

No. 704,645.

**Patented July 15, 1902.**

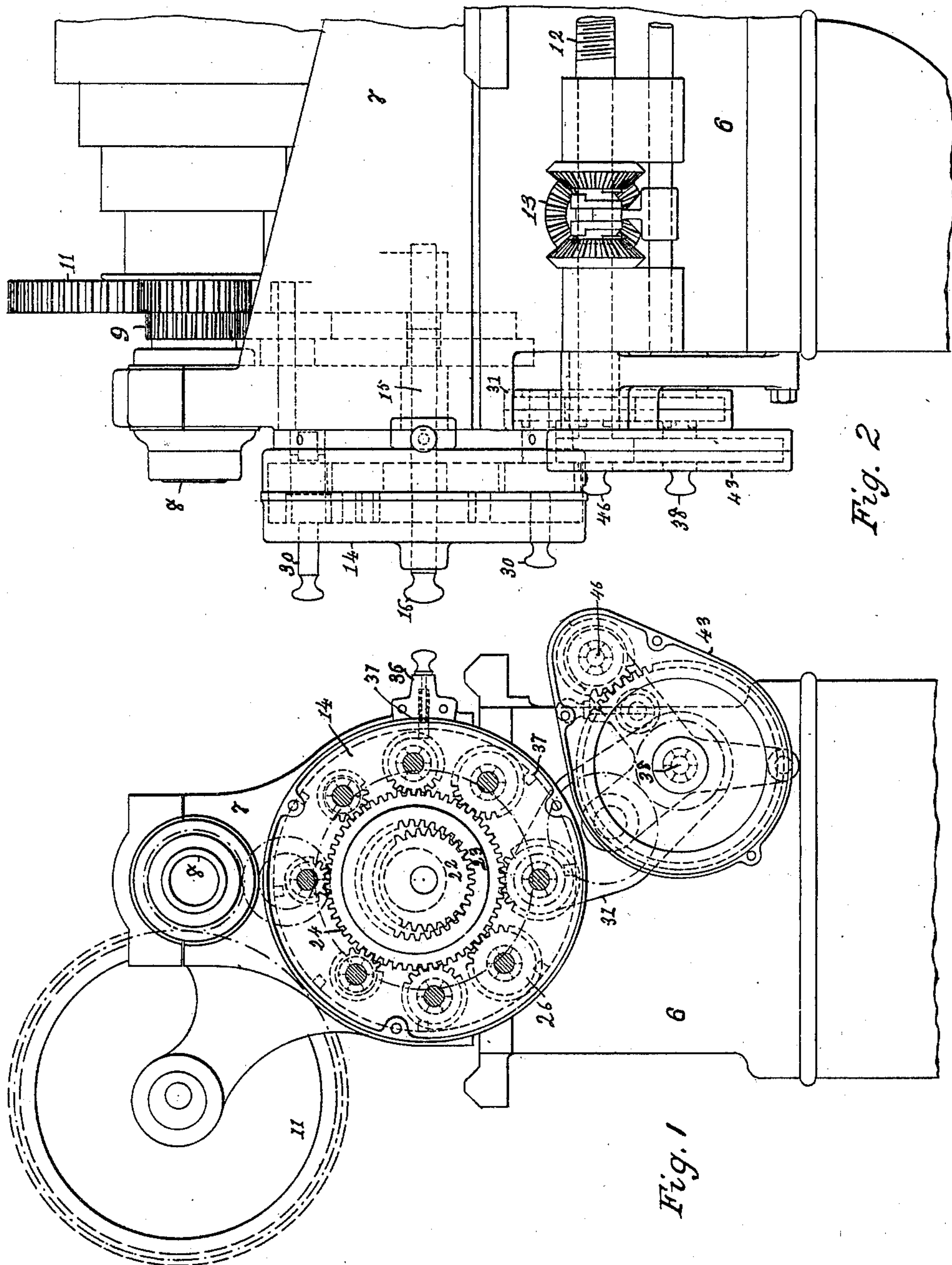
H. R. ISLER.

