Aug. 8, 1961 H. GANG ET AL 2,995,299

CONSTANT FACTOR MECHANISM

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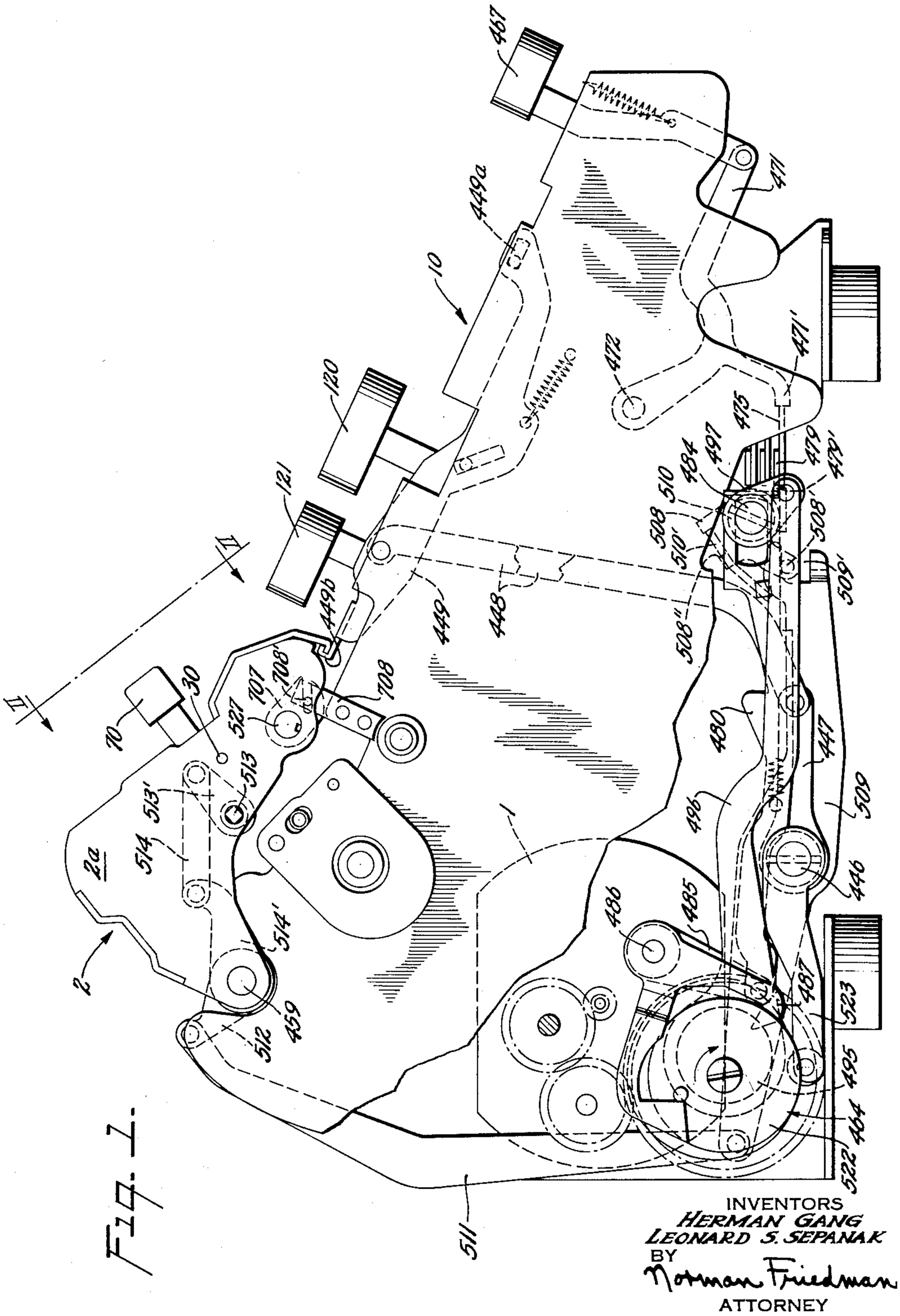

Fig. 1.

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Fig. 2.

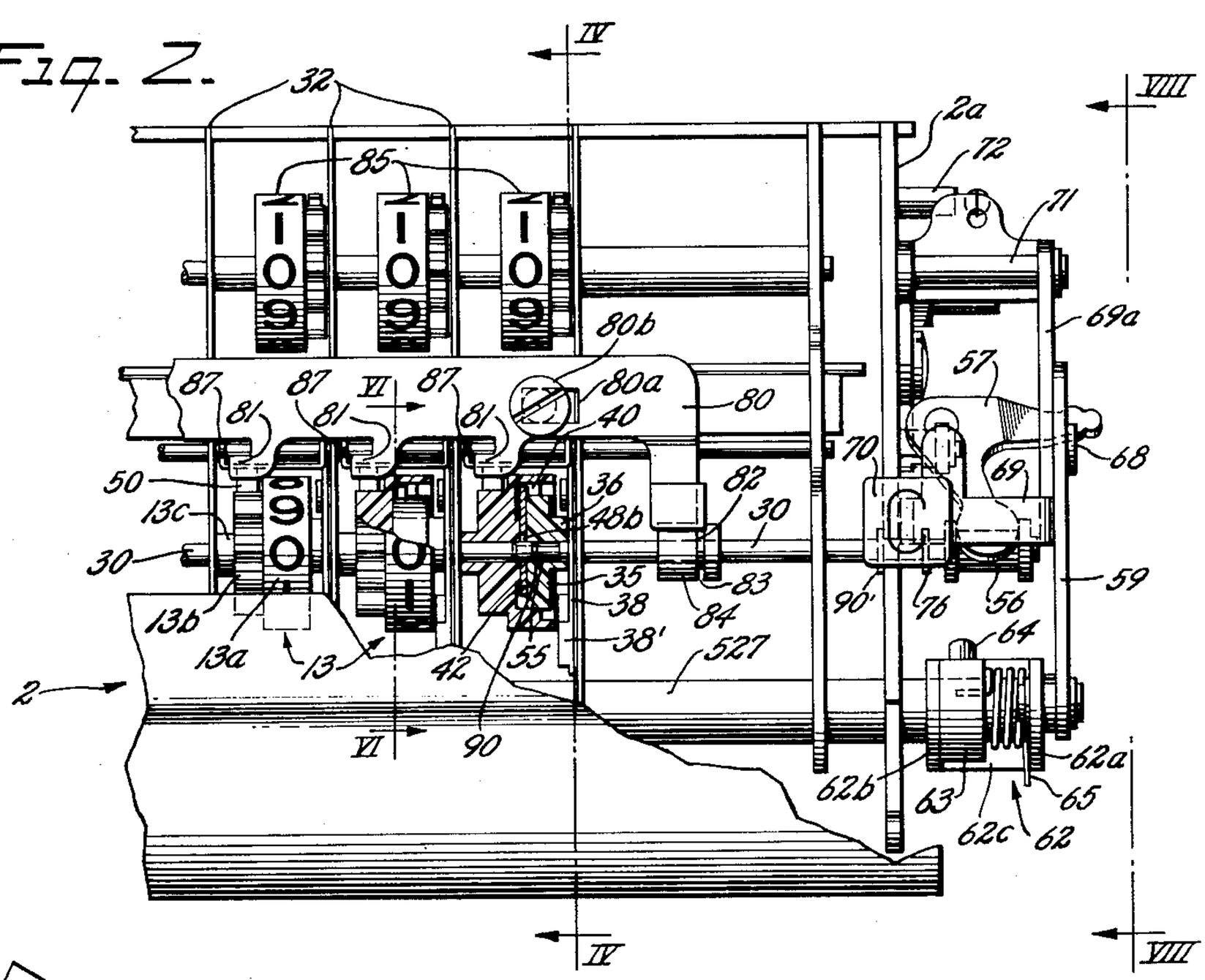

Fig. 3.

