E. A. WEITERSHAUSEN & H. F. OTTENBACH.

INDEXING MECHANISM.

APPLICATION FILED JUNE 21, 1910.

1,001,484.

Patented Aug. 22, 1911.

5 SHEETS—SHEET 1.

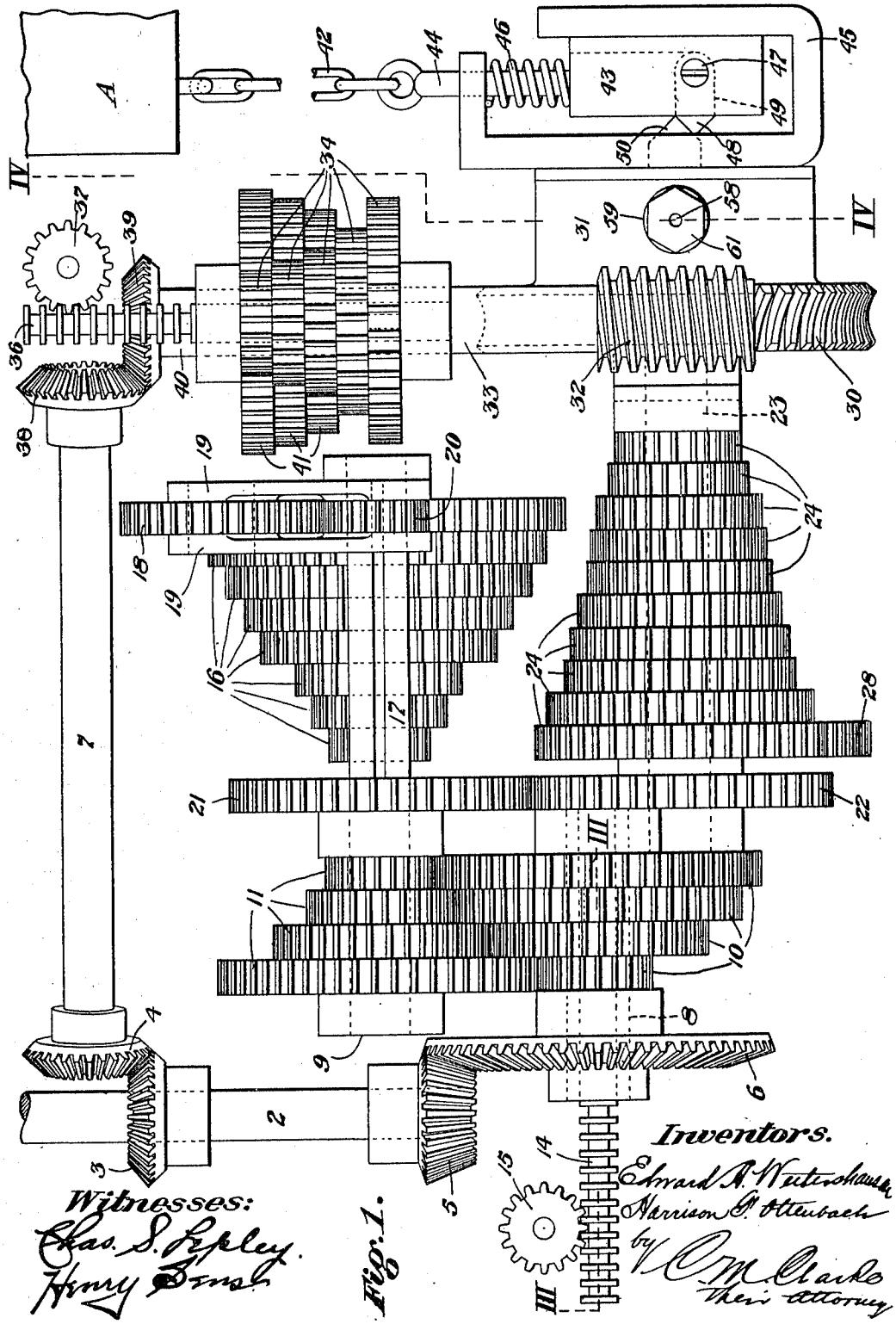

Fig. 1.

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5 SHEETS—SHEET 2.

