arms and the bounding walls of the aperture in the disk and adapted to permit the latter to slide transversely to the axle, and also to turn through a small angle relatively to the hub, without themselves being subjected to torsional stress; and a pair of cheek plates carried by the axle and serving to retain and guide the disk in the plane of the radial arms and also (if necessary) to prevent the escape of the springs laterally. When compounded (*i. .e* having its rim portion constituted by two or more annular elements juxtaposed side by side and independently displaceable transversely to the axle) such a rudimentary form of the improved spring wheel may have as many sets of radial arms and cushion springs as there are disks or annular elements comprised in the rim portion, the arms of one set alternating, as regards angular position, with those of the adjacent set or sets.

Reference is to be had to the accompanying drawings wherein

Figure 1 is a side elevation of what may be termed the rudimentary form of a compound spring wheel constructed according to the present invention, the nearer cheek plate being removed. Fig. 2 is an edge view of the wheel. Fig. 3 is a similar view to Fig. 1, showing a slightly modified construction, and Fig. 4 is a section on line 4—4 of Fig. 3. Fig. 5 is a side view of part of a compound spring wheel with the nearer cheek plate removed, drawn to a larger scale and showing a practical development of the invention, and Fig. 6 is a section on line 6—6 of Fig. 5. Fig. 7 is an edge view of a compound spring wheel, illustrating its action when running or resting upon a road having a considerable degree of camber.

Similar letters of reference indicate corresponding parts throughout the drawings.

Figs. 1 and 2 show a compound spring wheel

whereof the rim-portion comprises two similar elements each independently displaceable transversely to the axle. Upon the hub A are fixed a pair of cheek plates B^1 B^2, and between them two similar sets C^1 C^2 of arms which extend radially to the axle D. In the example illustrated each set of radial arms consists of four members disposed at equi-angular intervals about the axle, the arms of the one set bisecting the angles made by those of the other set.

Each of the two similar elements E^1 E^2 of the rim-portion of the wheel consists of a disk encircled by and carrying a separate tire e^1 or e^2 and apertured as indicated so as to accommodate the hub A and the corresponding set of radial arms C^1 or C^2, in whose plane the disk is retained by the adjacent cheek plates B^1 or B^2 on the one side and by the other disk on the opposite side, so that each disk can only move transversely to the axle D.

The aperture in each disk E^1, E^2, while conforming in general configuration to the hub and arms, is sufficiently large not only to permit the necessary play of said disk in all directions in its own plane, but also to admit springs F, F, between the approximately radial sides c, c, of each arm and the opposed portions e, e, of the bounding wall of the aperture in the disk. These springs F, which may be attached to the arm or (as shown) to the disk, or may be free to slide relatively to both, are of such form as to act only as cushions between the disk and arms without being subjected to torsional stress in consequence of relative movement between those parts, and for this purpose the springs may be simple segmentally curved leaf springs (single or laminated), the ends of the spring bearing upon the one part while the summit of the curve bears upon the other part as indicated. It will be obvious however that the form of the springs might be considerably varied; thus for example, helical or spiral springs might be used, or cushions of an elastic substance such as rubber.

As it may happen that (with some forms of springs) only a small part of the length of each radial arm is actually utilized to form an abutment for the associated springs, while all the arms are virtually integral with the cheek plates, it follows that each arm may be replaced by a block serving as a combined cross-brace and distance piece between the cheek plates B^1, B^2, as indicated in Figs. 3 and 4. In such case, alternate blocks C^3 and C^4 serve as abutments for the springs F^1 appertaining to the respective disks E^1 E^2, and those of each set pass through apertures g^2 or g^1 in the disk to which they do not appertain, said apertures being sufficiently large to allow of the necessary play of the disk relatively to the block. In the construction illustrated in Figs. 3 and 4, that end of each spring F^1 which is nearest to the center is shown as attached to and capable of turning about a cross-pin or bolt f which connects the cheek plates B^1 B^2 near the hub A, the opposite end of the spring making sliding contact with the approximately radial surface c^1 of the corresponding block C^3 or C^4, while the bow of the spring makes sliding contact with the opposed surface e which bounds the aperture in the corresponding disk E^1 or E^2. There are eight cross-pins f while two springs, appertaining respectively to the disks E^1 and E^2, are attached to each cross-pin.

In Figs. 5 and 6, which illustrate a practical development of the arrangement shown in Figs. 3 and 4, the rim portion of the wheel comprises four similar and independent elements E^1 E^2 E^3 E^4 mounted side by side. Of these the first and third elements (counting from one face of the wheel) E^1 E^3, are supported by springs F^2 which in the face view, Fig. 5, coincide with one another, while the second and fourth elements E^2 and E^4 are similarly supported by springs F^3 which in the same view likewise coincide with one another. Each spring is two-armed, its middle being bent to form an eye rotatable about one of the cross-pins f^1 while both of its arms f^2 f^3 extend from the pin in a direction approximately radial to the wheel, the free end of the one arm f^2 bearing against one of the radial faces c^2 of a block C^5 or C^6 while the other arm f^3 takes a sliding bearing, as hereafter described, against the corresponding element of the rim portion of the wheel.