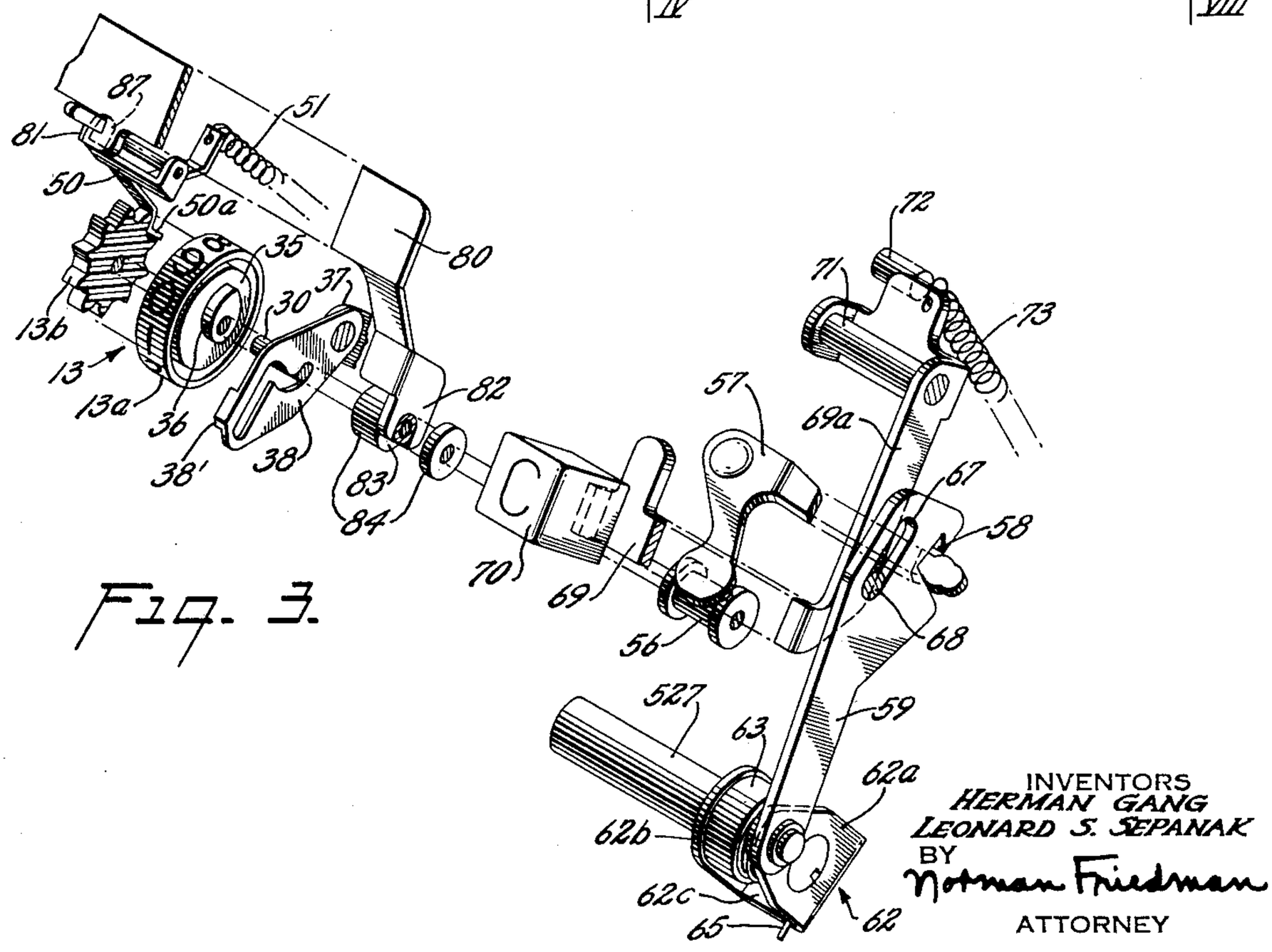

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Fig. 4.

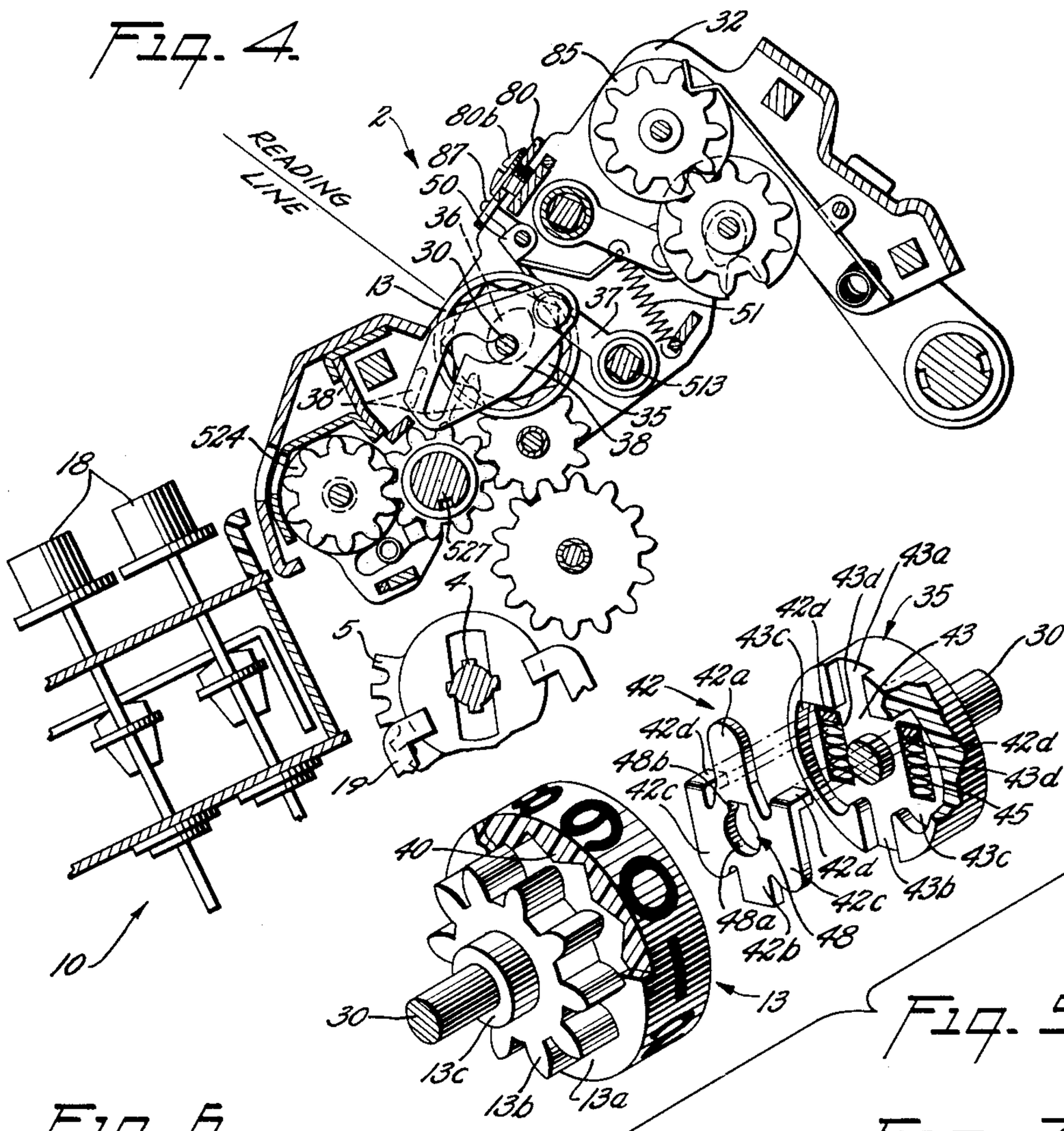

Fig. 5.

Fig. 6.

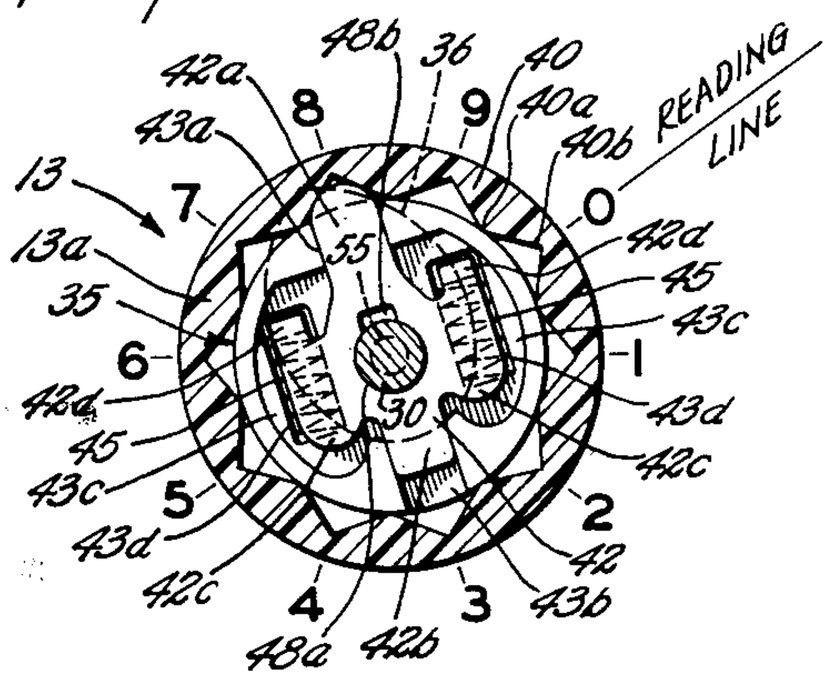

Fig. 7.