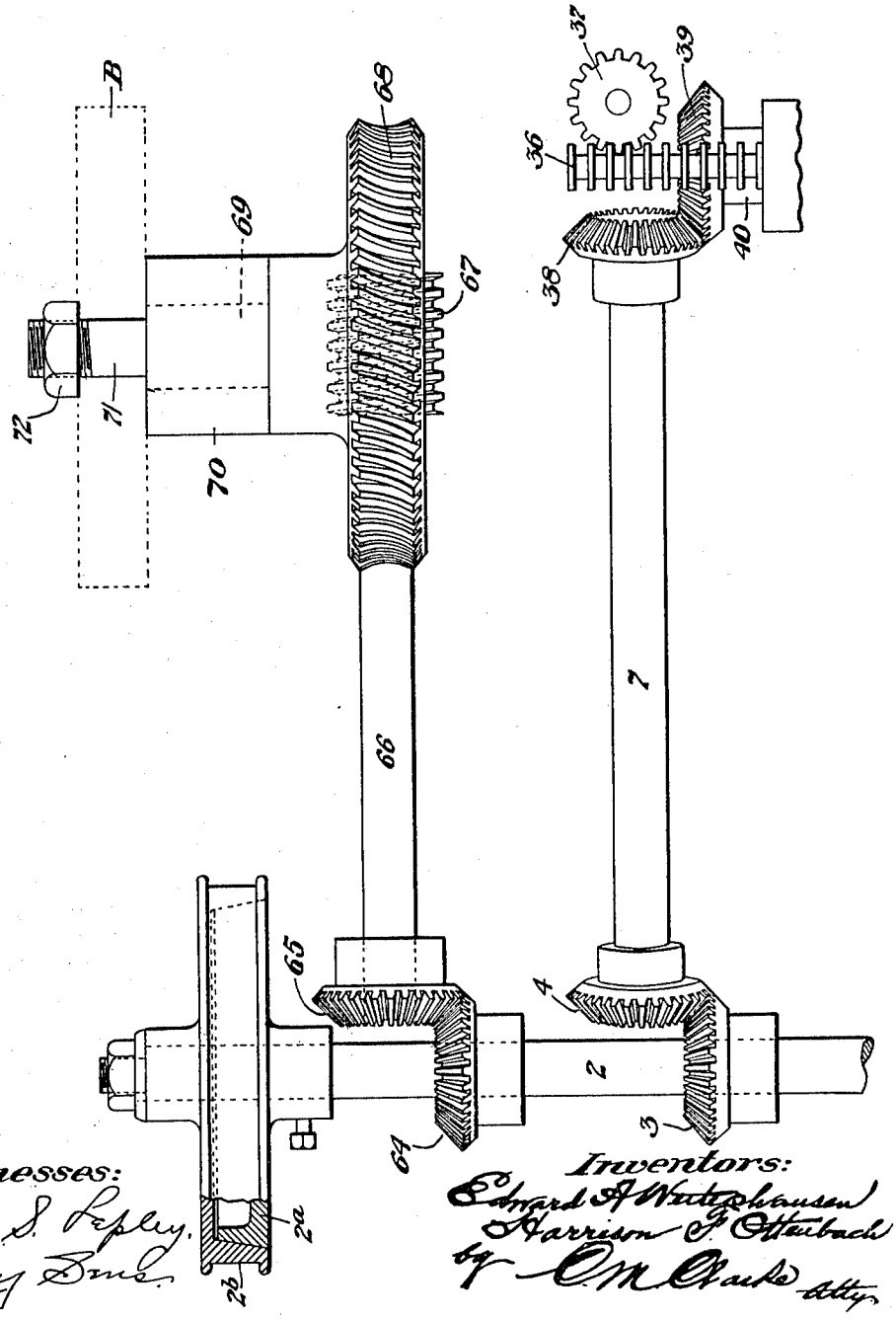

Fig. 1a.

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5 SHEETS—SHEET 3.

Fig. 2.