## DIFFERENTIAL SPEED MECHANISM.

(Application filed Nov. 4, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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2 Sheets—Sheet 2.

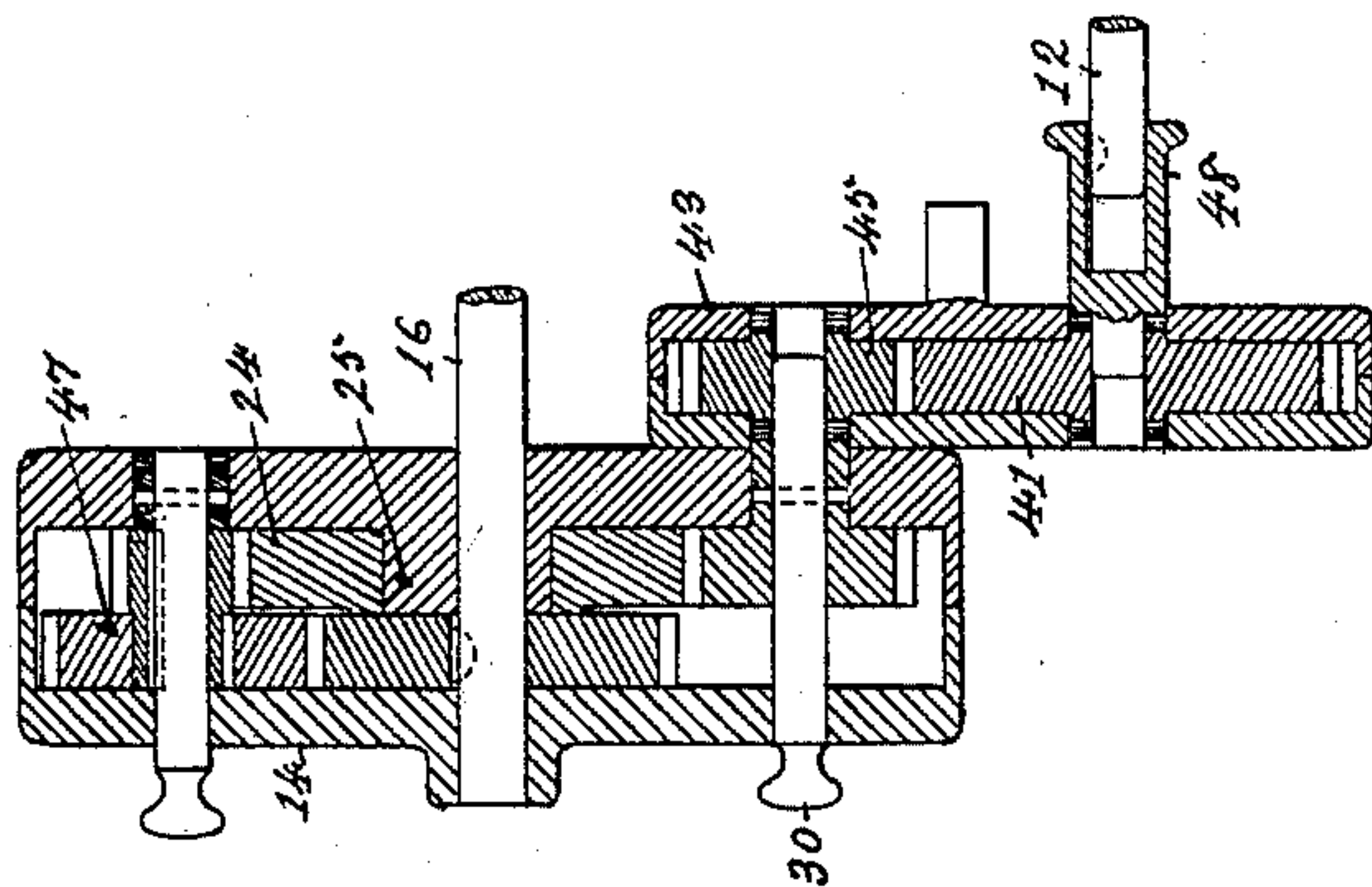


Fig. 5

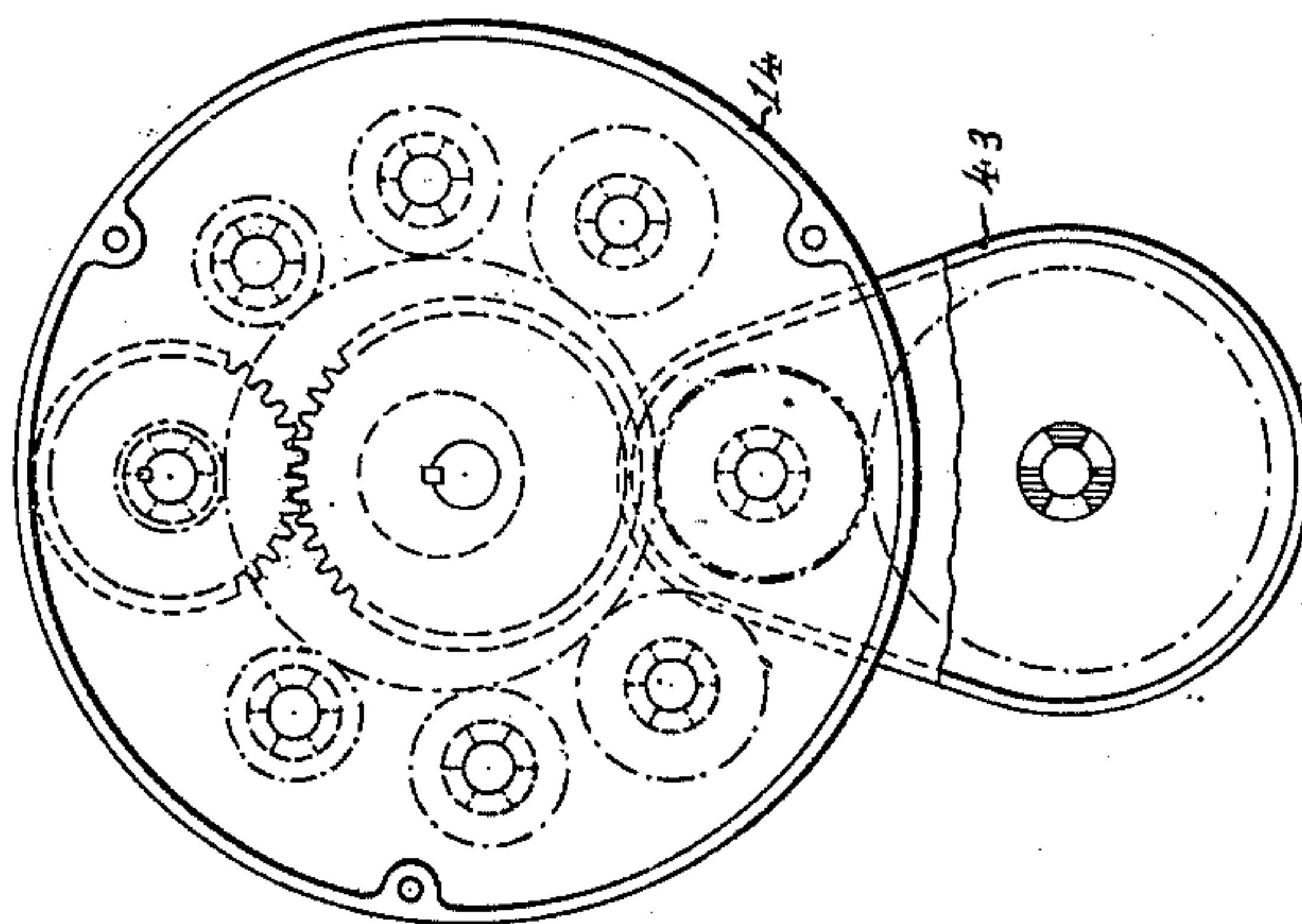


Fig. 4