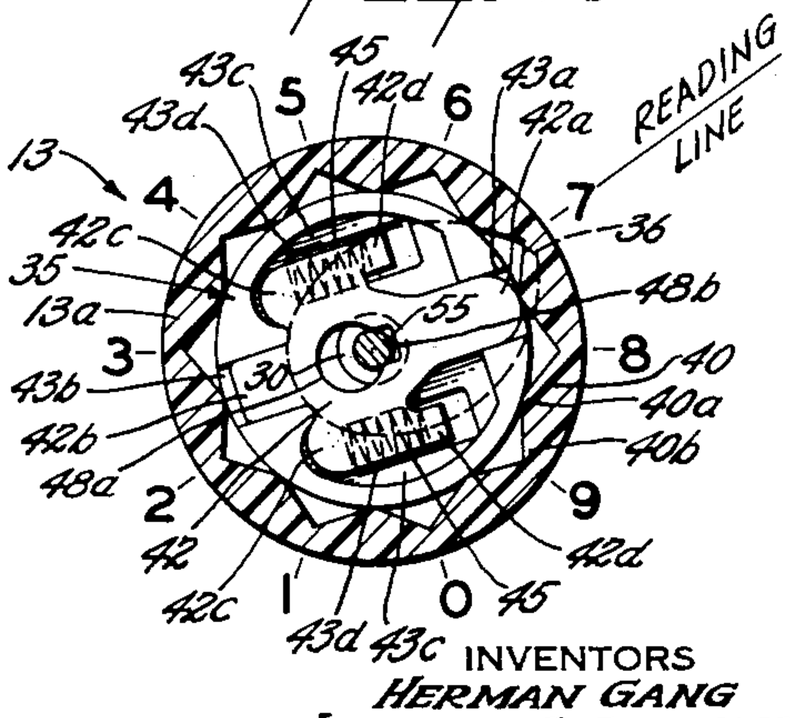

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Fig. 8.

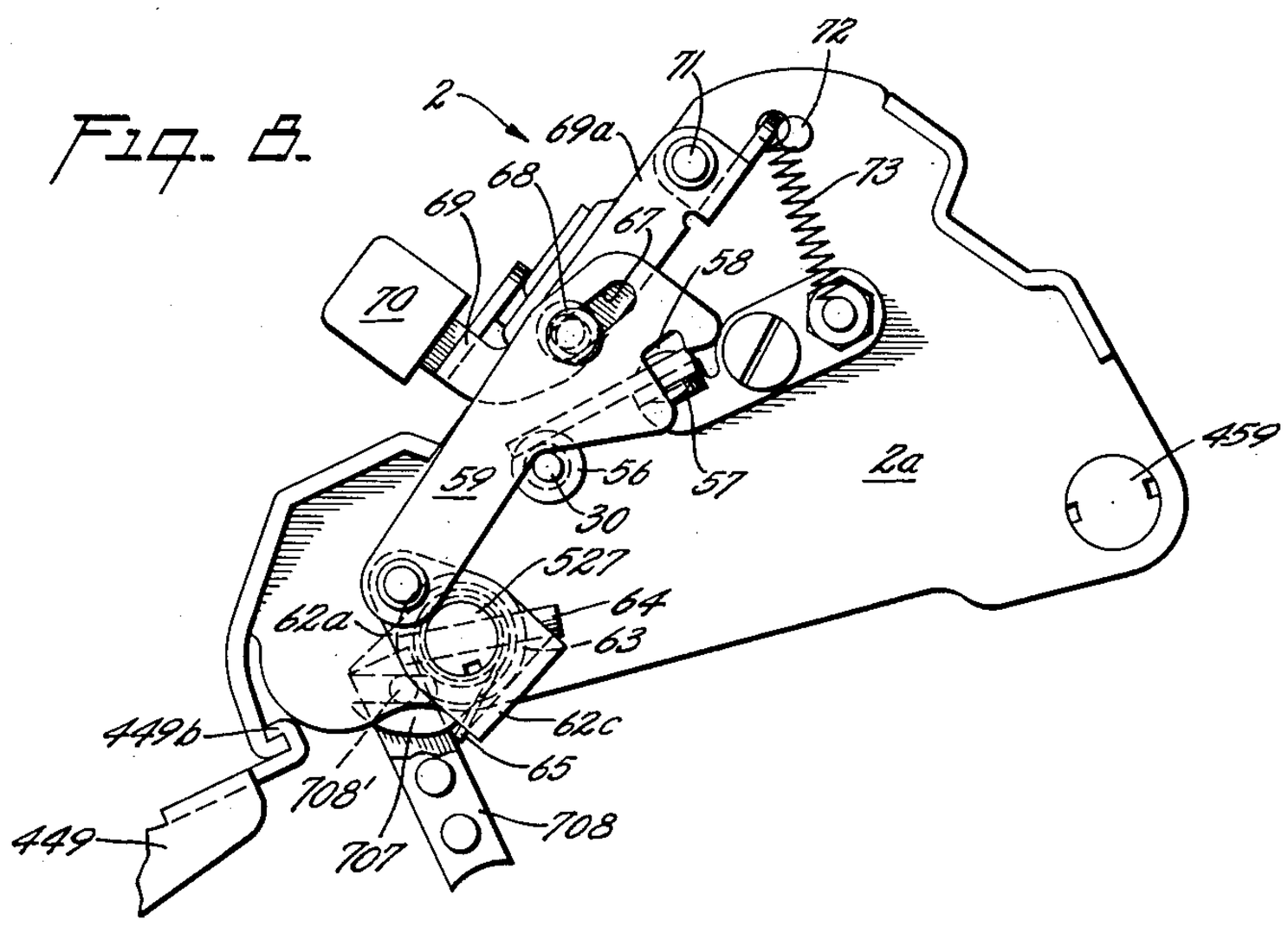


Fig. 9.