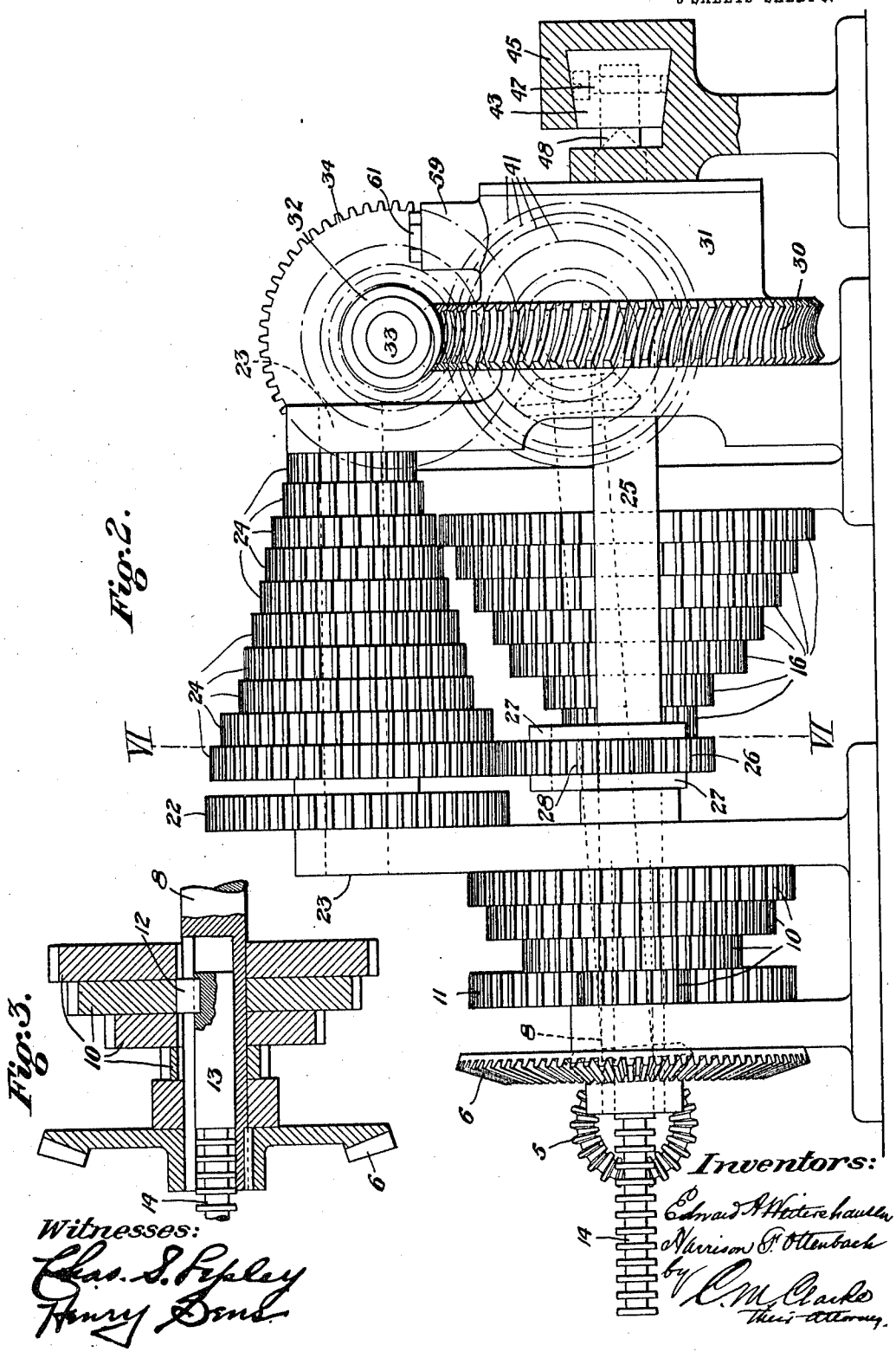

Fig. 3.

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5 SHEETS—SHEET 4.