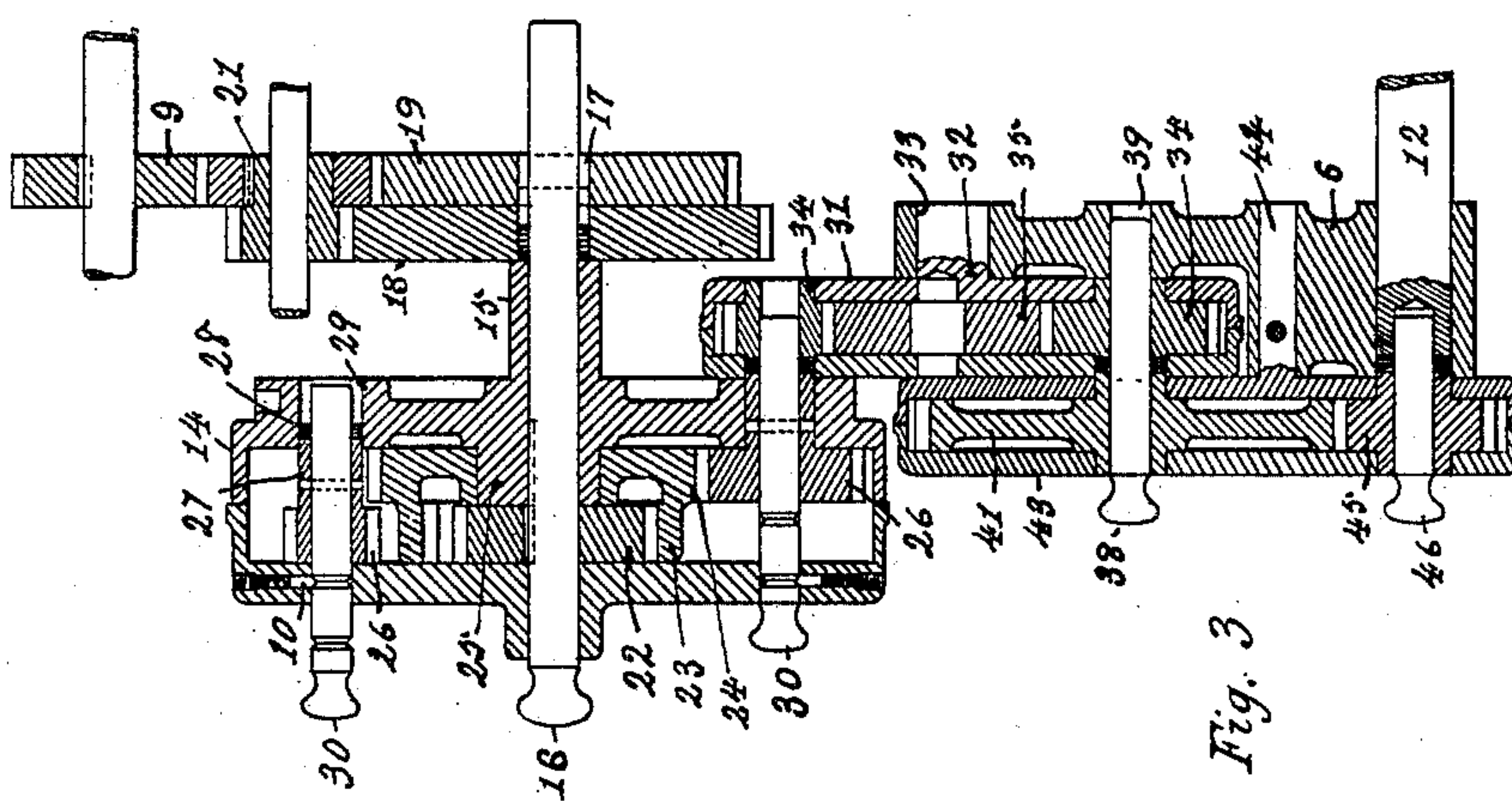


Fig. 3

WITNESSES

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# UNITED STATES PATENT OFFICE.