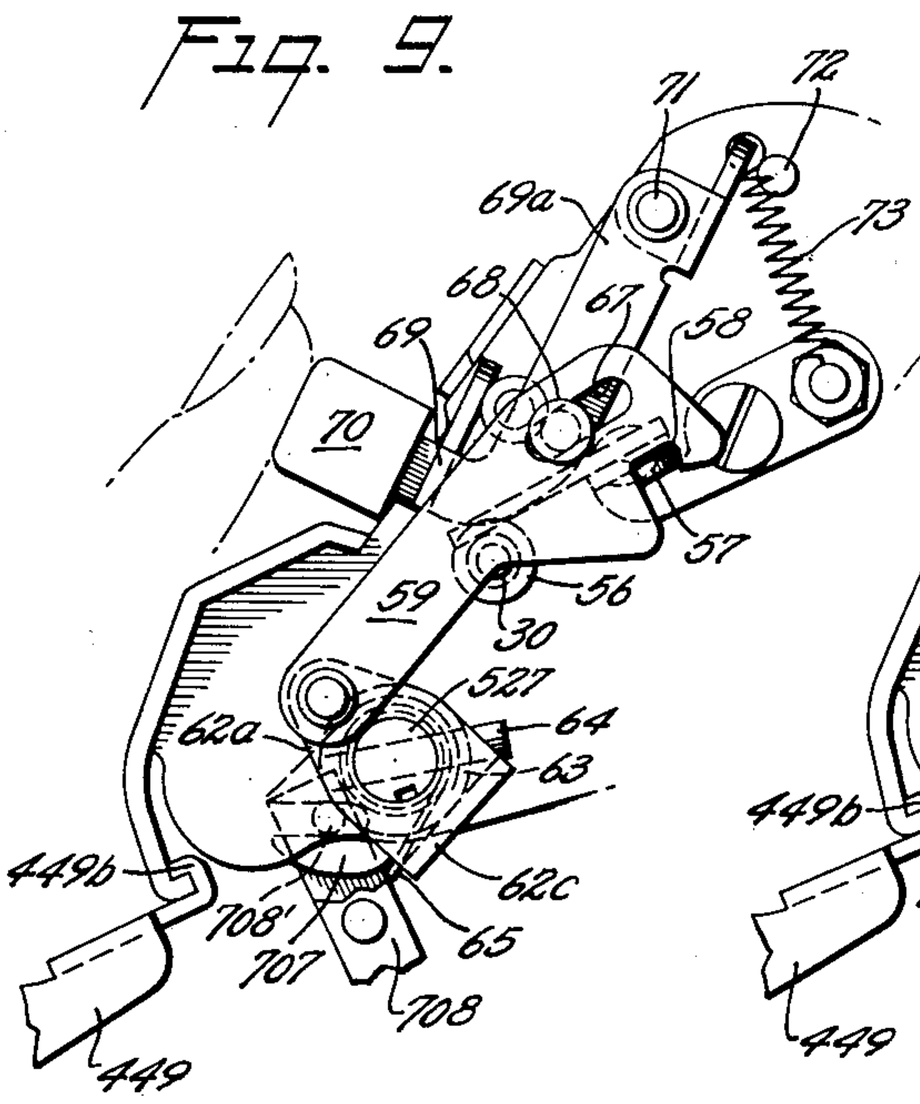
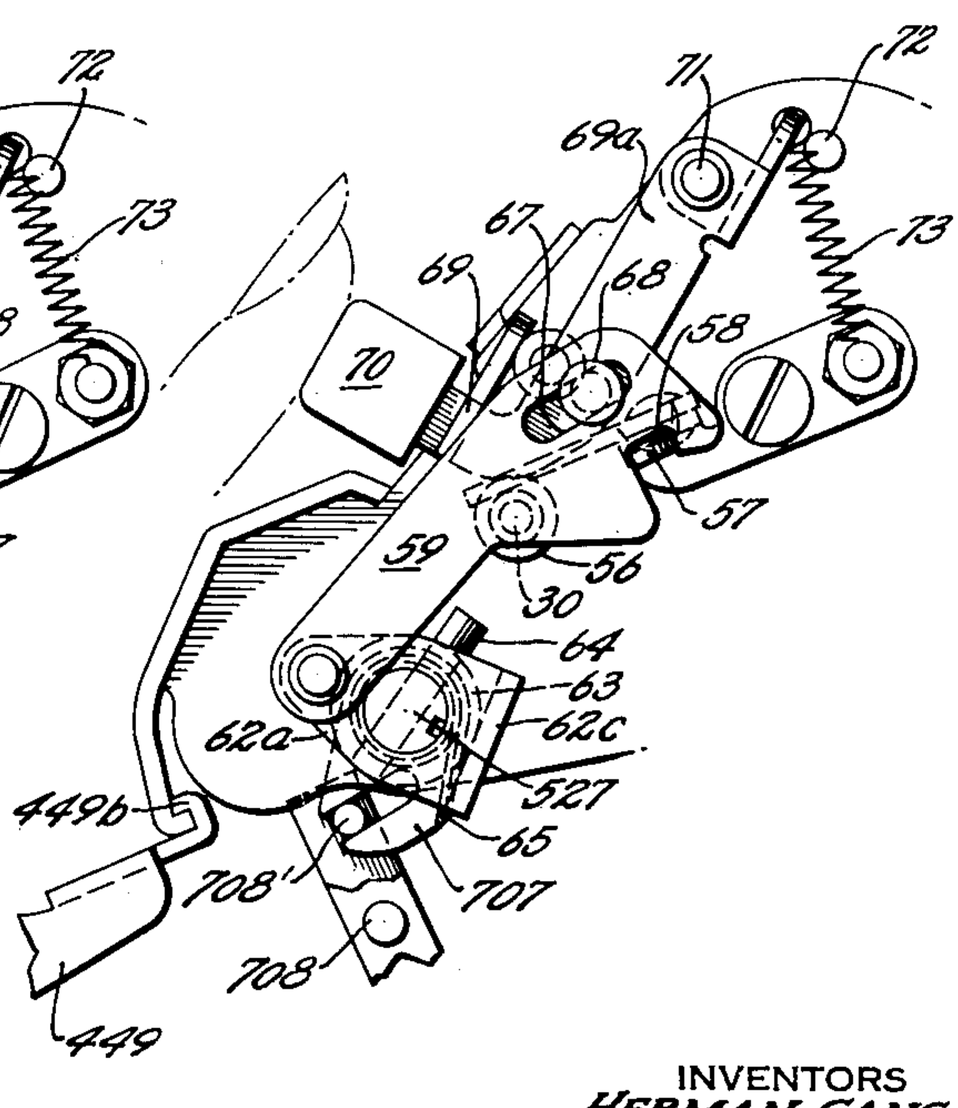


Fig. 10.



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United States Patent Office

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CONSTANT FACTOR MECHANISM

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Filed Feb. 11, 1957, Ser. No. 639,358
21 Claims. (Cl. 235—144)

The present invention relates to improvements in calculating machines.

More specifically, the invention pertains to a new and improved mechanism whereby a constant factor can be entered in a register of a calculating machine.

Generally, when an arithmetic program is carried out on a calculating machine, the appropriate register is first reset by being cleared to zero to erase any digital values appearing in the register. For many operations, however, it is desirable that the register be reset at some constant value other than zero at the beginning of each program. Various mechanisms have been devised in the past for achieving this result, as disclosed in the following patents: No. 1,995,434 granted March 26, 1935 to A. A. Overbury; No. 2,360,704 granted October 17, 1944 to J. L. Moody; and No. 2,660,377 granted November 24, 1953 to H. J. Chall.

The mechanisms of these patents all embody substantially the same approach to the problem of entering a constant factor into a register. They provide a resetting device adjustably coupled to each numeral wheel. In normal operation, positioning of the resetting device to a predetermined position places the wheel in zero registering position. To enter the constant factor, the resetting device and numeral wheel must first be cleared to zero. The resetting device is then locked in position and the constant factor value entered into the wheels through the keyboard and differential actuating mechanism. The resetting device is thereafter unlocked and the wheel recoupled thereto. In all subsequent resetting operations, the resetting device will be brought to its given predetermined position, but because of the angular digital adjustment of the wheel relative to the resetting device, the wheel will be set at the constant factor value in the cleared condition of the register.

From the foregoing it will readily be seen that to enter a constant factor value using the prior art mechanisms, it is always necessary to pre-clear the register and then enter the value through the keyboard. If the constant factor to be entered is a value which has been obtained by a previous machine computation and already appears on the dials of the register, the operator must read the dials, transcribe the value from the dials to the keyboard, and operate an appropriate motor key to enter the value into the register thereby affording an opportunity for human error in the reading of the dials or the operation of the keyboard.

The present invention, on the other hand, has as its object an arrangement such that a value appearing on a register may be directly inserted into the register as a constant factor without the necessity of erasing the value from the register and reentering said value into the register as a constant factor.

It is a further object of the invention to provide a constant factor mechanism in which the power drive of the machine is utilized to operate the mechanism for entering the constant factor, it merely being necessary for the operator to manually adjust the mechanism from normally inactive condition to active condition.

It is a further object to provide a new and improved coupling means between a numeral wheel and its associated resetting device.

In the drawings:

FIG. 1 is a left side elevation of a calculating machine

in which the constant factor mechanism of the present mechanism is incorporated.

FIG. 2 is a fragmentary view of the right side of the machine carriage taken on line II—II of FIG. 1, with parts broken away and in section.

FIG. 3 is an exploded perspective view showing the numeral wheel and related resetting mechanism of one order, and the constant factor mechanism.

FIG. 4 is a section taken on line IV—IV of FIG. 2.

FIG. 5 is an exploded perspective view showing a numeral wheel, the associated resetting hub, and the plate therebetween for coupling the wheel with the hub.

FIG. 6 is a section taken on line VI—VI of FIG. 2.

FIG. 7 is a view similar to FIG. 6 showing the position of the coupling plate ratcheting past the internal teeth of the numeral wheel as the resetting hub is rotatively restored to zero position relative to the wheel.

FIG. 8 is a right side elevation of the carriage taken on line VIII—VIII of FIG. 2, showing the mechanism for controlling entry of the constant factor in normal, inactive position.

FIG. 9 is a view similar to FIG. 8 showing the position of the mechanism as adjusted to active position by depression of the constant factor control key, but prior to operation of said mechanism.

FIG. 10 is a view similar to FIG. 9 showing the mechanism in operated position.

INTRODUCTION

The constant factor mechanism of the present invention is shown and will be described as embodied in a calculating machine of the general type of that disclosed in Patent No. 2,531,206 issued November 21, 1950 to Herman Gang, to which reference is made for a detailed description of such machine.