Fig. 4.

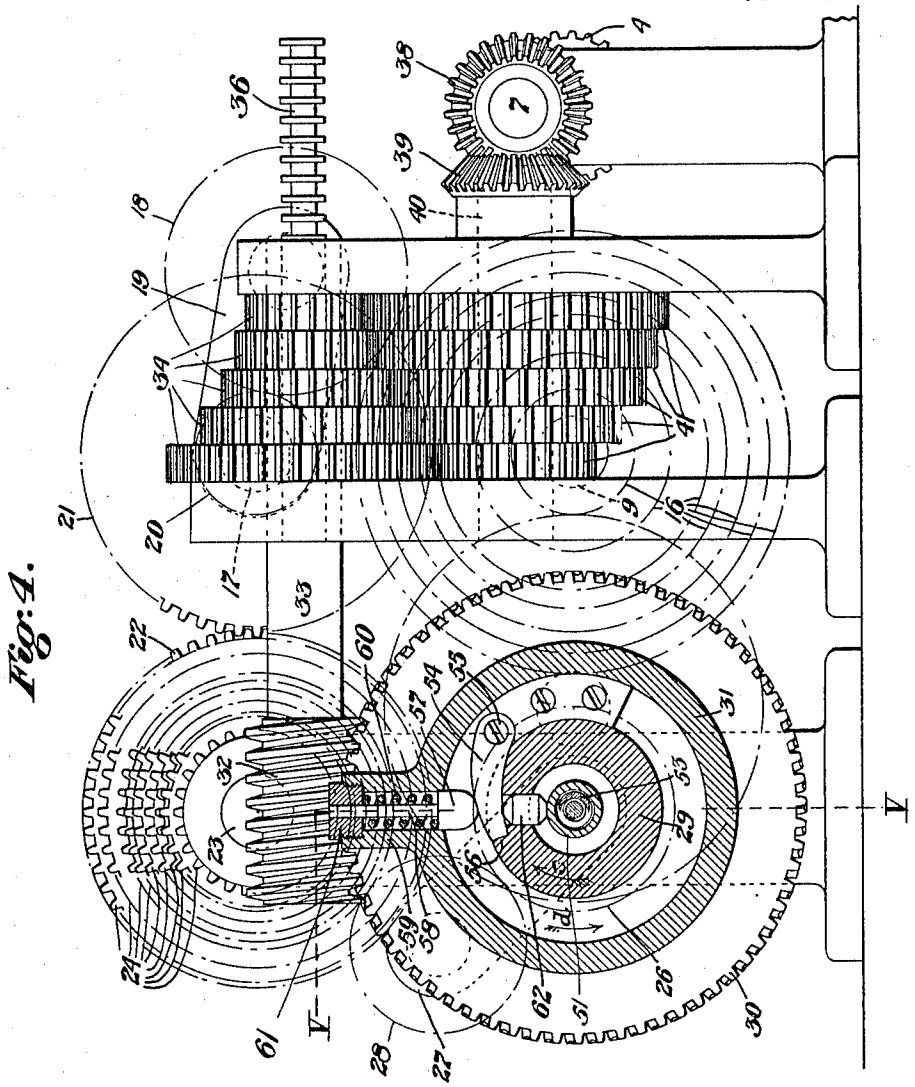
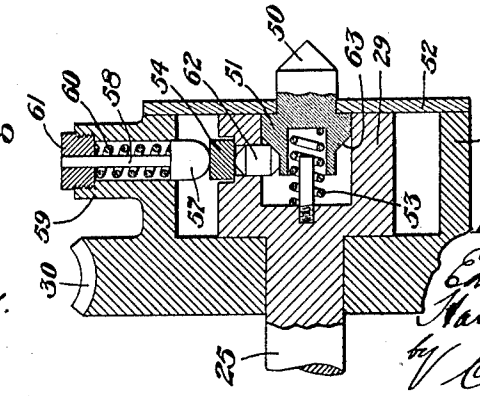


Fig. 5.



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5 SHEETS—SHEET 5.

Fig: 7.

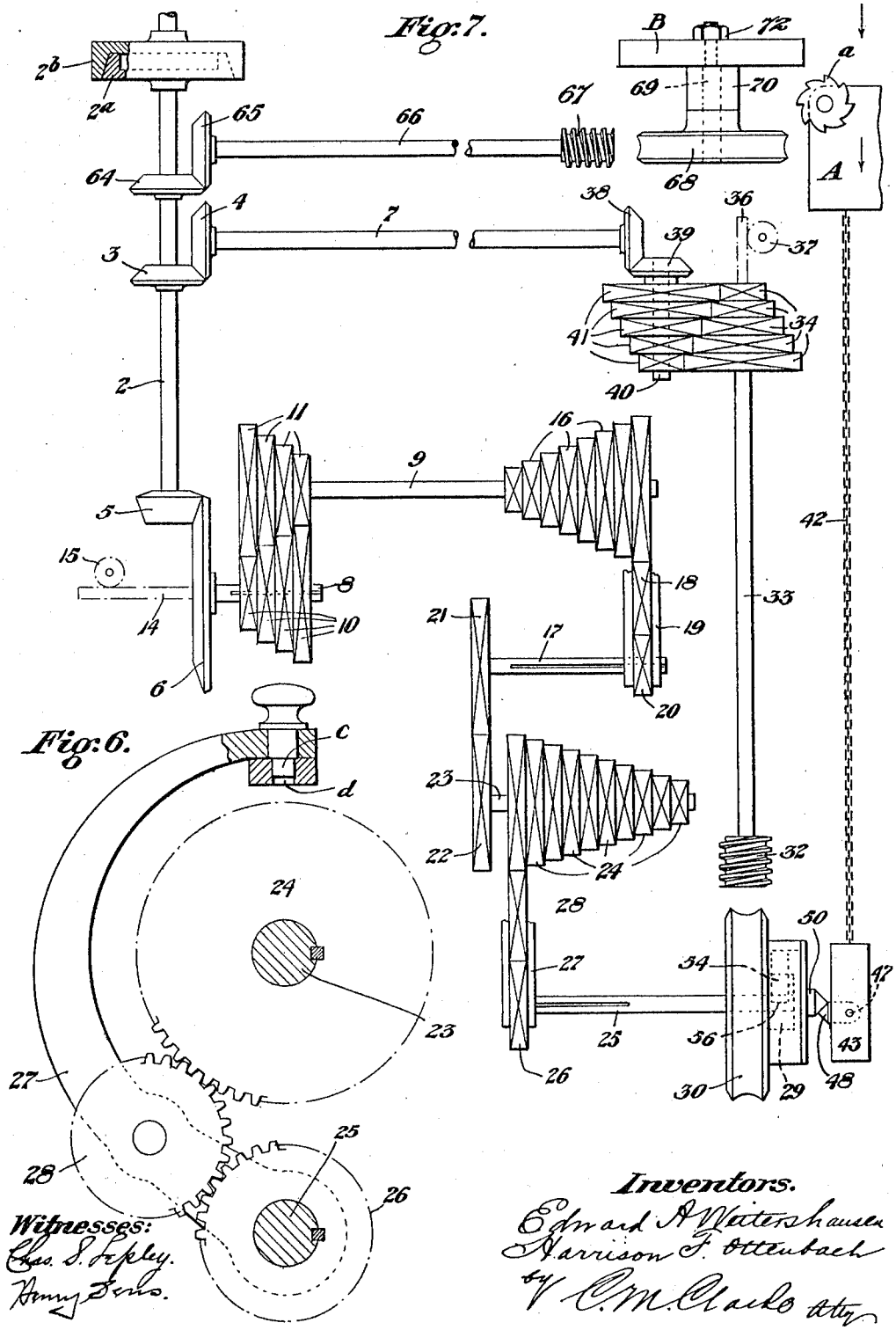

Fig: 6.

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UNITED STATES PATENT OFFICE.

EDWARD A. WEITERSHAUSEN AND HARRISON F. OTTENBACH, OF PITTSBURG, PENNSYLVANIA.

INDEXING MECHANISM.

1,001,484. Specification of Letters Patent. **Patented Aug. 22, 1911.**

Application filed June 21, 1910. Serial No. 568,126.

To all whom it may concern:

Be it known that we, EDWARD A. WEITERSHAUSEN and HARRISON F. OTTENBACH, citizens of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Indexing Mechanism, of which the following is a specification, reference being had therein to the accompanying drawing.

Our invention refers to improvements in indexing gears for gear cutting machines, or wherever it is desired to cut any predetermined number of teeth or to make circumferential divisions up to any practical extent, as say from 10 to 400 continuously without excepting any number between.

In gear cutting and other similar machinery, it is not ordinarily possible to successfully cut teeth of any number desired owing to the limitations of the gears, the necessity for substituting or changing wheels, etc., so that the efficiency of the machine is limited to certain numbers and proportions, as is a well known fact with machinists.

In carrying out our invention, we employ a primary and a secondary train of gears. The primary set of gears is operable to make any predetermined number of cuts or equivalent operations to one complete revolution of the blank, within its limitations, without the assistance of the secondary train. The secondary train of gears is operable, with the primary gears to control the normal operation thereof and to accomplish any other desired number of cuts or equivalent operations, not possible with the primary train alone, beyond and supplemental to the normal range or capacity of the primary train of gears. In each case the operation of the positively geared rotating mechanism for the blank to be cut is controlled through stop shaft mechanism, operating to release a friction-driven main shaft during the shifting period and to lock it against movement during the cutting period. The stop shaft is provided with a pawl-controlled abutment. Its movement is either for a complete revolution in normal operation of the primary train of gears alone, the position of the pawl being stationary, or for less than a complete revolution, as controlled by the secondary train of gears. In the latter case, the position of the pawl is gradually changed whereby to effect engagement of the abutment before the stop shaft has completed an entire revolution, thus slightly retarding the travel of the rotating mechanism for the blank, to insure the desired number of intermediate rotative movements and stops. The particular desired number of such movements and corresponding stops is ascertained and secured by and through the change speed gearing incorporated in the primary and secondary trains.

The invention is illustrated in the accompanying drawings, in which:—

Figure 1 is a plan view of the gearing entire. Fig. 1ª is a similar view showing the friction actuated drive shaft and the connections therefrom to the blank. Fig. 2 is a side elevation of the apparatus shown in Fig. 1. Fig. 3 is a detail sectional view on the line III. III. of Fig. 1. Fig. 4 is an end elevation of the construction shown in Fig. 1, enlarged, partly in section on the line IV. IV. of said figure. Fig. 5 is a vertical sectional detail view on the line V. V. of Fig. 4. Fig. 6 is a vertical sectional view indicated by the line VI. VI. of Fig. 2. Fig. 7 is a diagrammatic view of the entire apparatus with its parts in their proper operative relations.

Both the primary and secondary sets of gears are actuated primarily from the main shaft 2. Said shaft 2 is intended to be driven continuously, except when arrested by the stop shaft mechanism hereinafter described, by any suitable friction mechanism, as for instance a disk 2^a secured to shaft 2 and a co-acting friction disk 2^b, continuously driven by a belt or gearing from any suitable prime mover. The friction engagement between disks 2^a and 2^b is such that when the stop shaft mechanism is released, shaft 2 and the connected gearing driven thereby, will be operative. When the stop shaft mechanism operates to arrest transmission of power through either the primary train of gears or through the primary and secondary trains of gears, then slippage occurs between disks 2^a and 2^b, until such time as the stop shaft mechanism operates by release to effect the free transmission of power to the blank rotating mechanism, from shaft 2.

The blank B is mounted on the end of blank spindle 69 rotatably mounted in bearing 70, said spindle having the terminal 71

to which the blank B is secured by nut 72, or by other suitable means. It is intended that blank B shall be partially rotated to the desired degree for each tooth cutting operation of the positively actuated tool or cutter *a* corresponding to each reciprocation of the tool head A. That is to say, blank B is rotated partially and periodically during a single entire revolution, a number of times equaling the number of teeth, or divisions between the teeth, to be cut therein. The tool head A is reciprocated in the direction of the arrow slowly, whereby to effect the cutting operation by cutter *a* through the blank B, by well known means, and is retracted quickly at the end of the cutting operation for a new cut. Between the end of one cutting operation and the commencement of the next, the blank B is to be rotated the desired distance, corresponding to the diametrical pitch of the tooth.

Ordinarily, in cutting teeth in gears, no difficulty is encountered for gears of standard pitch or usual numbers of teeth. However, between the range of 10 to 400 teeth to any given circumference, there are many instances in which the ordinary gears of gear cutting machines are not capable of being set to cut some particular other number of teeth, as for instance 121 teeth. The present invention contemplates the use of the primary gearing for cutting teeth within the ordinary range of operations usually performed by gear cutting machines as at present designed, wherein the changes are made by change gear mechanism, within the usual range provided for. Also, the cutting of intervening numbers of teeth not provided for by the primary train of gears, by means of the secondary train of gears, acting on the stop shaft mechanism, whereby with the secondary train of gears set to cut any predetermined number, of additional teeth, for instance 1, 2, 3, etc., this may be provided for by fractionally diminishing the adjustment of the blank through the primary gears, by the secondary gears, whereby to secure a corresponding additional number of partial rotations of the blank, to the desired extent, comprising the whole number of partial rotations, in a complete revolution of the blank.

Assuming the shaft 2 to be an intermittently operative shaft, continuously subject to the friction transmitted by the driving power of disk 2^b, and subject to the periodical stop control of the stop shaft mechanism, and to operate to actuate blank B through the bevel gears 64, 65, shaft 66, worm 67 and worm wheel 68 secured to spindle 69, transmission through the primary set of gears from shaft 2 is controlled as follows: Bevel gear 5 on shaft 2 engaging bevel gear 6 on shaft 8, transmits rotation to the particular gear of the coniform group 10, through a key 12, slidingly mounted centrally of shaft 8, and extending laterally through a slot therein. (Fig. 3). Key 12 is mounted in a longitudinally adjustable rod 13 having an adjustable extension 14 provided with a series of rack teeth in operative engagement with the pinion 15. Said pinion is mounted on a shaft and provided with a hand wheel or other actuating mechanism, not shown, but whereby the key 12 may be set to transmit motion to the particular one of gears 10, according to the speed to be transmitted. All of said gears 10 mesh into a companion series of gears 11, keyed to shaft 9, so that the particular one of the gears 10, which is temporarily keyed to shaft 8 will drive its companion gear 11 and shaft 9. On shaft 9 is secured a coniform series of gears 16, any one of which as desired, will transmit rotation, through idler pinion 18 and spline pinion 20, in shifting arm 19, to spline shaft 17. Said shifting arm 19, (similar to arm 27 shown in detail in Fig. 6) is slidably adjustable along spline shaft 17, whereby to transmit to it the desired speed depending upon which particular gear of the group 16 it is intermeshed with.

Secured to spline shaft 17 is a pinion 21 intermeshing with pinion 22 of shaft 23 carrying a coniform series of pinion gears 24. Rotation is transmitted from any particular one of said gears 24 to stop shaft 25 through idler pinion 28 and spline gear 26, mounted in shifting arm 27, shown in detail in Fig. 6. Said arm is shifted along splined stop shaft 25 to the desired position, and is locked in place by any suitable means, as a key *c*, adapted to enter one of a series of slantingly arranged sockets *d*, suitably forming a portion of the framework of the machine. Such construction is of well known arrangement, and further description thereof is not necessary.

Stop shaft 25 constitutes the terminal member of the primary train of gears just described, and the amount of free rotation of said stop shaft, until arrested, controls the corresponding extent of rotation of the blank B through gears 64, 65, during such time as shaft 2 is permitted to rotate under the friction drive mechanism 2^a, 2^b, until said shaft 2 is positively arrested by the arresting of stop shaft 25. To effect the arresting of stop shaft 25 at the proper time, and assuming the desired number of cuts of blank B to be within the possible range of the primary gears, it is necessary to assume also that the worm wheel 30, which is freely mounted around shaft 25, is normally stationary. We will therefore assume that shaft 33 carrying worm 32, (meshing into worm wheel 30) is disconnected from the coniform series of gears 34 by withdrawal of the co-acting key, simi-

lar to key 12 and operable by rack 36 and pinion 37 in the same manner as described, as to key 12.

Pivotally mounted on a screw or pin 55 within the shrouded hub of worm wheel 30, is a pawl 54, normally pressed into engaging position by a button 57 on the end of stem 58 mounted within an upward extension 59 of housing 31. Button 57 is normally thrust down by a spring 60 mounted within the extension 59 and secured by a terminal cap 61 as clearly shown. Normal rotation of stop shaft 25 and its enlarged hub 29 is in the direction of the arrow *c* on said hub, Fig. 4, when abutment 56 is released from engagement with pawl 54. To disengage the pawl, we provide a tapered lifting pin or button 62 which is pushed up by the bevel shoulder 63 of a plunger 51, mounted within the housing of the worm wheel 30, extending through a front plate 52 thereof and normally thrust outwardly by a spring 53. Plunger 51 is provided with a wedge or coniform shaped terminal 50 extending beyond the plate 52.

For the purpose of actuating the above described releasing mechanism for the pawl, a sliding block 43 is provided, mounted in a suitable guide or frame 45, having a connecting pin or link 44 and connected with the reciprocating cutter head A by a flexible connection 42, as a chain. Spring 46 normally retracts sliding block 43 so that when cutter holder A moves forwardly in the cutting operation, the block 43 will be thrust by the spring back to its position shown in Fig. 1.

Pivotally mounted at 47 in block 43 is a finger or dog 48 having a bevel terminal, bearing backwardly against a rear wall 49 of block 43 in its forward movement and adapted to bear against the tapering terminal 50 of plunger 51. After the cutting operation, during which the blank B remains stationary the cutter head A is reciprocated backwardly for a new operation (by means not shown) and during such reverse reciprocation and before the next cutting operation commences, the blank B is rotated the desired extent for the next tooth. Backward movement of block 43 and its key 48, depresses plunger 51 backwardly, whereby pawl 54 is thrown upwardly from engagement with shoulder 56, to effect disconnection of the worm wheel 30 and stop shaft 25. When the stop shaft is thus released, main shaft 2 is likewise immediately released, whereupon the friction drive mechanism will immediately transmit power through bevels 64, 65, and shaft 66 and worm gearing 67, 68, to the blank spindle 69, the extent of movement depending upon the rotation of stop shaft 25. Assuming the secondary train of gears to be inoperative, as stated, pawl 54 being but momentarily lifted and plunger 51 being thrust outwardly by its spring immediately after dog 48 has passed beyond it, pawl 54 will then be held downwardly by spring 60 and button 57, and will arrest shoulder 56 at the termination of one complete revolution of the stop shaft. This operation will continue for each reciprocation of the cutter holder A.

The secondary train of gears is driven from main shaft 2 by bevel gears 3, 4, shaft 7, bevel gears 38, 39, and coniform series of gears 41 on shaft 40. A corresponding coniform series of gears 34 is loosely mounted on shaft 33 and any particular one of said gears is keyed to the shaft by a key similar to key 12 and actuated by the rack 36 and pinion 37 for such purpose. The rack also has a sufficient range of movement outwardly to entirely disconnect all of the said gears 34 from shaft 33 when the secondary train is not needed. When however, it is desired to supplement or modify the control of the stop shaft 25 by the secondary train, that particular wheel 34 which will give the desired extent of movement is keyed to shaft 33. Upon release of pawl 54, worm 32 will actuate worm wheel 30, carrying pawl 54 slowly around with it in the opposite direction, as indicated by the arrow *d*, from that of stop shaft 25 and its hub 29, whereby to advance and meet shoulder 56, before it has made an entire revolution.

It will thus be seen that, depending upon the gearing, the rotation of the stop shaft is reduced to a fraction less than a complete revolution, thereby reducing the extent of periodic partial rotation of blank B. Thus, assuming that the primary gears, without the assistance of the secondary train, will effect 120 stop periods of the blank and it is desired to stop the blank 121 times, this can be done by causing or effecting the engagement of shoulder 56 by pawl 54 at the proper moment, to reduce the amount of travel of the stop shaft to the desired proportionate degree, to acquire the additional stop in one complete revolution.

It will be readily understood that by shifting the key in shaft 33 to the particular gear 34, controlling the speed, additional stops to the desired number for an entire revolution of the blank may be secured, within the range provided for. It will also be understood that suitable charts showing the proper combination of gears are provided for the machinist, whereby to effect any desired number of stops of the blank.

Assuming there to be 120 teeth in the main worm wheel 68, then the proper gears must be used on the primary train to cause stop shaft 25 to make 120 stops or turns while shaft 66 makes 120 turns. Now if 60 divisions are wanted, shaft 66 would have to make 120 turns while stop shaft 25 makes 60 turns, or if 30 divisions are wanted, shaft

66 would have to make 120 turns while stop shaft 25 is making 30 turns or stops. This is accomplished by the shifting lever of pinion 15 and the sliding key 12, in combination with the changes which can be made through shifting arms 19 and 27, to effect the proper combination with the gearing 10, 11. When additional cold numbers of stops are required, the result is secured through the change gears 34, 41, in the manner already described, whereby to effect the controlling supplemental movement of worm wheel 30 carrying pawl 54. It may be stated that worm wheel 30 is timed to correspond with 120 teeth in worm wheel 68 on the main machine, at a ratio of from 1 to 1 to 5 to 1, as controlled through change speed gears 34—41. In making say 121 divisions, the key in gears 34 must be set to cause worm wheel 30 to turn at a ratio of 1 to 1, which causes the pawl 54 to travel a fraction of a revolution with wheel 30 to meet shoulder 56, whereby stop shaft 25 now makes less than a full turn to each stop, or in other words, is retarded enough to allow stop shaft 25 to make say 121 stops while shaft 66 turns 120 times.

It will be understood that in the use of the primary train alone there is no interval exceeding 5 divisions which cannot be made through the primary train, and as the secondary train has a capacity or range of from 1 to 5 supplemental divisions, the limitations of the principal train are thus entirely compensated for, whereby to accomplish every possible division from 10 to 400. It will also be understood that the invention may be applied, where practicable, to any circumferential dividing machine.

What we claim is:—

1. Gearing for circumferential dividing machines comprising a main shaft provided with friction drive mechanism, means geared with said shaft for intermittently rotating a blank, a train of gearing in driving engagement with the main shaft embodying change speed mechanism and provided with a terminal stop shaft, and means controlled by the intermittent action of a reciprocating cutter holder for alternately locking and releasing said stop shaft, substantially as set forth.

2. In gearing for circumferential dividing machines, the combination of a main driving shaft, frictional driving means therefor, means geared with the main shaft for rotating a blank when the main shaft is actuated by the friction drive mechanism, a train of change speed gearing in driving engagement with the main shaft and provided with a stop shaft controlling the movement of the friction driven main shaft, locking and unlocking mechanism for the stop shaft, and a reciprocating cutter holder and means actuated thereby controlling the operation of said locking and unlocking mechanism, substantially as set forth.

3. In gearing for circumferential dividing machines, the combination of a main driving shaft, frictional driving means therefor, means geared with the main shaft for rotating a blank when the main shaft is actuated by the friction drive mechanism, a train of change speed gearing in driving engagement with the main shaft and provided with a stop shaft having a locking abutment and a pawl, means for disengaging said pawl, and reciprocable mechanism adapted to actuate said means, substantially as set forth.

4. In gearing for circumferential dividing machines, the combination of a main driving shaft, frictional driving means therefor, means geared with the main shaft for rotating a blank when the main shaft is actuated by the friction drive mechanism, a train of change speed gearing in driving engagement with the main shaft and provided with a stop shaft having a locking abutment, a spring pressed pawl adapted to engage said abutment, means for disengaging said pawl, a reciprocable cutter holder, and a co-acting reciprocable element having a device adapted to operate the pawl-disengaging means, substantially as set forth.

5. In gearing for circumferential dividing machines, the combination of a main driving shaft, frictional driving means therefor, means geared with the main shaft for rotating a blank when the main shaft is actuated by the friction drive mechanism, a train of change speed gearing in driving engagement with the main shaft and provided with a stop shaft having a locking abutment, a gear wheel embracing the stop shaft provided with a spring pressed pawl, a depressible plunger adapted to disengage the pawl, a reciprocable element having a device for engaging said plunger, and a secondary train of change speed gearing geared with the main shaft and with the gear wheel embracing the stop shaft, substantially as set forth.

6. In gearing for circumferential dividing machines, the combination of a main driving shaft, frictional driving means therefor, means geared with the main shaft for rotating a blank when the main shaft is actuated by the friction drive mechanism, a train of change speed gearing in driving engagement with the main shaft and provided with a stop shaft having a locking abutment, a wheel embracing the stop shaft provided with a spring pressed pawl, means mounted in the stop shaft for disengaging the pawl, a reciprocable element having a device for engaging said means, and means geared with the main shaft and with the pawl carrying wheel embracing the stop shaft provided with change speed gearing

for actuating said pawl carrying wheel to effect variable locking of the stop shaft, substantially as set forth.

7. The combination with the blank actuating mechanism, friction driven shaft, change speed gearing, stop shaft, and gear wheel surrounding the stop shaft; of means carried by said gear wheel for locking the stop shaft, a reciprocable cutter holder, a reciprocable element actuated thereby for unlocking the stop shaft at each reciprocation of the cutter holder, and a secondary train of change speed gearing geared with the friction driven shaft and with the gear wheel surrounding the stop shaft, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

EDWARD A. WEITERSHAUSEN.
HARRISON F. OTTENBACH.

Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."