No. 845,103. PATENTED FEB. 26, 1907.

B. LJUNGSTROM.

GEARING.

APPLICATION FILED JULY 26, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

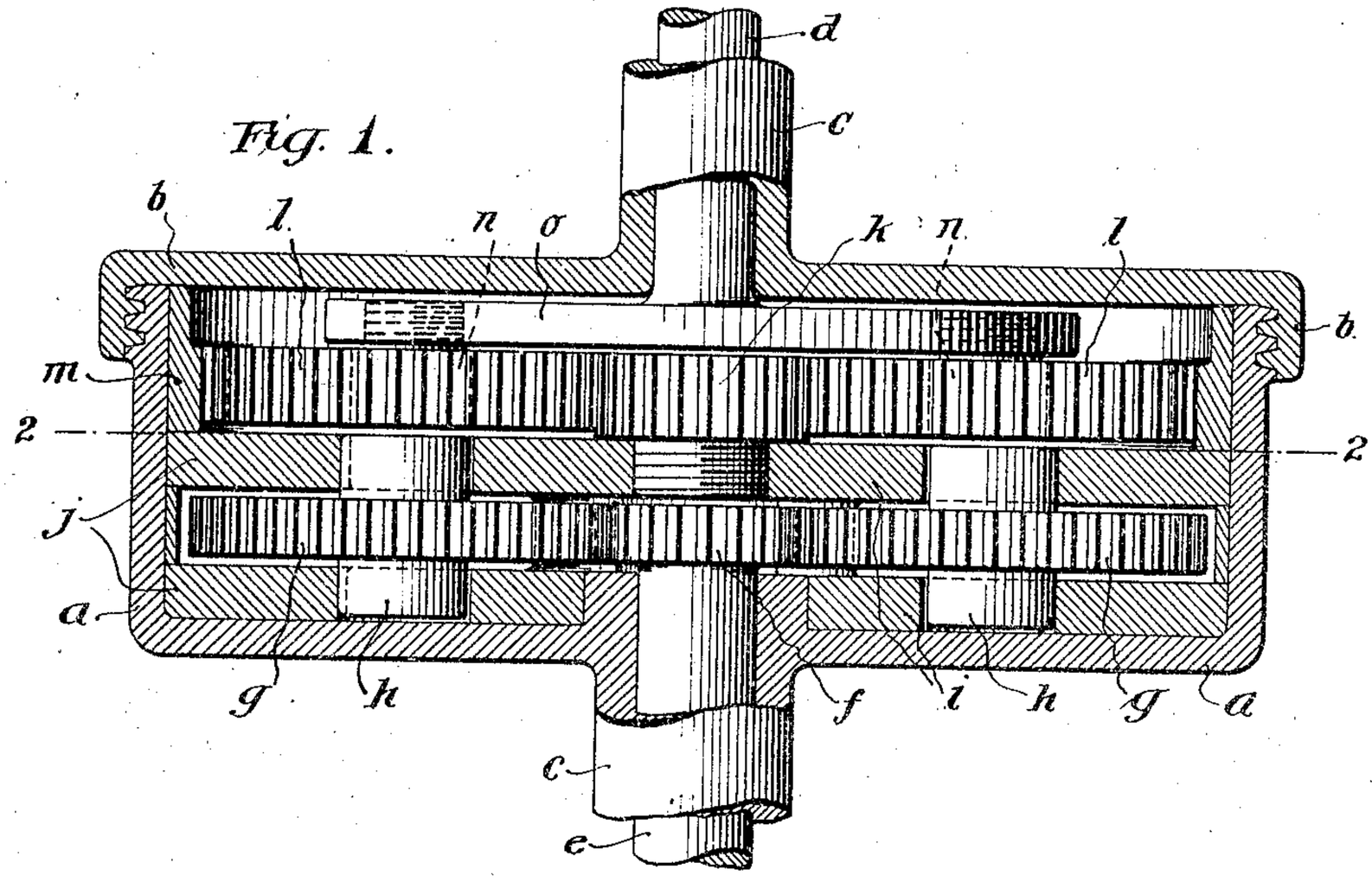
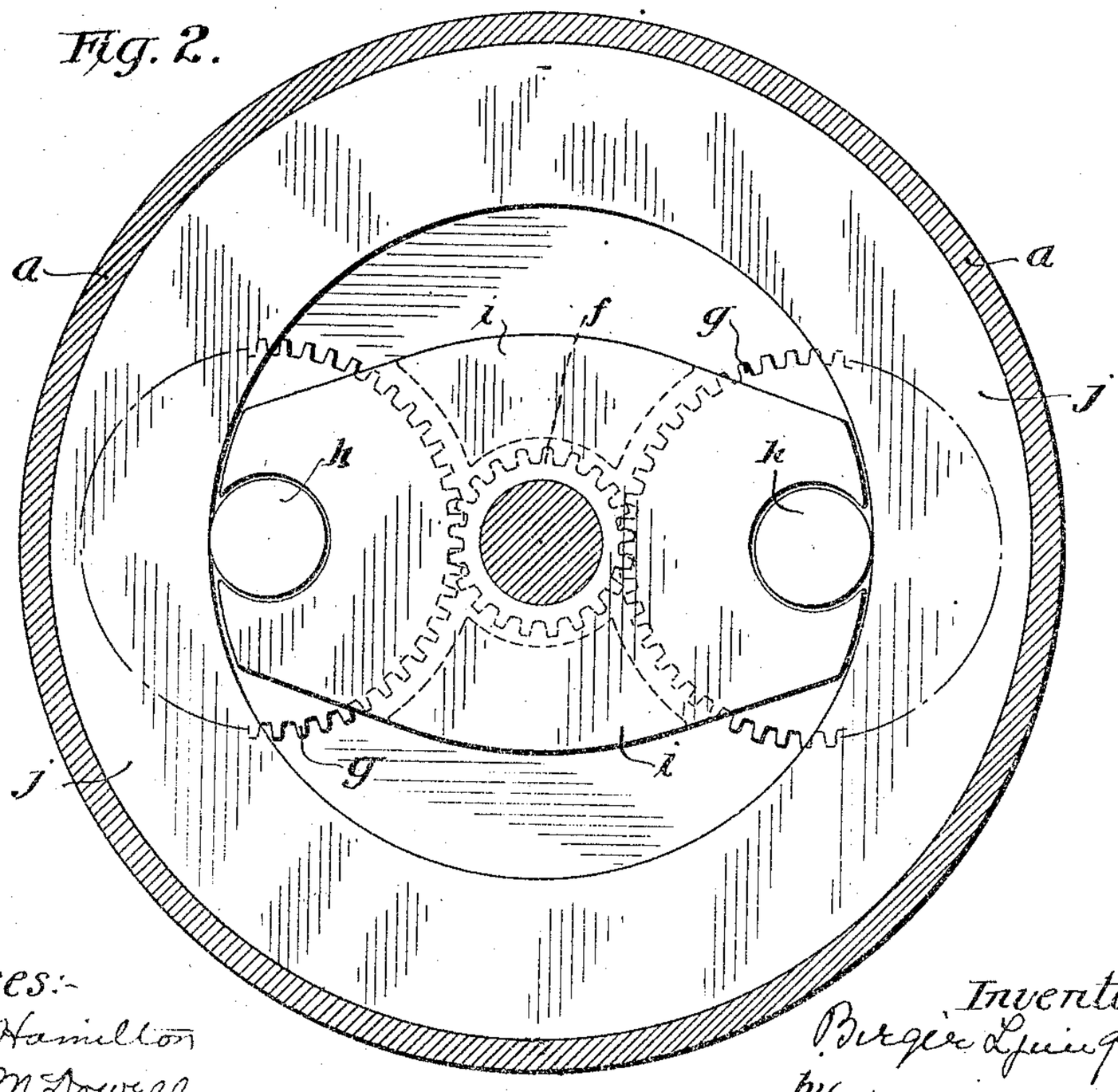