The machine includes a conventional accumulator of product-dividend register comprising an ordinally arranged series of numeral wheels or dials. Associated with each wheel is a resetting device in the form of a hub provided with a resetting cam. A resetting arm provided for each resetting device is cooperable with said cam to restore said devices to a given predetermined normal position whereby resetting of the numeral wheels is effected. The wheels are normally in such an angular position relative to the resetting hubs that when said hubs are restored to normal position, the wheels will then be in zero registering position.

To enter into the register as a constant factor a value which appears on the register, the coupling between the wheels and hubs is rendered ineffective, the numeral wheels locked against rotation and the hubs rotatively reset to their normal or what may be termed their "zero" position. Thereafter, the coupling between the wheels and hubs is rendered effective and the wheels unlocked. From the foregoing, it will be seen that the wheels have been angularly or rotatively adjusted relative to the clearing hubs so that the wheels register the constant factor value when the hubs are reset to normal (zero) position. In all subsequent resetting operations, the wheels when reset will register the constant factor value rather than zero.

GENERAL DESCRIPTION OF MACHINE

Referring to the drawings, the machine includes a main body **10** (FIGS. 1, 4) and a transversely shiftable carriage **2** mounted thereon. Mounted in the carriage **2** are an accumulator or product-dividend register comprising an ordinal series of numeral wheels **13** (FIG. 4), a multiplier storage register comprising storage wheels **524**, and a counter register comprising wheels **85**. Body portion **10** is provided with the usual keyboard including digital value keys **18** and a clear key **467** (FIG. 1) manually

depressible to initiate a cycle of operation of the clearing or resetting mechanism for wheels **13**.

Amounts set up on actuating gears **5** (FIG. 4) by means of keys **18** and setting bails **19** are registered either additively or subtractively in accumulator wheels **13** according to the direction of rotation of the actuator shaft **4**. A plus key **120** (FIG. 1) and minus key **121** respectively control additive and subtractive operation of the registering mechanism.

Registration is effected in the counter dials **85** by counting fingers (not shown) which operate substantially as set forth in Patent No. 2,273,237 to Walters.

The power for operating the machine is provided by an electric motor **1**.

RESETTING MECHANISM

The ordinally arranged series of numeral wheels **13** (FIGS. 2–5) comprising the accumulator register are loosely journalled for rotation on a shaft **30** which extends across the carriage **2** and is supported in left and right-hand side plates **2***a* (FIGS. 1, 2) of the carriage. Each wheel **13** comprises an annular cup-shaped portion **13***a* on the outer periphery of which are consecutively disposed the various digits 0 through 9 inclusive. Integral with the base of portion **13***a* there is formed a numeral pinion gear **13***b* adapted to cooperate with an intermediate gear of the digital actuating mechanism. An integral spacer collar **13***c* extends to the left of pinion **13***b* and abuts an auxiliary framing plate **32** of the carriage to prevent leftward movement of wheel **13**.

Adjustably coupled to each numeral wheel **13** is a resetting or clearing device in the form of a hub **35** journalled for rotation on shaft **30**. As hereinafter described, the nature of the coupling between the wheel **13** and its associated hub **35** is such that the wheel and hub can be rotatably adjusted relative to one another for entry of a constant factor.

Normally, however, the wheel and hub are coupled together in such an angular relation that when said hub is returned to a predetermined normal "zero" angular position, the wheel will be in zero registering position.

Since each wheel **13** and its hub are normally coupled together for concomitant rotation as a unit, the registration of a digital value other than zero in the wheel will cause it and the hub to assume an angular position corresponding to that digital value. To reset the wheels to zero position, each hub is reset to its predetermined zero position whereby the wheels will likewise be restored to zero position as described below.

The resetting mechanism is constructed substantially as disclosed in Patent No. 2,617,594 issued November 11, 1952 to Herman Gang, noting particularly FIG. 5 of said patent. Such mechanism includes a heart-shaped resetting cam **36** (FIGS. 2, 3, 4) integral with the right side of each resetting hub **35**. For operation in conjunction with cams **36**, a like number of arms **37** are fixed on a rock shaft **513** rotatably mounted in the carriage framing. Each arm is provided with a pivoted member **38** having a pair of oppositely disposed flanges **38′**. The arrangement is such that upon rocking of shaft **513** clockwise (FIG. 4, counterclockwise FIG. 1), one or the other of flanges **38′** will engage the cam **36** of the related hub **35** and thereby reset the hub (and the wheel **13** coupled to the hub) in the direction of lesser travel.

Shaft **513** is rocked to effect resetting of hubs **35** in response to depression of clear key **467** by mechanism which will now be described. For a fuller description of said mechanism, reference is made to the aforementioned Patent No. 2,531,206.

Referring to FIG. 1, the stem of clear key **467** is attached at its lower end to the forward end of a lever **471** pivotally mounted on a fixed stud **472**. Lever **471** terminates at its rear in a horizontally extending finger **471′** adapted for contact with an arm of a bell crank **475** pivotally mounted for rotation about a vertical axis. The other arm of bell crank **475** is connected to a horizontal slide **479** which extends across the machine. Depression of clear key **467** will rock lever **471** clockwise causing the finger **471′** thereof to engage bell crank **475** to move slide **479** toward the left side of the machine (i.e., toward the viewer in FIG. 1). The movement of slide **479** unlatches a slide **480** for forward movement allowing a one-cycle clutch **464** to be engaged. Clutch **464** is driven by a suitable gear train from the electric motor **1** and is of well-known construction in which a spring pawl mounted on the driven member of the clutch is held out of engagement with the driving member by a detent **487**. Slide **480** is pivoted at its rear end to an arm **485** fixed on a shaft **486**. Forward movement of slide **480** in response to depression of key **467** will cause arm **485** to rock shaft **486** counterclockwise thus removing detent **487**, which is fast on the shaft, from engagement with the spring-biased pawl of one-cycle clutch **464**, and thereby permitting the pawl to engage the driving member of the clutch to effect one cycle of rotation of the clutch.

Clutch **464** during its cycle of operation provides the power to operate the mechanism adjusted to active position by slide **479**. To this end, the driven member of the clutch is provided with an eccentric cam **495**. The eccentric cam is adapted to impart a reciprocatory movement to a link **496** which is attached at its forward end to a crank arm **497** fixed on a rotatable shaft **484** which extends across the machine. Thus when clutch **464** is operated, shaft **484** is rocked clockwise during the first half of the cycle and rocked back to normal position during the second half of the cycle.

It will be recalled that shaft **513** is rocked counterclockwise (FIG. 1) to restore resetting cams **36** and hubs **35** to normal position. The clockwise rocking movement of shaft **484** under the control of eccentric cam **495** is utilized to rock shaft **513** as follows.

A crank arm **513′** fast with shaft **513** has link connection **514** with an arm **514′** fixed on the carriage shaft **459** on which carriage **2** is rotatably mounted. Shaft **459** is journalled for rotation in and ordinal sliding movement relative to the fixed framing of the machine body portion **10**. An arm **512** splined to shaft **459** is pivoted to the upper end of a link **511** which is pivoted at its lower end to the rearward end of a lever **509**. Lever **509** is loosely supported for rotation intermediate its ends on a shaft **446**, and is formed at its forward end with a forwardly opening slot **509′**. An arm **508** provided with a leftwardly extending pin **508′** is slidably mounted on shaft **484** and is coupled to the shaft for rocking movement therewith by a collar **510** having a laterally extending lug **510′** which extends into a slot **508″** of said arm **508**. Normally, arm **508** is located sufficiently far to the right of lever **509** so that pin **508′** lies outside of slot **509′**. Slide **479** is provided with a rearwardly extending projection **479′** formed with a slot the walls of which engage the forward edge of arm **508**. Accordingly, when slit **479** is shifted to the left in response to depression of clear key **467** as described earlier, arm **508** will also be moved to the left to position pin **508′** within slot **509′** in driving relation with lever **509**. The subsequent clockwise rocking movement of shaft **484** and arm **508** will rock lever **509** counterclockwise and cause the linkage train **511**, **512**, **514′**, **514**, and **513′** to rock shaft **513** counterclockwise and thereby effect resetting of hubs **35** and wheels **13** coupled thereto.

As it is necessary that the intermediate gears in the carriage **2** be out of mesh with the intermediate gears in the machine body when wheels **13** are reset, a clearout cycle of clutch **464** operates to raise the forward end of the carriage. A cam **522** rotated with the driven member of clutch **464** serves to depress an arm **523** at the beginning of a resetting cycle. Arm **523** is fast on shaft **446**, as are arms **447** pivoted to the lower ends of links **448**. Carriage lifters **449** are provided with slots

449*a* at their forward ends by which they are pivotally mounted on pins on the inner sides of the right and left side frames respectively of the machine. The rearward end portions of lifters **449** are provided with hooked end portions **449***b* adapted to fit under and over an inwardly turned shelf located at the front and extending along the length of the carriage **2**. The upper ends of links **448** are pivoted to the rear portions of lifters **449**.