HERMAN R. ISLER, OF HAMILTON, OHIO, ASSIGNOR TO CHARLES F. HILKER,  
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## DIFFERENTIAL-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 704,645, dated July 15, 1902.

Application filed November 4, 1901. Serial No. 81,132. (No model.)

*To all whom it may concern:*

Be it known that I, HERMAN R. ISLER, a citizen of Switzerland, residing at Hamilton, Ohio, have invented a new and useful Improvement in Differential-Speed Mechanism, of which the following is a specification.

My invention relates to differential-speed mechanism of the class adapted to use on machine-tools and elsewhere; and the objects of my improvement are to provide a plural number of rotatively-adjustable casings each containing a series of pinions graduated in size, the pinions in each casing being journaled therein, with their axes equidistant from the axis of its rotation, said casings being mounted in such relation to each other that the axes of the pinions carried by one casing may be caused to successively register with the axis of either of the pinions carried by the adjacent casing. Clutches are formed on one end of the respective pinions, and means provided to move the pinions in one casing into and out of engagement with the pinions on the adjacent casing, whereby a variety of speeds may be imparted to a driven gear from the uniform speed of a driving-gear. These objects are attained in the following-described manner, as illustrated in the accompanying drawings, in which—

Figure 1 is an end elevation of my improvement with the outer plate of the casings removed and mounted on an engine-lathe; Fig. 2, a front elevation of an engine-lathe with parts broken away and provided with my device; Fig. 3, a sectional view through the axes of the casings and spread out on a vertical plane; Figs. 4 and 5 an end elevation and sectional view, respectively, of a modified form of construction.

In the drawings, 6 represents the bed of an engine-lathe, 7 the head-stock, 8 the live-spindle, 9 the spindle-gear, 11 the back gear, 12 the lead-screw, and 13 the reversing and driving gears therefor, all constructed and arranged in the ordinary manner.

Cylindrical casing 14 is formed with projecting hub 15, whereby it is journaled to rotate in the head-stock 7. Pull-pin 16, provided with radial key 17, is extended axially therethrough and through said hub and movably engages with either of the gears 18 and

19 by means of said key. Said gears are of different sizes and impart different speeds to said pull-pin 16 from the spindle-gear 9 through a differential intermediate pinion 21.

Driving-pinion 22 is splined on pull-pin 16 within casing 14 and continuously engages with internal gear 23. Said gear is formed with spur-gear 24 and is mounted to turn on boss 25, which projects from one side within the casing and eccentric to pull-pin 16 and the axis of rotation of the said casing.

A series of pinions 26, each formed with a projecting hub 27, which terminates in a clutch-face 28, are journaled by means of said hubs in a series of bearings 29, which are formed in the casing at intervals in a circle described from the axis of the rotation of the casing. Said pinions are so graduated in size in relation to their location in said circle as to compensate for the eccentricity to said circle of that portion of spur-gear 24 adjacent thereto, whereby either or all of them may be moved lengthwise into or out of engagement with said spur-gear by means of corresponding pull-pins 30, with which each of said pinions is provided, and maintained in adjusted position by means of spring-catches 10.

A secondary casing 31 is formed with projecting hub 32, whereby it is rotatively adjustable in bearing 33, formed in the lathe-bed 6. A plural number of pinions 34, each formed with a clutch-face on one end, are mounted within said casing 31 equidistant from its axis of rotation. Said pinions are of such graduation in size and so distributed in relation to each other as to be in continuous engagement with an intermediate gear 35, which is journaled within the casing eccentric to its axis of rotation on hub 32.

The position of casing 31 in relation to casing 14 is such that their edges overlap each other sufficiently to cause the axis of either of the pinions in one casing to register with the axis of either of the pinions in the other casing when they are adjusted to both intersect a straight line between the axes of rotation of the casings. In this position of registration of either one of pinions 26 with either one of pinions 34 said pinions 26 may be moved into or out of engagement with pinions 34 and simultaneously with spur-gear 24 by means of the



corresponding pull-pin 30. Latch 36, mounted on the head-stock, is arranged to engage with a corresponding catch 37, found in the periphery of casing 14, to maintain it in adjusted position in addition to the entrance of pull-pin 30 within the bore of the adjacent pinion 34. The position of rotative adjustment of casing 31 is maintained by means of a pull-pin 38 being inserted through the bore of one of the pinions 34 and into a hole 39 in the lathe-bed which registers therewith.