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

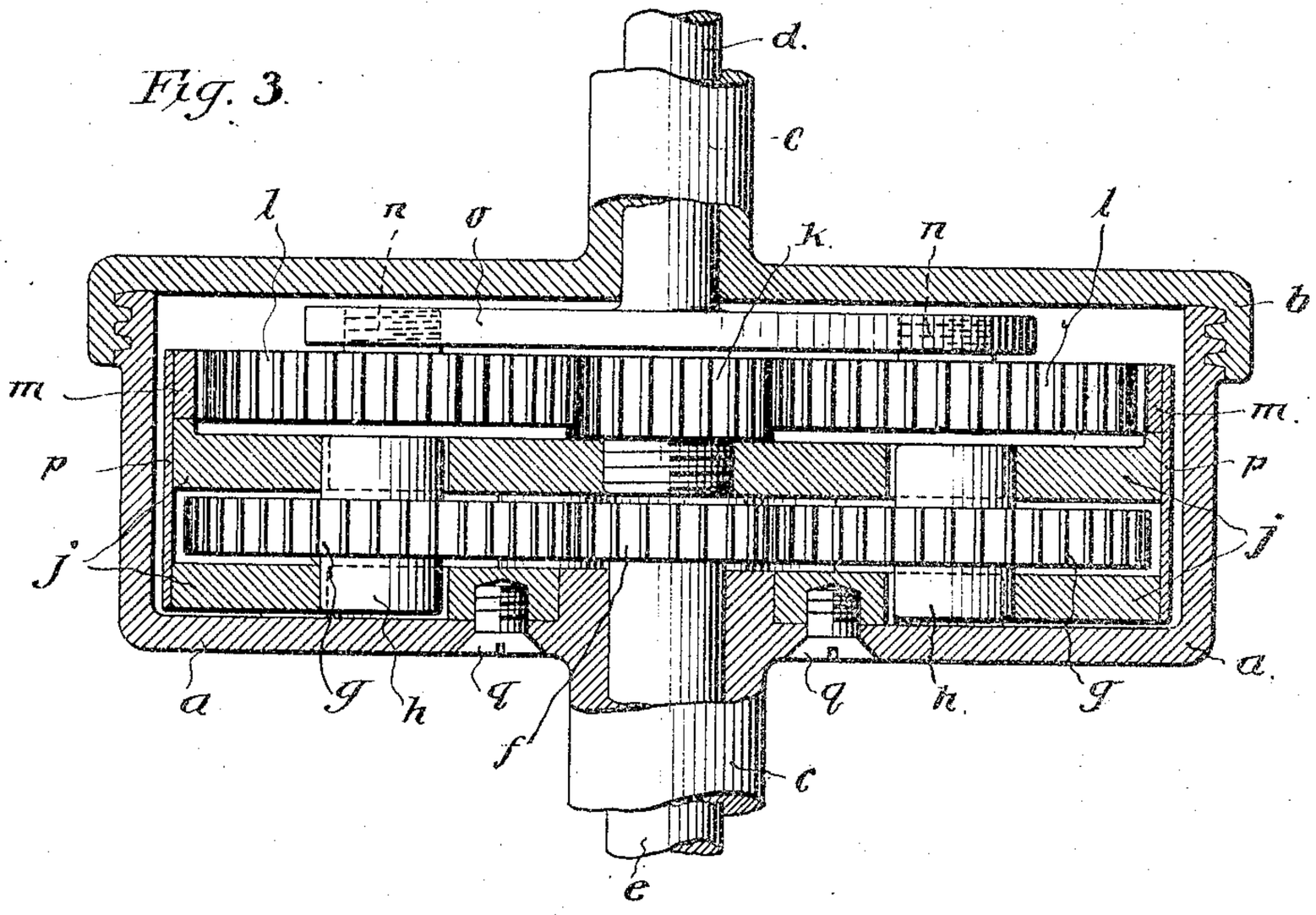
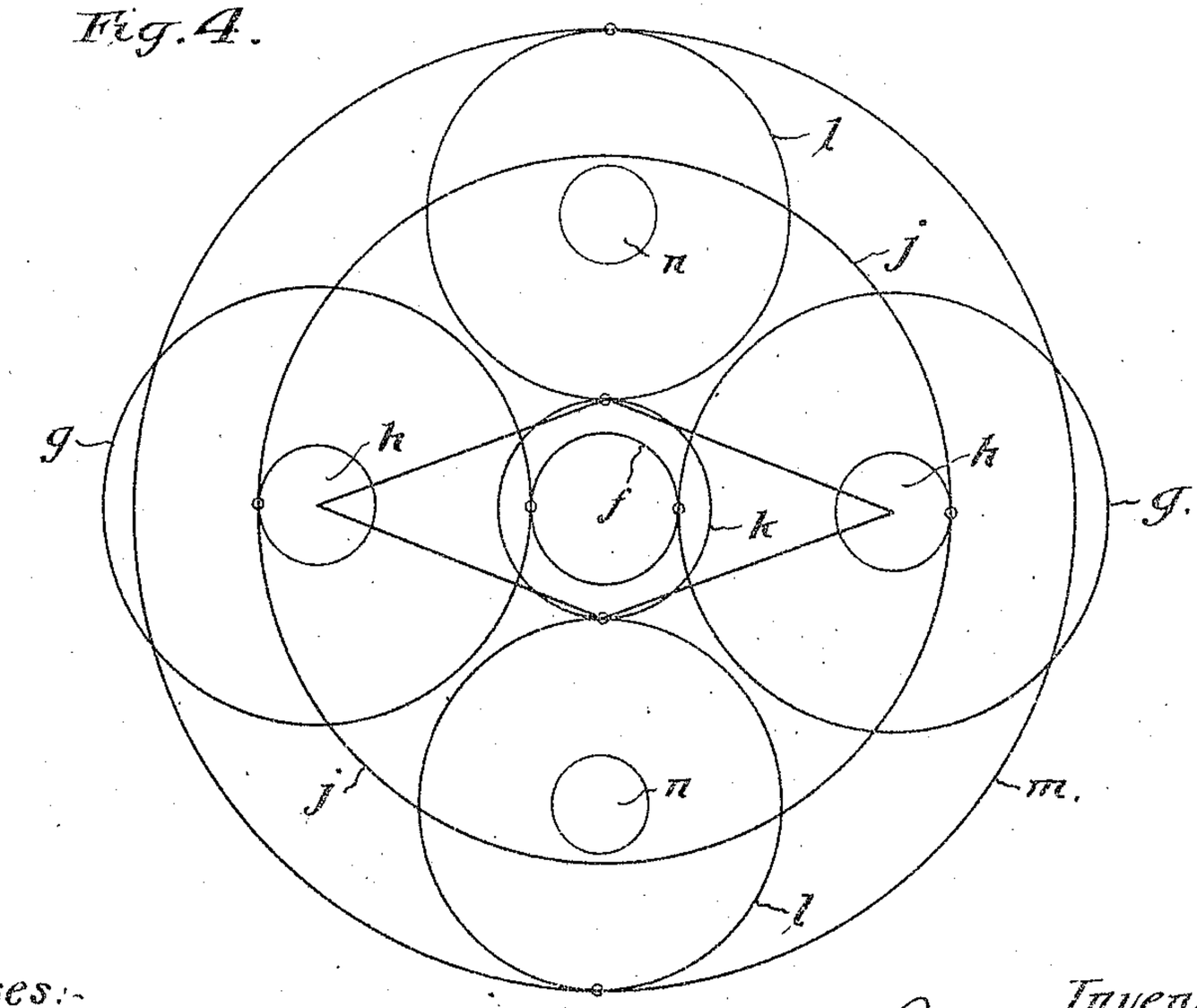


Fig. 4.



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UNITED STATES PATENT OFFICE.

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GEARING.

No. 845,103. Specification of Letters Patent. Patented Feb. 26, 1907.

Application filed July 26, 1905. Serial No. 271,369.

To all whom it may concern:

Be it known that I, BIRGER LJUNGSTROM, a subject of the King of Sweden, residing at Stockholm, Sweden, have invented a new and useful Improvement in Gearings, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to a gearing device for effecting a certain relative motion between two shafts, and more particularly two high-speed shafts in line with each other and designed to rotate in the same direction. Gearing devices of this kind are used in different machines, among which are centrifugal machines for separating solid matter from liquids, in which a device within the bowl is driven from a shaft within the hollow driving-shaft of the bowl, the first shaft having a motion which relatively to the shaft of the bowl is very slow.

According to this invention the desired motion between the two shafts is effected by means of small gear-wheels rotating around their own axes, said axes also rotating around the shaft of the centrifugal bowl. As, however, the rotating speed of a centrifugal bowl is very high, these wheels rotating bodily around the shaft of the centrifugal bowl would on account of the centrifugal force press so hard on their bearings that great difficulties would arise against their being journaled and possibly make it impracticable to journal them at all. By my invention such difficulties are avoided, and, besides, the whole gearing mechanism is so arranged that it takes up a very small space.

In the drawings, Figure 1 is a vertical section, and Fig. 2 a horizontal section, of one form of mechanism embodying my invention. Fig. 3 is a vertical section of a modification. Fig. 4 is a schematic view.

The form shown in Figs. 1 and 2 will be first described. *a* is a frame in the form of a box, and *b* its cover, the box and cover both having hollow extensions *c c*. The shaft *d* is placed within the extension *c* of the box-cover. *c* and *d* are the two shafts between which the desired relative speed or motion is to be effected, and for the purpose of the present description it may be assumed that the shaft *c* is driven at the desired speed from a suitable driving-shaft, the shaft *d* being driven by the shaft *c* and having imparted to it the desired speed of rotation relative to the shaft *c* through the medium of the gearing device within the box. *e* is a third shaft within the extension *c* of the box. This shaft may be assumed for the purposes of the present description to be stationary, although it may rotate provided it rotate in a direction opposite to shaft *c* or in the same direction at a different speed. The shaft *e* is on its upper end provided with a cog-wheel or pinion *f*, gearing into the two gear or cog wheels *g*. The gears *g* are provided with shafts *h*, pressing against the rolling-surfaces of the inner walls of the annular frames *j*, which are secured to the box *a*. The shafts *h* have rather a large diameter compared with the wheels *g* and are embraced by the frame or cross-piece *i*, rotatable around the axes of the shafts *c d e*. When a relative motion is effected between the shaft *e* and pinion *f* and the shaft *c* and box *a*, said motion being, for instance, effected by rotating the box *a* and fixing the shaft *e*, the gears *g* will rotate around the axis of the box *a*. On account of the centrifugal force they will then press the shafts *h* hard against the rolling-surfaces of the frames *j*. As the gears *g*, however, mesh with the pinion *f* they will when being brought around the axis of the box *a* rotate around their own axis, and so the shafts *h* will roll upon the rolling-surfaces of the frames *j*. The gears *g* with their shafts *h* will thus get a planetwise motion around the axis of the box *a*, imparting a rotary motion to the cross-piece *i*. *k* is a pinion secured to the cross-piece *i*, the axis of the pinion coinciding with the axes of the shafts *c d e*. *m* is a cog-ring or circular rack with internal teeth secured to the inner wall of the box *a*. The two spur gear or cog wheels *l* are placed between and mesh with the pinion *k* and rack *m*. The cog-wheels *l* rotate on shafts *n*, that project from the fram or disk *o*, secured to the shaft *d*.

As the cross-piece *i* rotates as above described the pinion *k* rotates, and the gears *l* rotate on shafts *n* and at the same time roll on the rack *m*, and consequently the shafts *n* and gears *l* will get a planetwise motion around the pinion *k*, imparting a rotary motion to the disk *o* and shaft *d*. In this way the shaft *d* will rotate relatively to the shaft

c and box *a*, and thus the desired relative motion between shaft *c* and shaft *d* is effected.

The operation of the gearing will be better understood if the box *a* be thought fixed and the shaft *e* rotated. Then the pinion *f*, meshing with the gears *g*, will rotate them, whereby the shafts *h* will roll upon the rolling-surfaces, imparting a rotary motion to the cross-piece *i* and the pinion *k*. Of course the speed of the pinion *k* will be very low relatively to the speed of the pinion *f*. The pinion *k*, meshing with the gears *l*, will rotate them, whereby on account of their meshing with the cog-ring *m* they will get a planetwise motion around the axis of the box *a*. They then impart a rotary motion to the disk *o*, the speed of said disk being very low relatively to the speed of the pinion *k*. Thus the shaft *d* will rotate at a very low speed relatively to the shaft *e*.

The construction shown in Fig. 3 differs from that shown in Figs. 1 and 2 in the following respects: The frames *j* and rack *m* are placed within and secured to a ring *p*, separate from and rotatable with reference to the box *a*. The cross-piece *i* is secured to the bottom of the box *a* by means of the screws *q*. As in the first-described construction, the gears *g*, driven from the pinion *f*, rotate around their shafts. As, however, in this construction the cross-piece *i* is fixed relatively to the box *a*, the frame *j* will obviously be rotated by means of the shafts *h*. The rack *m*, being secured to the ring *p*, which is secured to the frame *j*, rotates with the frame *j*, and the gears *l*, engaging both the pinion *k* and rack *m*, rotate on shafts *n* and at the same time roll on rack *m*, imparting a planetwise motion to the gears *l* and shafts *n*, and thus rotating disk *o* and shaft *d*. In this way the desired relative motion between shaft *c* and shaft *d* is effected.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The combination with the two shafts to be driven with a definite relative speed, of a third shaft and three frames, the first frame having a circumferential rolling-surface, a pinion and gears and their shafts carried by the second frame, the gear-shafts frictionally engaging said rolling-surface, gears carried by the third frame, a rack connected with one of the first two frames so as to rotate therewith, the last-named gears engaging the pinion and rack, and a pinion on the third shaft engaging the first-named gears, one of the first two frames being connected to one of the driven shafts and the third frame connected to the other driven shaft.

2. The combination with the two shafts to be driven with a definite relative speed, of a third shaft, all of said shafts having common axes, a pinion on the third shaft, gears outside the third shaft engaging said pinion, gear-shafts, a frame having a circumferential rolling-surface with which the shafts of said gears engage, a frame carrying said gears, one of said frames being connected with the first driven shaft, a pinion secured to the gear-carrying frame whose axis is common to the axes of said shafts, a circular rack connected with the frame having the rolling-surface so as to turn therewith, gears engaging the last-named pinion, and a third frame carrying the last-named gears and connected to the second driven shaft.

3. The combination with the two shafts to be driven with a definite relative speed, of a third shaft, a pinion thereon, gears engaging said pinion, gear-shafts, a frame carrying said shafts, an annular frame surrounding the third shaft between which and said frame said gears are arranged, the inner face of the last-named frame constituting a rolling-surface with which the shafts of said gears frictionally engage, one of said frames being connected with one of the said driven shafts, a pinion secured to the gear-carrying frame, a circular rack connected with the annular frame so as to turn therewith, gears engaging the last-named pinion and the rack, and a third frame connected to the second driven shaft and carrying the last-named gears.

4. The combination with the two shafts to be driven with a definite relative speed, of a box turning with the first shaft, gears in said box, gear-shafts, a third shaft, a pinion thereon engaging said gears, and two frames, one frame carrying the shafts of said gears and the other frame having a rolling-surface with which the shafts of said gears frictionally engage, one of said frames being secured to said box, a pinion secured to the gear-carrying frame, a circular rack within the box connected with the frame having a rolling-surface so as to turn therewith, gears in said box between and engaging the last-named pinion and the rack, and a third frame connected to the second driven shaft and carrying the last-named gears.

5. The combination with the two shafts to be driven with a definite relative speed, both shafts having a common axis and the second shaft revolving within the hollow first shaft, of a box turning with the first shaft, a third shaft whose axis is common to the axes of the other shafts and which turns within the first shaft, gears in said box between the axes of said shafts and the circumferential wall of the box, gear-shafts, a pinion on the third shaft engaging said gears, and two frames within the box, one frame carrying the shafts of said gears and the other frame being annular and located within the box between the gear-shafts and the box-wall, and its inner face constituting a rolling-surface with which the shafts of said gears frictionally engage, one of said frames being secured to said box, a pinion secured to the gear-carrying

frame, a circular rack within the box connected with the annular frame so as to turn therewith, gears in said box between the last-named pinion and the rack and engaging the pinion and the rack, and a third frame connected to the second driven shaft and carrying the last-named gears.

6. The combination with the two shafts to be driven with a definite relative speed, of a box turning with the first shaft, gears in said box, a third shaft, a pinion thereon engaging said gears, and two frames, one frame carrying the gears and the other frame having an annular driving-surface with which said gears engage, a member having a second annular driving-surface turning with the second frame, one of said frames being secured to said box, a pinion secured to the gear-carrying frame, other gears in said box engaging the last-named pinion and said second annular driving-surface, and a third frame connected to the second driven shaft and carrying the last-named gears.

7. The combination with the two shafts to be driven with a definite relative speed, of a box turning with the first shaft, gears in said box, gear-shafts, a third shaft, a pinion thereon engaging said gears, and two frames, one frame carrying the shafts of said gears and the other frame having an annular rolling-surface with which the shafts of said gears frictionally engage, a member having a second annular driving-surface turning with the second frame, one of said frames being secured to said box, a pinion secured to the gear-carrying frame, other gears in said box engaging the last-named pinion and said second annular driving-surface, and a third frame connected to the second driven shaft and carrying the last-named gears.

8. The combination with two shafts to be driven with a definite relative speed, of a third shaft, a pinion on the third shaft, gears engaging said pinion, a frame carrying said gears, a pinion carried by said frame, other gears engaging the second pinion, a second frame carrying an annular driving-surface adapted to drive the first set of gears, one of said frames turning with one of the driven shafts, and a third frame carried by the other driven shaft, one of the last two frames carrying the second set of gears and the other turning with an annular driving-surface adapted to engage the second set of gears.

9. The combination with two shafts to be driven with a definite relative speed, of a box turning with one of the shafts, a set of gear-wheels within the box, annular driving means within the box and with which said gears engage, a central pinion meshing with said gears, a cross-piece by which said gears are held, a pinion secured to the cross-piece, a second set of gear-wheels within the box and meshing with the pinion secured to the cross-piece, annular driving means within the box and which the second set of gears engage, and means connecting the said mechanism within the box and the other driven shaft.

In testimony of which invention I have hereunto set my hand, at Stockholm, on this 8th day of July, 1905.

BIRGER LJUNGSTROM.

Witnesses:

AUGUSTUS E. INGRAM,

HARRY ALBILEN.