Each cross-pin f^1 carries four springs, two as F^2, for the elements E^1 E^3 and two, as F^3, for the elements E^2 E^4, the springs F^2 alternating with the springs F^3 as indicated in Fig. 6.

Each element E^1 E^2 E^3 and E^4 of the rim portion of the wheel consists of a simple annular felly carrying on its outer periphery the corresponding tire e^1 e^2 e^3 or e^4, and provided on its inner side with brackets G^1 or G^2 which afford a sliding bearing for the arms f^3 of the corresponding set of springs F^2 or F^3, each of said brackets being adapted, by means of apertures g^3 or g^4 or otherwise, to clear the corresponding block C^6 or C^5 of the set which do not appertain to the particular element to which the bracket is attached.

As each spring arm f^3 may have a considerable sliding movement relatively to the bracket G^1 or G^2 against which it bears, it is preferred to interpose an anti-friction device between the bracket and spring. This device may consist, as shown, of a roller H carried by the bracket and having its periphery outstanding from the face e^5 of the latter so as to receive the pressure of the spring, the roller being fitted to run upon a path g^5 on the bracket approximately parallel to the radial face c^2 of the corresponding block C^5 or C^6. In order to retain the roller H in position, it is preferably fitted to work between a pair of side plates J J integral with the bracket and having slots j in which the roller gudgeons h are free to play.

It is to be clearly understood that in all wheels, whether simple or compound spring wheels, constructed according to the present invention, the springs (whatever their form or arrangement) operate only tangentially and not radially to the wheel, this being the case whether any particular spring happens for the time being to be bearing its share in supporting the load, or in transmitting rotary motion between the hub and rim portions, or in fulfilling both of these functions. That is to say, each spring operates solely in a direction perpendicular to that radius of the wheel to which the surfaces c^2 and e^5 (corresponding to and co-acting with said spring) are approximately parallel. Hence, for example, those springs which at any moment offer resistance to displacement of the rim portion transversely to the axle in consequence of the load, are those situated not vertically above or below, but on or near the level of the axle, at each side thereof.

It will be evident, without further description, that

the number of elements constituting the rim portion of a compound spring wheel constructed according to this invention, may be increased indefinitely within practical limits, either odd or even numbers of such elements being used as may be found most convenient, and the arrangement of the various parts and mode of attaching the springs being modified as may be necessary. On the other hand, by suppressing all but a single element of the rim portion, a wheel constructed according to this invention, will constitute a simple (*i. e.* a non-compound) spring wheel capable of being employed for any purpose which a spring wheel is adapted to serve.

It is to be clearly understood, in the case of a compound wheel, that no part of the wheel which is not displaceable transversely to the axle, and spring-held normally concentric therewith, is at any time in contact with the roadway. Hence, while each element E^1 E^2, etc. comprised in the rim portion of the wheel is thus displaceable, and constantly in contact with the ground, the cheek plates B^1 B^2, or any equivalent parts not so displaceable, are maintained constantly clear of the ground, this arrangement being essential to the wheel accommodating itself to the camber of the roadway or other obliquity of the surface over which the vehicle is passing.

Claims.

1. A spring road wheel for vehicles, consisting in the combination of a rim portion displaceable transversely to the axle; a hub provided with cheek plates adapted to confine such displacement of the rim portion to movement of said portion in its own plane; guides integral with the hub and rim portions respectively and extending approximately radially to the wheel; and springs in compression interposed between the guides on the hub and rim portions and each adapted on the one hand to slide so as to offer no resistance to stresses transmitted in the plane of the wheel in a direction parallel to the respective guides, and on the other hand to offer yielding resistance to stresses transmitted in the plane of the wheel in a direction not parallel to the respective guides, substantially as described.

2. A compound spring road-wheel for vehicles, consisting in the combination of a plurality of separate rim elements juxtaposed side by side and adapted to contact with the ground simultaneously, each having a circular periphery and being independently displaceable transversely to the axle; a hub provided with cheek plates adapted to confine the displacement of said rim-elements to movement each in its own plane, the outermost of said elements respectively making sliding contact with the adjacent cheek plate; guides integral with the hub and with each of the rim-elements respectively and extending approximately radially to the axle; and springs in compression interposed between the guides on the hub and those on the respective rim elements and each adapted on the one hand to slide so as to offer no resistance to stresses transmitted in the plane of the wheel in a direction parallel to the respective guides, and on the other hand to offer yielding resistance to stresses transmitted in the plane of the wheel in a direction not parallel to the respective guides, substantially as described.

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