Gear 41, formed with a clutch-face on one end of its hub adapted to detachably engage with the clutch-face on either of the pinions 34, is mounted to turn on pin 38 and preferably within a casing 43. Said casing is detachably journaled in a bearing formed in the lathe-bed by means of journal 44, projecting from one side thereof. Pinion 45, similar to gear 41 and of different size therefrom, is formed also with a clutch-face on the corresponding end of its hub and journaled within casing 43 in continuous engagement with gear 41. The axes of gear 41 and pinion 45 are equidistant from journal 44, that either of them may be adjusted to engage with the corresponding pinion 34, while the other registers with the lead-screw 12 and may be engaged therewith by means of the usual clutch in addition to a pull-pin 46, which is extended axially therein.

A modified form of construction is shown in Figs. 4 and 5, wherein the internal gear 23 is omitted and spur-gear 24, mounted directly on eccentric boss 25, is driven through intermediate differential pinion 47 from the drive-pinion 22, which is mounted on shaft or pin 16 concentric with casing 14 and eccentric to spur-gear 24.

When it is so desired, casing 31, together with the pinions mounted therein, may be displaced by casing 43, when gear 41 and pinion 45 should be formed with a clutch-face on each end of their hubs to alternately engage with sliding clutch 48 on the lead-screw 12 and with either of the properly-adjusted pinions 26.

In operation a wide interval between the speed of the live-spindle gear and that of the lead-screw may be effected by means of the engagement of pull-pin 16 with either of gears 18 or 19. Said interval of speed may be graduated into smaller intervals by means of the successive engagement of pinions 26 with either of the pinions 34, each of which pinions 34 permits a different series of changes in speed of the lead-screw by engagement with the series of pinions 26. After all the graduations of speed in the lead-screw have been effected in the above manner the positions of gear 41 and pinion 45 may be reversed, when the same number, but of different speeds, may be in like manner secured.

Having fully described my improvement,

what I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. The combination with a drive-gear and a driven gear, of a plural number of casings each being rotatively adjustable and overlapping at their edges, a series of pinions of different sizes mounted in each casing on a circle concentric with its axis, a clutch-face formed on one end of each pinion, means to separately move the pinions in one casing into clutching engagement with either of the pinions in the adjacent disk when adjusted into registration therewith, the said engaging pinions forming parts of a train of gears between the drive and driven gears.

2. In a train of gears between a drive and a driven gear, the combination with a primary and secondary series of pinions of different sizes each series mounted equidistant from a common center and the pinion of each series successively adjustable around said center to a fixed point common to both series, of clutches formed on the end of one series of pinions adapted to engage with clutches formed on the adjacent end of the pinions of the other series, and means arranged to move the pinions of one series separately into clutching engagement with either of the pinions of the other series when both are adjusted to register with said fixed point.

3. The combination with a drive-gear, and a driven gear formed with a clutch-face, of a series of idle pinions of different sizes mounted equidistant from a common center and adjustable around said center, each of said pinions being formed with a clutch-face on one end, and movable endwise into engagement with said drive-gear and simultaneously into clutching engagement with the driven gear.

4. The combination with a drive-gear, and a series of driven gears movable around a common center and each formed with a clutch-face, of a series of idle pinions each formed with a clutch-face and movable around a common center and into registration with a corresponding driven gear, and means arranged to move either of the pinions endwise into engagement with the drive-gear and simultaneously into clutching engagement with the corresponding driven gear.

5. The combination with a drive-gear, and a driven gear formed with a clutch-face, of a series of pinions of different sizes each formed with a clutch-face and movable around a common center into successive registration with the driven gear, said pinions being separately movable endwise into engagement with the drive-gear and simultaneously into clutching engagement with the driven gear.

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Witnesses:

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