Counterclockwise rocking of shaft **446** in response to depression of arm **523** by cam **522** will, therefore, raise the forward end of carriage **2** through arms **447**, links **448**, and lifters **449**. As clutch **464** approaches its full cycle position at the end of a resetting cycle, arm **523** is allowed to move upwardly as a suitable spring (not shown) pulls the carriage downwardly to its normal position.

A shaft **527** (FIGS. 1, 2, 3, 8, 9, 10), which is rotatably mounted in the carriage framing and is adapted to be rocked clockwise (FIG. 1) and returned as an incident to a resetting operation, is utilized as the power drive means for operating the constant factor set-up mechanism as described subsequently. A crank **707** (FIG. 1) is splined on shaft **527** and extends forwardly between two spaced plates **708** which are mounted on and extend upwardly from the left-hand side frame of the machine body. Plates **708** are provided with a pin **708'** extending therebetween and through an open end slot in the end of crank **707**. Crank **707** is therefore held against lateral movement when carriage **2** is shifted. However when carriage **2** is raised in the resetting operation, the pin **708'** in engagement with the slot of crank **707** will hold the forward end of the crank from upward movement. Therefore as shaft **527** is raised with carriage **2**, crank **707** will be rocked clockwise and due to the splined connection with shaft **527** will rock the shaft in like direction. When the carriage is lowered to normal position at the end of a resetting cycle, shaft **527** will of course be restorted counterclockwise.

CONSTANT FACTOR MECHANISM

(*Coupling between wheels and hubs*)

As stated earlier, numeral wheels **13** are normally coupled to resetting hubs **35** for rotation therewith in such a relative angular disposition of these parts that when the hubs are reset to their predetermined zero or normal position, the wheels will be in zero registering position, as shown in FIG. 6. In accordance with the present invention, a constant factor is entered by: (1) causing the numeral wheels **13** to register the constant factor value; (2) locking the wheels against rotation and rendering the coupling between the wheels and resetting hubs **35** ineffective so that the hubs can be reset to their normal zero position without causing rotation of the numeral wheels; (3) resetting the hubs to their normal zero position; and (4) thereafter unlocking the wheels and rendering the coupling between the wheels and hubs effective for rotation of the wheels with the hubs. With regard to step (1), it should be noted that if the wheels **13** register the value to be entered as a constant factor as a result of a previous computation performed by the machine, one may proceed immediately with steps (2) et seq., for entry of the constant factor. This is in contrast to the operation of prior art constant factor mechanisms wherein the entry of a constant factor always requires that the register be cleared to zero and the constant factor value inserted through the keyboard. Of course, in the use of the mechanism of the present invention, the constant factor value can also be entered through the keyboard if desired or necessary.

The adjustable coupling between resetting hubs **35** and numeral wheels **13** will now be described. With reference to FIGS. 2, 4–7, the annular sheel **13***a* of each numeral wheel **13** is internally toothed to provide an annular series of ten equiangularly spaced teeth **40** providing high points **40***a* and low points **40***b*. Each low point corresponds to a different digital registering position

of wheel **13**. The associated resetting hub **35**, which is rotatably journalled on shaft **30**, is disposed within annulus **13***a* and is of a diameter slightly less than the locus of high points **40***a* for rotation therewithin. The driving coupling between each hub **35** and wheel **13** is provided by a coupling plate **42** comprising medial oppositely directed arms **42***a*, **42***b*, and symmetrically arranged side arms **42***c* which are laterally bent to form lugs **42***d* disposed to the opposite sides of arm **42***a*. The inner face of hub **35** is formed with a recess **43** contoured to receive plate **42**. Recess **43** comprises opposite radial portions **43***a*, **43***b* which receive arms **42***a* and **42***b* respectively and are of a width to closely fit the width of said arms, whereby plate **42** is constrained to rotate with hub **35**. The recess **43** also includes enlarged arcuate side portions **43***c* adapted to receive side arms **42***c*. The bases of recess portions **43***c* are provided with inwardly formed slots **43***d* which receive lugs **42***d* and also house compression springs **45** which urge the lugs toward the ends of said slots. The central portion of plate **42** is formed with a keyhole-shaped aperture **48**, said aperture comprising a circular portion **48***a* and a narrow portion **48***b* which extends radially in the direction of arm **42***a*. Circular portion **48***a* of aperture **48** serves to rotatably mount plate **42** on shaft **30** with a close running fit between the plate and shaft.

Noting FIG. 2, the inner end face of resetting hub **35** abuts the end wall of annulus **13***a*, while coupling plate **42** is securely held between a rightwardly extending boss of said wall and the base of recess **43**. Heart-shaped resetting cam **36** integral with hub **35** abuts resetting member **38**, thereby restraining the hub against movement to the right.

Springs **45** acting on lugs **42***d* of plate **42** urge arm **42***a* thereof in a radially outward direction along recess portion **43***a* of hub **35**. Arm **42***a* (FIG. 6) is thereby centered intermediate two adjacent teeth **40** of numeral wheel annulus **13***a* in contact with the adjacent side walls of said teeth. Since shaft **30** is of substantially the same diameter as the circular portion **48***a* of plate aperture **48**, said shaft holds the plate arm **42***a* blocked in radially outward position in meshed driving relation with teeth **40**, and thus wheel **13** and hub **35** are coupled together for conjoint rotation. Rotary movement of either the hub or wheel member (as in resetting or registering operations respectively) will cause a corresponding simultaneous rotation of the other member, since the torque of the driving member will be transmitted to the driven member through abutment of the edges of plate arms **42***a* and **42***b* with the sides of the respective mating recesses **43***a* and **43***b*.

There is also provided for each numeral wheel **13** the usual pivoted check pawl **50** (FIGS. 3, 4) formed with a forwardly extending detent portion **50***a* biased clockwise by a spring **51** into engagement with the teeth of numeral pinion **13***b*. Pawl **50** serves to accurately locate wheel **13** in the various rotary digital positions of the latter, and also to prevent overtravel of the wheel in registering operations. As wheel **13** rotates, the teeth of its pinion **13***b* will rock pawl **50** counterclockwise against the urge of spring **51** whereby said teeth ratchet past detent **50***a* of the pawl.

CONSTANT FACTOR MECHANISM

(*Constant factor set-up*)

Let us assume that the mechanism has been in a normal condition of adjustment wherein operation of the resetting mechanism causes the numeral wheels to be restored to positions of zero registration, and it is now desired to set up for constant factor operation wherein operation of the resetting mechanism will return the numeral wheels not to zero, but to the constant factor registration. The numeral wheels must first be caused to register the constant factor value, either as the result of a previous machine computation or by insertion through the

keyboard and digital actuating mechanism. Mechanism is provided whereby thereafter, in response to manual depression of a suitable constant factor control key and initiation of a resetting operation, the wheels are locked against rotation, the coupling between the wheels and hubs rendered ineffective, the hubs reset to their zero position while the wheels are held at the constant factor setting, and finally the wheels unlocked and the coupling between the wheels rendered effective again. As hereinafter described, the wheels are locked against rotation and the coupling between the wheels and hubs rendered ineffective by: (1) blocking pawls **50** against rearward counterclockwise movement thus preventing the teeth of numeral pinions **13***b* from ratcheting past the pawl; and (2) longitudinally shifting shaft **30** to the left to radially align reduced diameter portions thereof with the central apertures **48** of coupling plates **42**. When resetting of hubs **35** is effected with the parts adjusted as indicated above, the substantial radial clearance now provided between the walls of apertures **48** and shaft **30** will permit arms **42***d* of said plates to be cammed inwardly by teeth **40** of stationary wheels **13** against the urge of springs **45**. Accordingly, as hubs **35** are rotatively reset to their zero position, arms **42***a* can ratchet past teeth **40**. FIG. 7 shows, by way of example, the position of the parts as a constant factor value of 7 is being set up. The coupled numeral wheel **13** and resetting hub **35** have first been jointly rotated from their zero position of FIG. 5 to cause the wheel to register the 7 value at the reading line. FIG. 7 shows the inwardly cammed position of coupling plate ratcheting past teeth **40** of the locked wheel **13** as the resetting hub **35** is reset to its predetermined zero angular position of FIG. 6.

The mechanism whereby the above operations are performed will now be described. Shaft **30** (FIGS. 2, 3, 8, 9, 10) is slidably mounted for longitudinal movement in the carriage framing plates **2***a* and is formed with a plurality of reduced diameter portions **55** (FIGS. 2, 6, 7) each located to the right of a coupling plate **42**. The diameter of shaft portions **55** is slightly less than the width of the radial aperture portions **48***b* of coupling plates **42** so as to free plates **42** for inward movement when said reduced portions **55** are aligned with the plates. A collar **56** fixed to the right end of shaft **30** is provided with enlarged end walls between which is received the forward end of one arm of a pivoted bell crank **57**. The other arm of the bell crank extends to the right beneath a downwardly opening slot **58** formed at the rear end of a link **59** which is pivoted at its forward end to one arm **62***a* of a U-member **62** which comprises two arms **62***a*, **62***b* and an interconnecting base **62***c*. Member **62** is loosely pivotally mounted on rock shaft **527** journalled for rotation in the carriage framing. A collar **63** is fixed to shaft **527** by a pin **64** which extends outwardly to the rear of the collar and shaft. A coil spring **65** is mounted on shaft **527** between collar **63** and arm **62***a*. One end of the spring is fastened to the collar while the free forward end of the spring abuts base portion **62***c* of U-member **62** and urges it counterclockwise into engagement with the rear end of pin **64**.

A longitudinal slot **67** formed in the rear portion of link **59** serves to adjustably support the link on a pin **68** fixed to the rear leg **69***a* of the right-angled stem **69** of a manually operable constant factor control key **70**. Stem **69** is pivotally supported on a stud **71** and is normally maintained in clockwise position abutting a stop **72** by a spring **73**, in which position pin **68** holds link **59** elevated with slot **58** above the right end of bell crank **57** as shown in FIG. 8.

Shaft **527**, which is utilized as the power drive means for effecting operation of the constant factor mechanism, is adapted to be rocked clockwise and returned as an incident to a resetting operation as described earlier. U-member **62**, being coupled to shaft **527** by spring **65**, will itself be rocked in like direction thus causing link **59** to move forwardly and return. Since, however, the link is normally held in disabled elevated position by pin **68** with slot **58** above the right end of bell crank **57**, the link will merely operate idly back and forth above the bell crank.

To effect leftward shifting movement of shaft **30** and thereby render the coupling between wheels **13** and hubs **35** ineffective during a resetting operation, key **70** is manually held depressed while a resetting operation is initiated and carried out in response to depression of clear key **467**. As seen in FIG. 9, depression of key **70** will enable link **59** by rocking key stem **69** counterclockwise, thereby lowering the rear end of the link by virtue of the pin and slot connection **67**, **68** between the stem and link. Link **59** is now in enabled driving relation with bell crank **57**, the right end of the bell crank being disposed within slot **58** of the link. When link **59** is subsequently moved forwardly in response to counterclockwise rocking of shaft **527**, as shown in FIG. 10, it will rock bell crank **57** clockwise and displace shaft **30** to the left to align the reduced portions **55** with the central apertures **48** of coupling plates **42**, as shown in FIG. 6 and in broken lines in FIG. 2. Leftward movement of shaft **30** is halted by abutment of a stop collar **76** fixed thereon (FIG. 2) with the right side plate **2***a* of the carriage before shaft **527** has completed its counterclockwise stroke. However, the yieldable coupling provided by spring **65** between the shaft and U-member **62** will permit the shaft to complete its stroke even though the linkage **57**, **59**, **62** is restrained against further movement by collar **76** and side plate **2***a*.

Movement of shaft **30** to the left is also employed to lock the numeral wheels **13** against rotation as follows. An elongated slide **80** (FIGS. 2, 3), mounted at the top of and extending across the carriage **2**, is prdvided at its end portions with a longitudinal slot **80***a* into which extends a guide pin **80***b* fixed to the carriage. Slide **80** is formed with an ordinal series of blocking lugs **81** each disposed slightly forwardly of and adapted for cooperation with the upper end of a corresponding numeral wheel check pawl **50**. Slide **80** is connected with shaft **30** to move longitudinally therewith by means of a fork **82** integral with the right end of the slide. The opposed arms of said fork extend into an annular groove **83** of a collar **84** fast on shaft **30**. In the normal right-hand position of shaft **30** and slide **80**, lugs **81** are inactively located to the right of upstanding noses **87** of pawls **50**. Upon a leftward shift of the shaft and slide, lugs **81** will be brought to active position wherein they lie in the path of movement of pawl noses **87**, thereby blocking pawls **50** against counterclockwise movement. Numeral wheels **13** are thus effectively rendered incapable of rotation and thereby locked against resetting, inasmuch as the teeth of numeral pinions **13***b* can rotatively ratchet past detents **50***a* of pawls **50** only if the latter are free for counterclockwise pivotal movement.

It should be noted that in a resetting cycle of operation, shaft **527** rocks counterclockwise (and thereby operates to move shaft **30** to the left) before resetting members **38** are caused to cooperate with heart-shaped cams **36** to reset hubs **35**. Since the shaft reduced diameter portions **55** are now aligned with the radial aperture portions **48***b* of plates **42**, arms **42***a* of said plates are no longer held blocked by shaft **30** in meshed driving relation with the teeth **40** of wheel **13**. As hubs **35** (and plates **42**) are rotatively reset to zero position while the wheels are locked against rotation, arm **42***a* will be cammed inwardly by teeth **40** against the urge of springs **45** (note FIG. 7) whereby the arm ratchets past said teeth. Coupling plate arm **42***a* is free for such inward camming movement since shaft portion **55** is of a smaller diameter than the width of the radial aperture portion **48***b* of plate **42** thereby providing substantial radial clearance between the plate and reduced shaft portion **55**.

Shaft **30** is maintained to the left by shaft **527** until after hubs **35** have been reset, whereupon shaft **527** rocks back to clockwise position upon lowering of the carriage **2**, thus returning shaft **30** to normal, right-hand position through linkage **62**, **59**, **57**, in which position the shaft **30** again maintains coupling arm **42***a* blocked in driving relation with teeth **40**. A second stop collar **90'** (FIG. 2), similar to collar **76**, fixed on shaft **30** is adapted to limit rightward movement of the shaft by abutment with the carriage framing plate **2***a*.

It should be noted that when shaft **30** is to be restored from its leftward position, arms **42***a* of coupling plates **42** will usually be urged to radially outward position by springs **45**, as shown in FIG. 6. If for any reason, however, arms **42***a* are not so held in outward position, shaft **30** might be jammed against rightward restoring movement by contact with the side edges of the plate apertures **48**. To avoid the possibility of such jamming, the left edge of each reduced diameter portion **55** of shaft **30** is bevelled outwardly at **90** (FIG. 2) to provide a camming surface which, if engaged by the side edges of apertures **48** in rightward movement of the shaft, will cam plate **42** to its usual radial position of FIG. 6 and permit shaft movement.

While there has been shown a specific form of the invention applied to a calculating machine of the type disclosed in Patent No. 2,531,206, it is intended that the present disclosure be illustrative only and not limitative of the claims, since the invention can readily be applied in other embodiments and to other types of machines. Thus, while the disclosed embodiment contemplates the provision of the constant factor mechanism in all the ordinal dials of an accumulator register, a lesser number or even only one dial may include the constant factor mechanism; and the constant factor mechanism can, if desired, be incorporated into a counter register.

With reference to possible modifications of the coupling between the wheels **13** and hubs **35** within the scope of the invention, it is not necessary that the coupling device be a plate mounted on shaft **30**. The coupling elements could comprise one or more balls radially movable in guide recesses formed in the resetting hub into driving relation with internal teeth **40** of the numeral wheel. Still further, whether the coupling elements be plates or balls, springs **45**—which urge the coupling elements to driving relation—could be omitted and shaft **30** provided with a bevel similar to but longer and less steep than that presently provided at **90** (whereby camming pressure is reduced), said bevel to always operate in a constant factor set-up operation to cam the coupling device radially outward to driving relation with the numeral wheel.

It will therefore be understood that various omissions and substitutions and changes in the form and details of the mechanism illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is our intention, therefore, to be limited only as indicated by the scope of the following claims.

We claim:

1. In a register, a numeral wheel digitally adjustable to register various digital values, a resetting device for said wheel, means effective to couple said numeral wheel to said resetting device for resetting therewith, selectively operable means for locking said numeral wheel against resetting and for rendering said coupling means ineffective, and resetting means for effecting operation of said resetting device while said numeral wheel is uncoupled from said resetting device and is locked against resetting, whereby said resetting device can be operated without causing resetting of said numeral wheel.

2. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, a resetting device for each wheel restorable to a predetermined position, means effective to couple each

numeral wheel to its resetting device for resetting therewith, selectively operable means for locking at least one of said numeral wheels against resetting and rendering ineffective the coupling means between said one numeral wheel and its resetting device, and means for restoring said resetting devices to said predetermined position while said one numeral wheel is uncoupled from its resetting device and is locked against resetting, whereby said resetting devices can be restored to said predetermined position without causing resetting of said one numeral wheel.

3. In a calculating machine, a register including an ordinally arranged series of digitally adjustable numeral wheels, resetting mechanism for said numeral wheels, means effective to couple said numeral wheels to said resetting mechanism for resetting thereby, normally ineffective means for locking said wheels against rotation and rendering ineffective the coupling means between said numeral wheels and resetting mechanism, and means for rendering effective said last mentioned normally ineffective means.

4. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, a resetting device for each numeral wheel, said resetting devices being adapted to be restored to a predetermined position, each numeral wheel being coupled to its resetting device for resetting therewith, and selectively operable means for uncoupling said numeral wheels from said resetting devices in any digitally adjusted position thereof and also locking said wheels against resetting from said adjusted position, whereby said resetting devices can be restored to said predetermined position without causing resetting of said numeral wheels.

5. The invention according to claim 4 including selectively operable means for enabling said uncoupling and locking means, and means for operating said uncoupling and locking means.

6. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, a resetting device for each numeral wheel, means effective to couple each numeral wheel to its resetting device for resetting therewith, resetting means for restoring said resetting devices to a predetermined position, mechanism operable to lock said numeral wheels against resetting and render said coupling means ineffective, means for operating said mechanism, a normally disabled drive connection between said mechanism and operating means, and selectively operable means for enabling said drive connection.

7. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, a resetting device for each numeral wheel, means effective to couple each numeral wheel to its resetting device for resetting therewith, normally inactive resetting means operable to restore said resetting devices to a predetermined position, means for selectively initiating a resetting cycle of operation, means for operating said resetting means within said cycle, normally disabled mechanism for locking said numeral wheels against rotation and rendering ineffective the coupling between each numeral wheel and its resetting device, means for selectively enabling said mechanism, and means responsive to initiation of said resetting cycle of operation for operating said mechanism prior to operation of said resetting means.

8. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, a resetting device for each numeral wheel, means effective to couple each numeral wheel to its resetting device for resetting therewith, normally inactive resetting means operable to restore said resetting devices to a predetermined position, means including a key for selectively initiating a resetting cycle of operation, means for operating said resetting means within said cycle, normally disabled mechanism for locking said numeral wheels against rotation and rendering ineffective the coupling between

each wheel and its resetting device, means including a key for selectively enabling said mechanism, and power drive means responsive to initiation of said resetting cycle of operation for operating said mechanism prior to operation of said resetting means.

9. In a calculating machine, a register including an ordinal series of digitally adjustable numeral wheels, a resetting device for each numeral wheel, means effective to couple each numeral wheel to its associated resetting device for resetting therewith, normally inactive resetting means operable to restore said resetting devices to a predetermine position, means for selectively initiating a resetting cycle of operation, means responsive to initiation of said cycle for operating said resetting means within said cycle, normally ineffective means for locking said wheels against rotation, normally ineffective means for rendering ineffective the coupling means between said wheels and resetting devices, normally disabled means for rendering effective said two last mentioned normally ineffective means, means for selectively enabling said normally disabled means, and power drive means responsive to initiation of said resetting cycle of operation for operating said normally disabled means.

10. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, resetting mechanism for said numeral wheels normally effective to cause resetting of said numeral wheels, means for selectively operating said resetting mechanism, means for divorcing said numeral wheels from said resetting mechanism whereby operation of said resetting mechanism will be ineffective to cause resetting of said numeral wheels, power drive means for operating said divorcing means, a normally disabled drive connection between said power drive means and divorcing means, and means for selectively enabling said drive connection.

11. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, cyclically operable resetting mechanism for said numeral wheels normally effective to cause resetting of said numeral wheels, means for selectively initiating a resetting cycle of operation, means for operating said resetting mechanism within said cycle, normally ineffective means operable to divorce said numeral wheels from said resetting mechanism whereby operation of said resetting mechanism will be ineffective to cause resetting of said numeral wheels, means for selectively rendering said divorcing means effective, and means responsive to initiation of said resetting cycle of operation for operating said last mentioned means prior to operation of said resetting mechanism.

12. In a calculating machine, a register comprising an ordinally arranged series of digitally adjustable numeral wheels, a resetting device for each wheel, means effective to couple each wheel to its resetting device for concomitant movement of said wheel and resetting device, resetting means operable to restore said resetting devices to a predetermined position, selectively operable means for rendering ineffective the coupling means between each wheel and its resetting device when said resetting device and wheel are in any given position, whereby said resetting device can be restored to said predetermined position while said numeral wheel is maintained at the given position, and the coupling thereafter rendered effective.

13. In a calculating machine including a register comprising an ordinally arranged series of digitally adjustable numeral wheel members, a resetting member for each numeral wheel member, and resetting means for restoring said resetting members to a predetermined position; means effective to couple each numeral wheel member to its associated resetting member for resetting therewith, said coupling means including a coupling element constrained for movement with one of said members, said coupling element being movably adjustable to and from driving relation with the other of said members, blocking means effective to maintain said coupling element in said driving relation, and means for selectively rendering said blocking means ineffective.

14. In a calculating machine including a register comprising an ordinally arranged series of digitally adjustable numeral wheel members, a resetting member for each numeral wheel member, and resetting means for restoring said resetting members to a predetermined position; means effective to couple each numeral wheel member to its associated resetting member for resetting therewith, said coupling means including a coupling element constrained for movement with one of said members, said coupling element being adjustable to and from driving relation with the other of said members, spring means for urging said coupling element to said driving relation, blocking means effective to maintain said coupling element in said driving relation, and means for selectively rendering said blocking means ineffective.

15. In a calculating machine including a register comprising an ordinally arranged series of digitally adjustable numeral wheel members, a resetting member for each numeral wheel member, and resetting means for restoring said resetting members to a predetermined position; means effective to couple each numeral wheel member to its associated resetting member for resetting therewith, said coupling means including a coupling element constrained for movement with one of said members, said coupling element being movably adjustable to and from driving relation with the other of said members, shaft means including a first portion of a given diameter operable to maintain said coupling element blocked in said driving relation and a second portion of a smaller diameter to permit said coupling element to move out of said driving relation, said shaft means being shiftable relative to said coupling element to bring either of said first and second shaft portions into alignment with the path of adjusting movement of said coupling element.

16. The invention according to claim 15, said numeral wheel and resetting members being mounted on said shaft means.

17. The invention according to claim 15, said shaft means being provided with an inclined cam surface intermediate said first and second shaft portions engageable with said coupling element to move said coupling element to said driving relation.

18. In a calculating machine including a register comprising an ordinally arranged series of digitally adjustable numeral wheel members, a resetting member for each numeral wheel member, and resetting means for restoring said resetting members to a predetermined position; means effective to couple each numeral wheel member to its associated resetting member for resetting therewith, said coupling means including a coupling element constrained for movement with one of said members, said coupling element being adjustable to and from driving relation with the other of said members, spring means for urging said coupling element to said driving relation, blocking means effective to maintain said coupling element in said driving relation, and selectively operable mechanism for locking said numeral wheels against resetting and rendering ineffective said coupling means, said selectively operable mechanism including means for rendering said blocking means ineffective.

19. In a calculating machine, a numeral wheel, a resetting device therefor, means for coupling said numeral wheel to said resetting device for resetting thereby, and shaft means upon which said numeral wheel and resetting device are rotatably mounted, said shaft means being axially shiftable to selectively render said coupling means effective and ineffective.

20. The invention according to claim 19 including blocking means operable to positively maintain said coupling means in effective condition.

21. The invention according to claim 20 including means for rendering said blocking means effective in re-

sponse to axial shifting movement of said shaft in a given direction.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,995,299 August 8, 1961

Herman Gang et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 58, for "slit" read -- slide --; column 5, line 38, for "restorted" read -- restored --; line 71, for "sheel" read -- shell --; column 8, line 35, for "prdvided" read -- provided --; column 11, line 12, for "determine" read -- determined --; column 14, line 1, for "2,342,352" read -- 2,342,325 --.

Signed and sealed this 22nd day of January 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents