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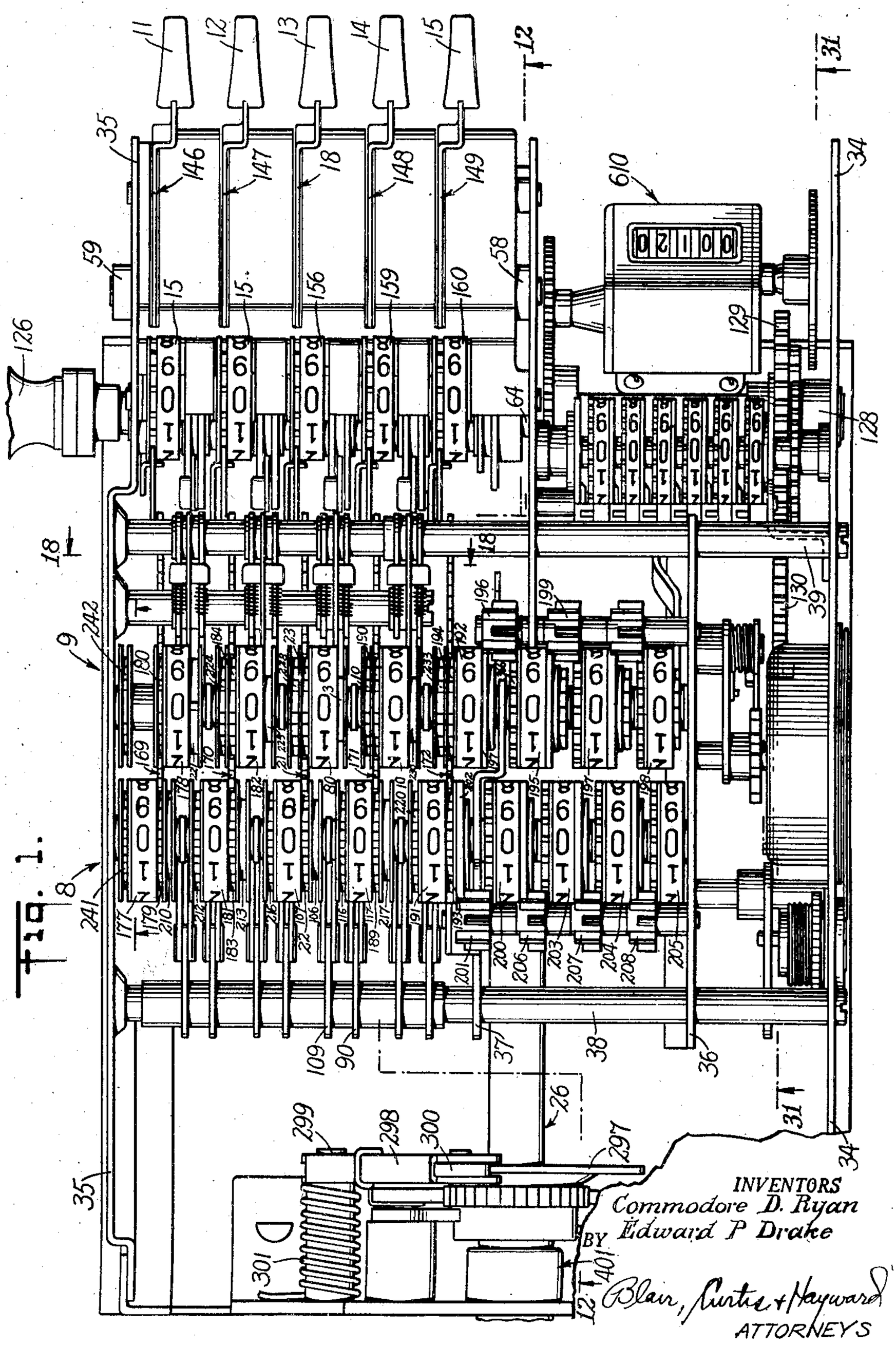

Fig. 1.

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Fig. 3.

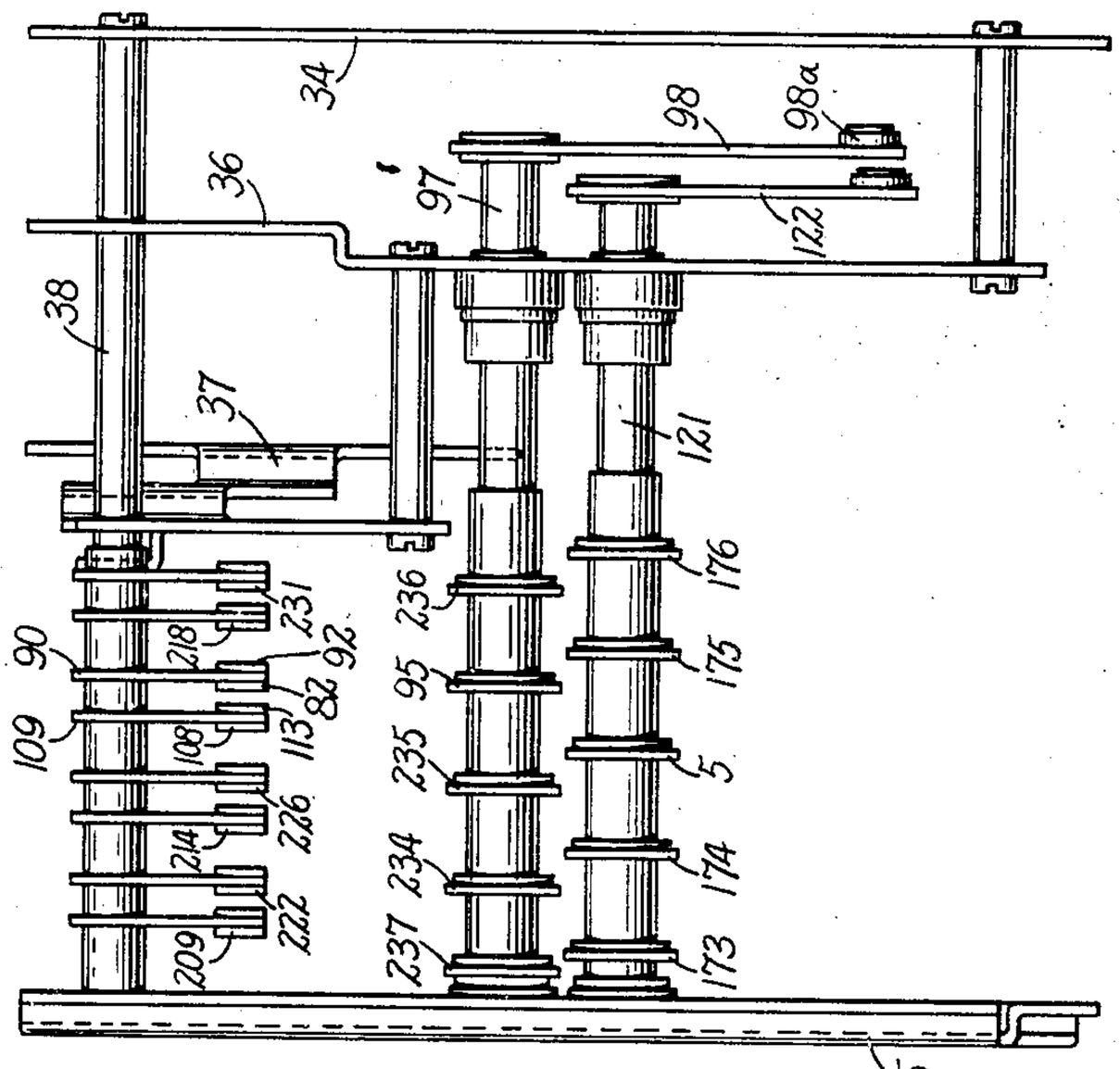

Fig. 2.

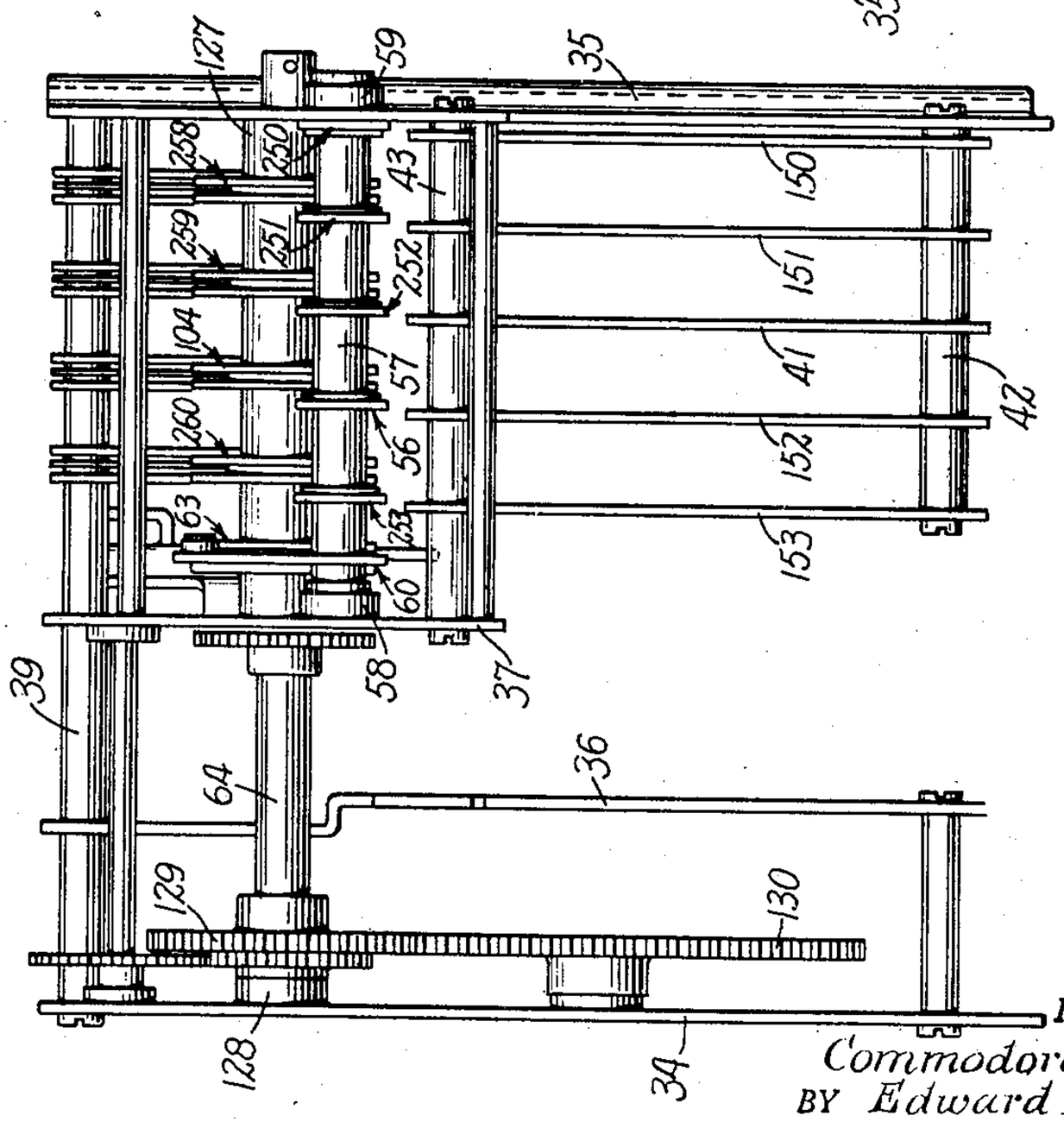

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Fig. 4.

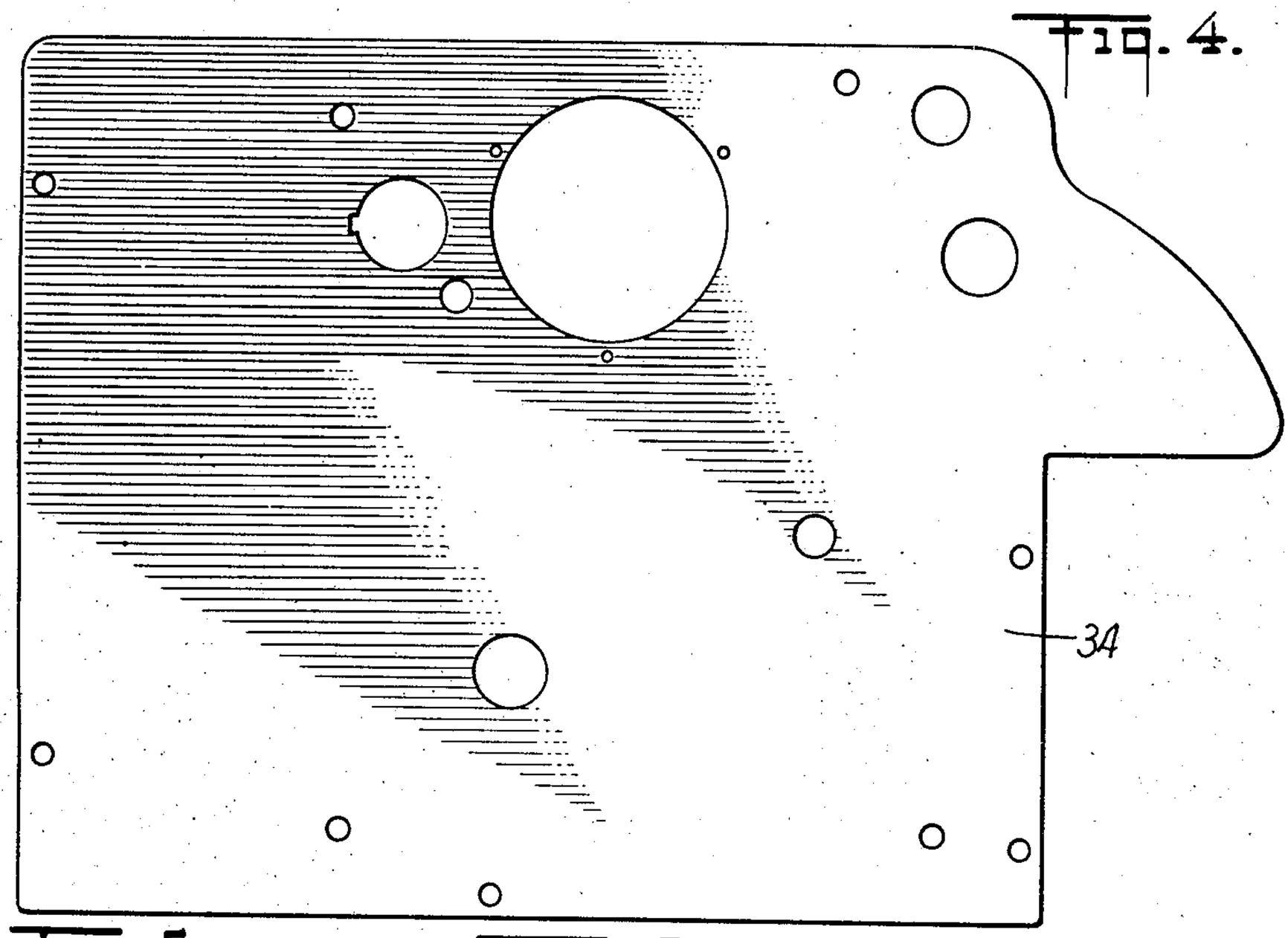

Fig. 5.

Fig. 6.

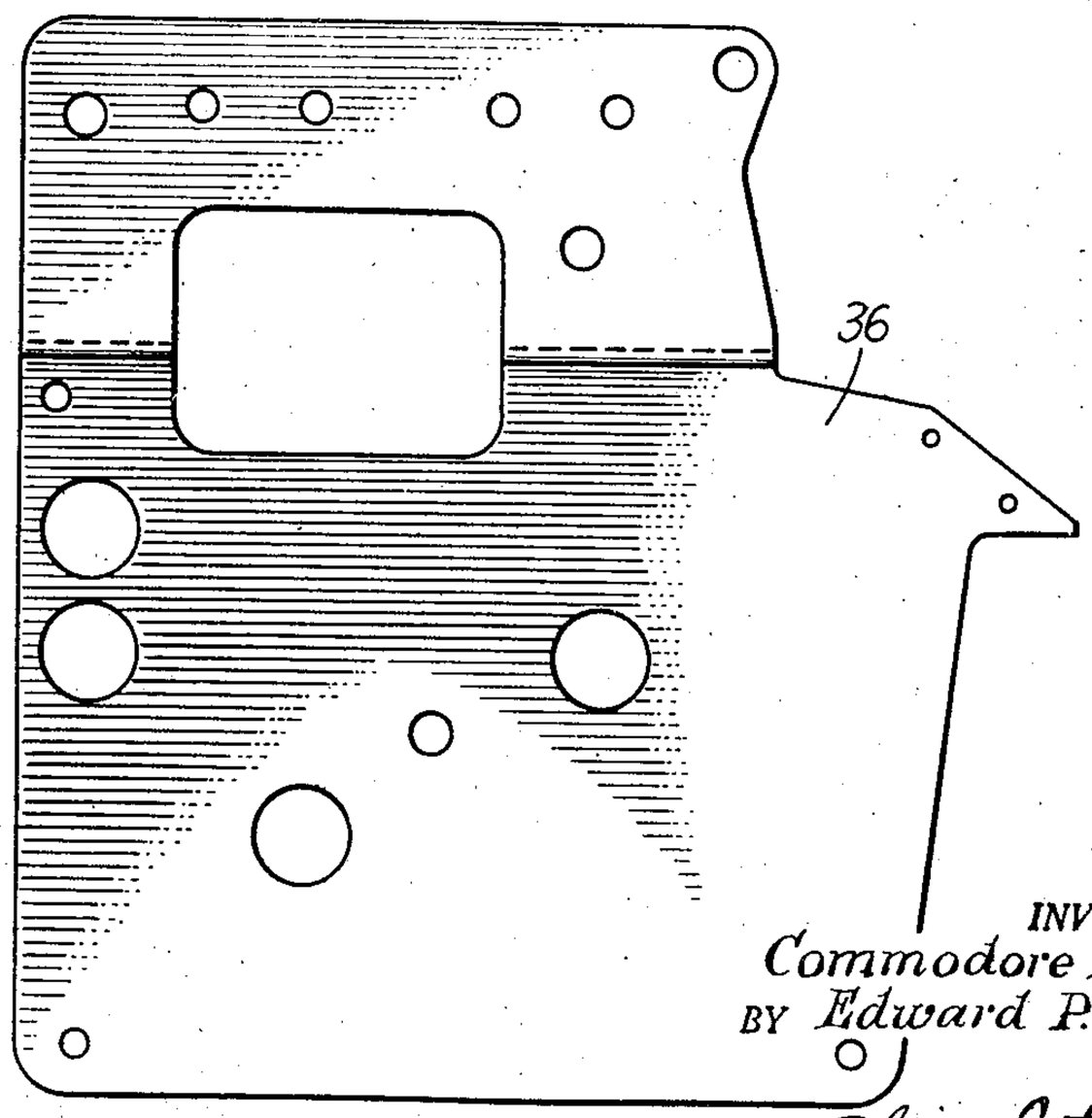

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Fig. 7.

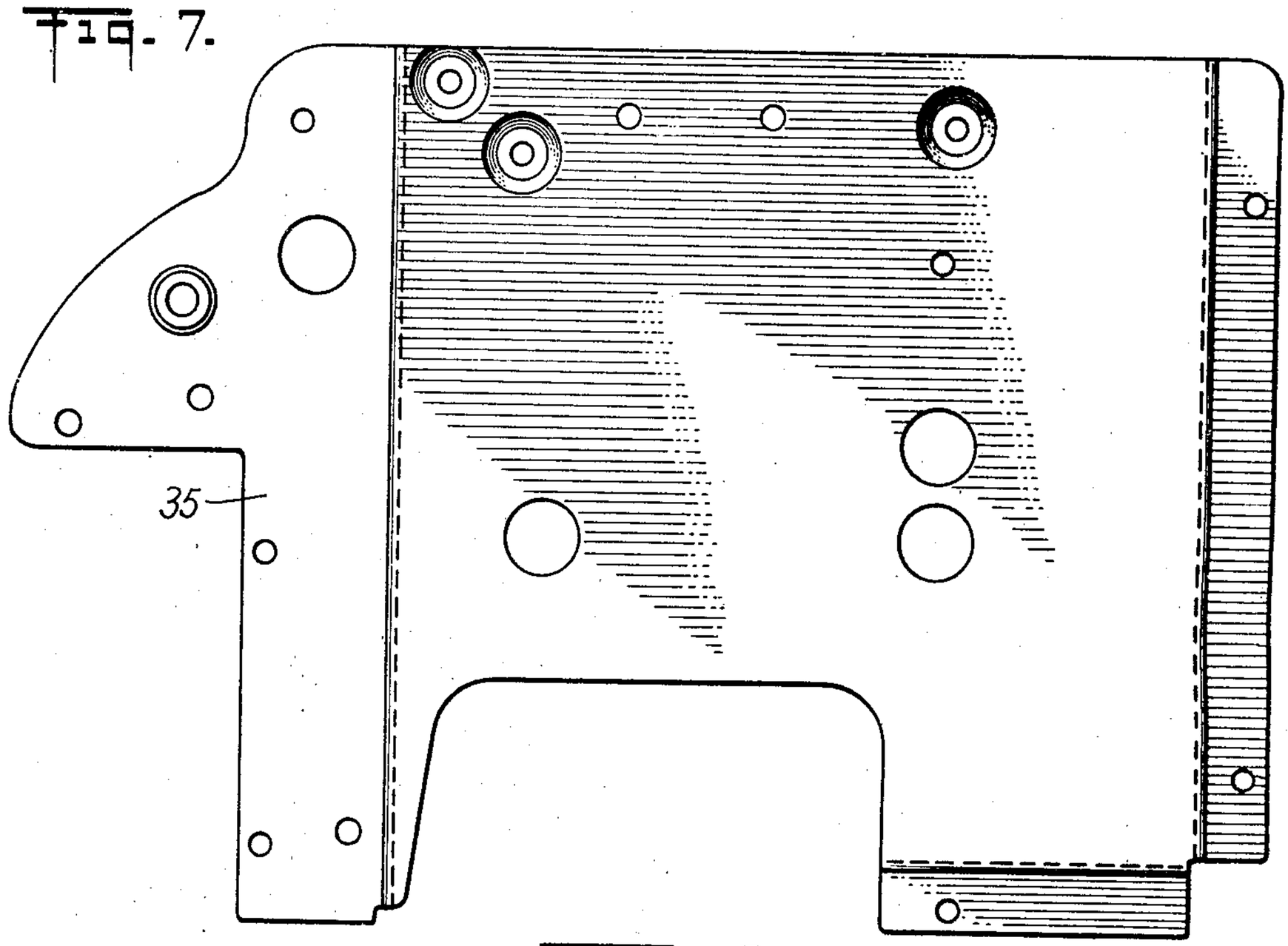

Fig. 8.

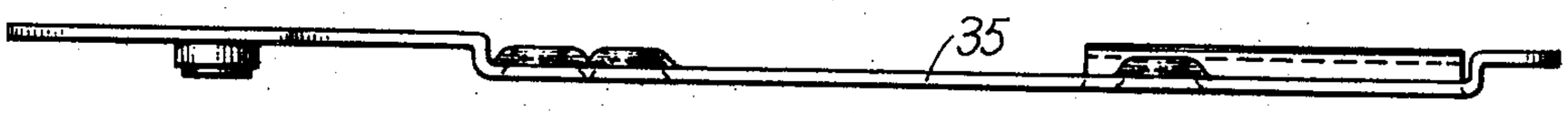

Fig. 9.

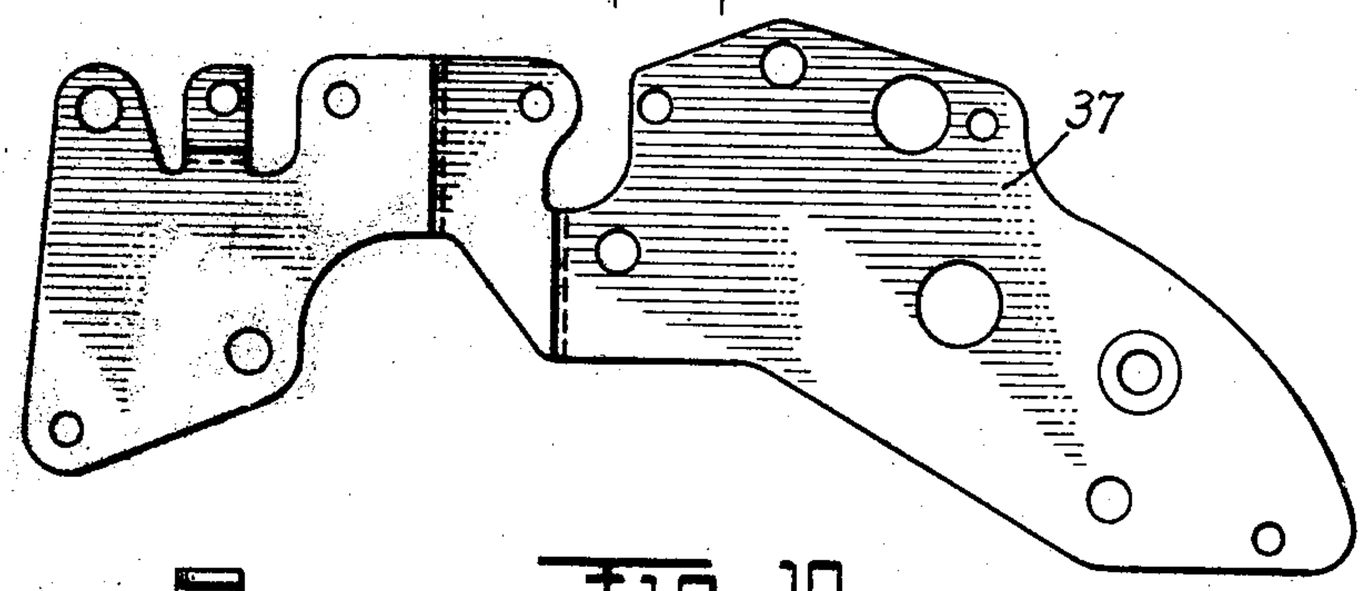

Fig. 10.

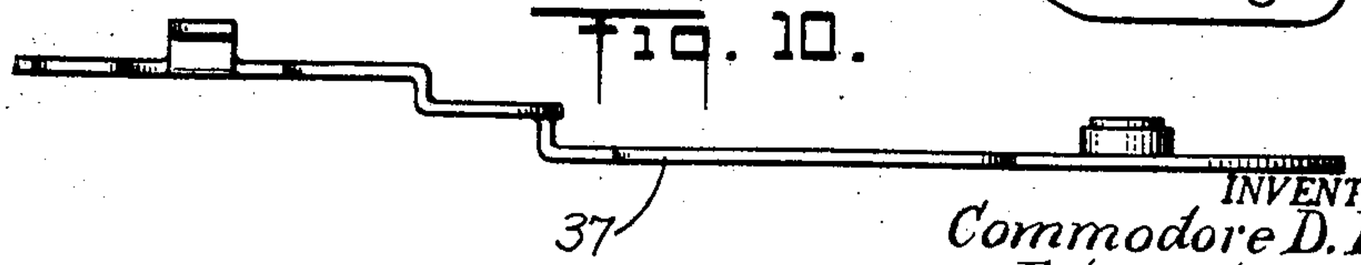

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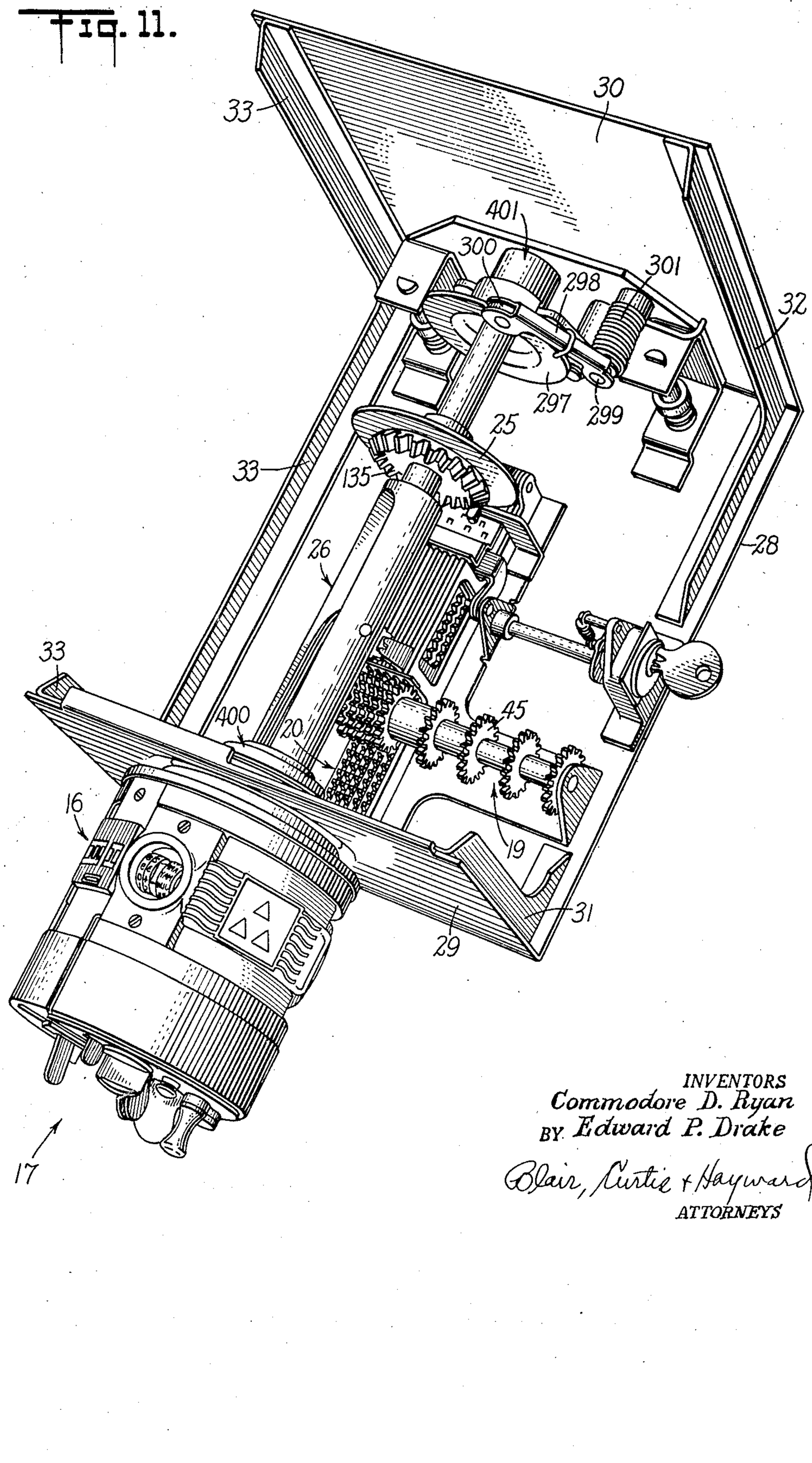
Fig. 11.



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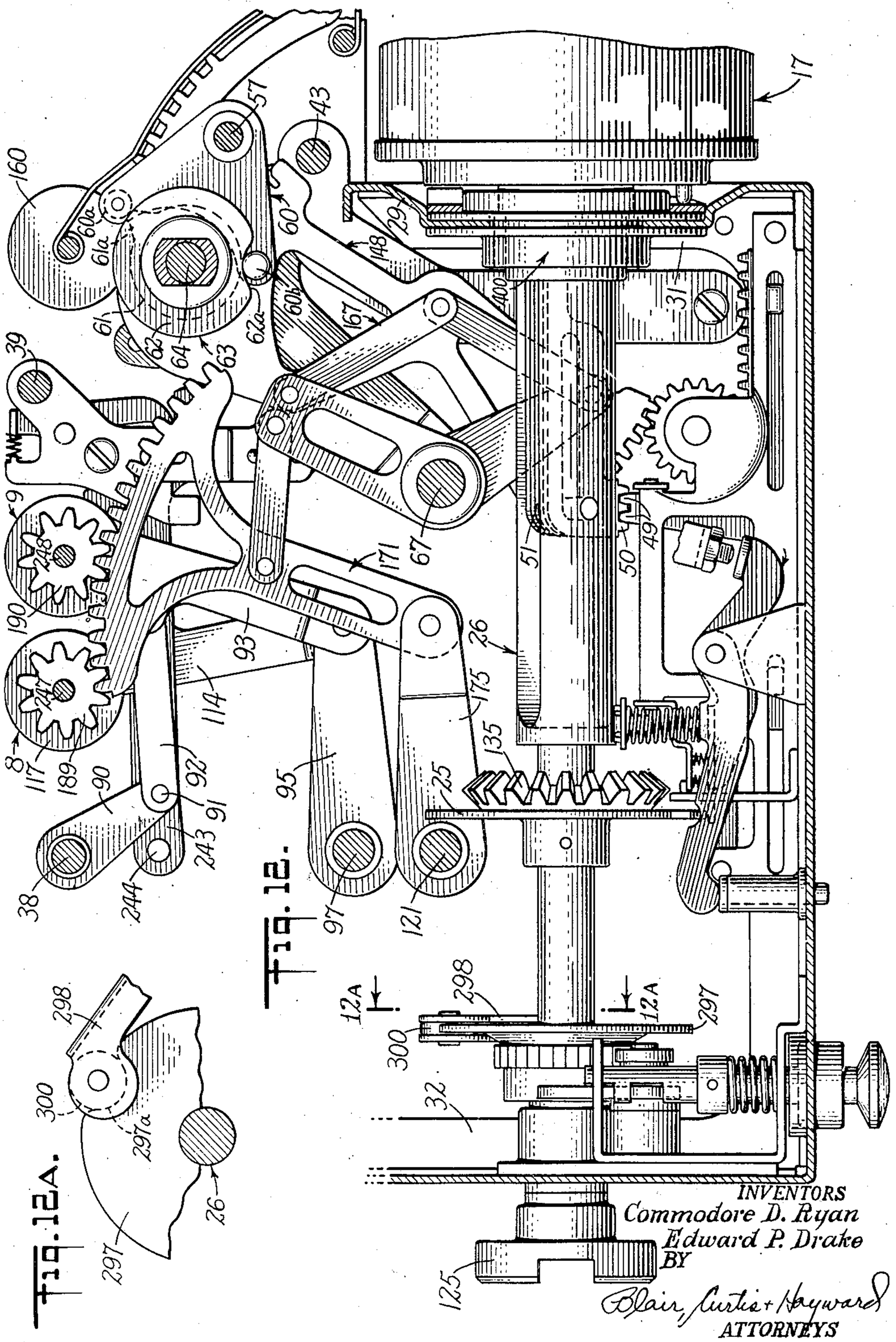

Fig. 12.

Fig. 12A.

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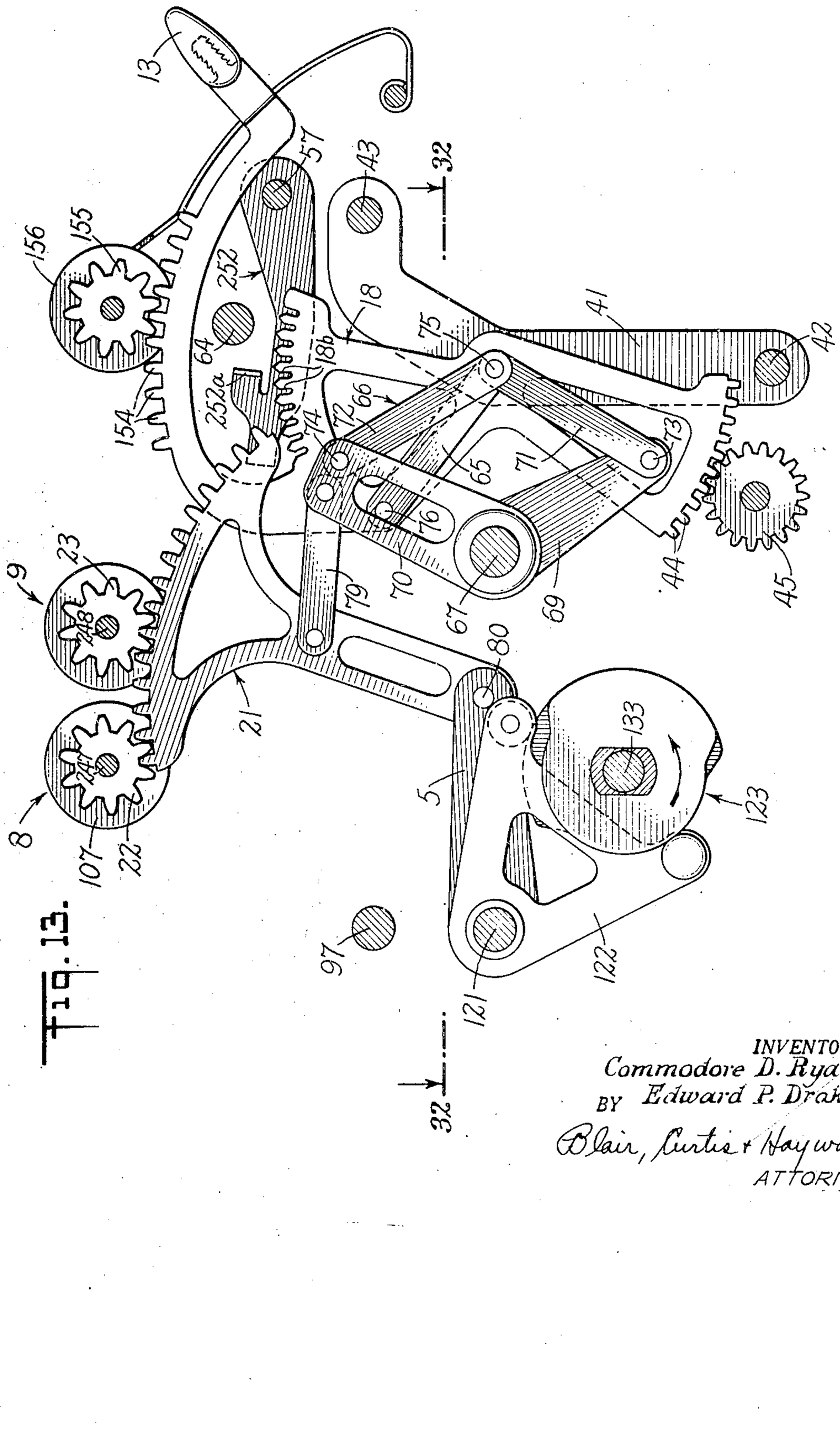

Fig. 13.

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Fig. 14.

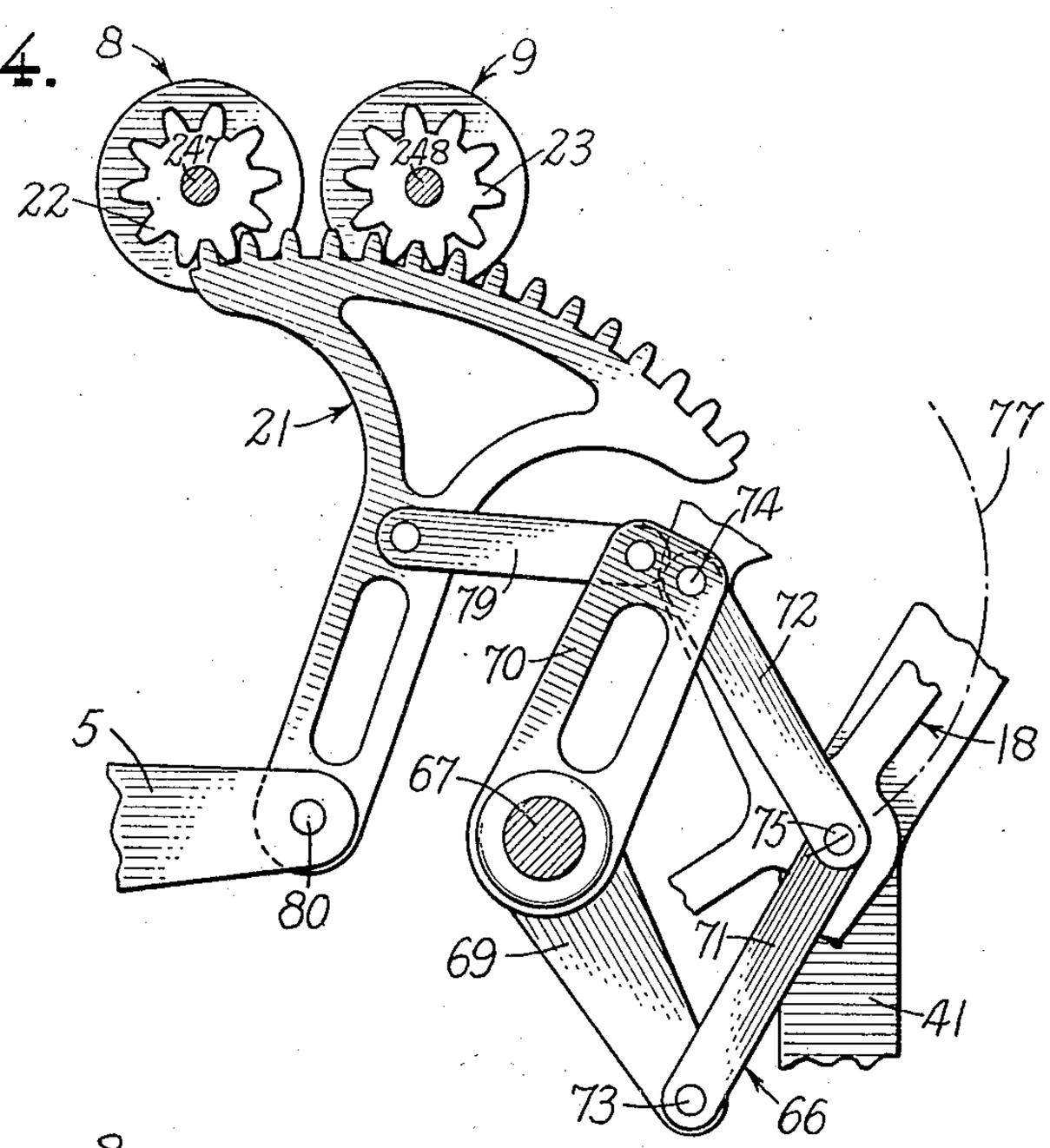

Fig. 15.

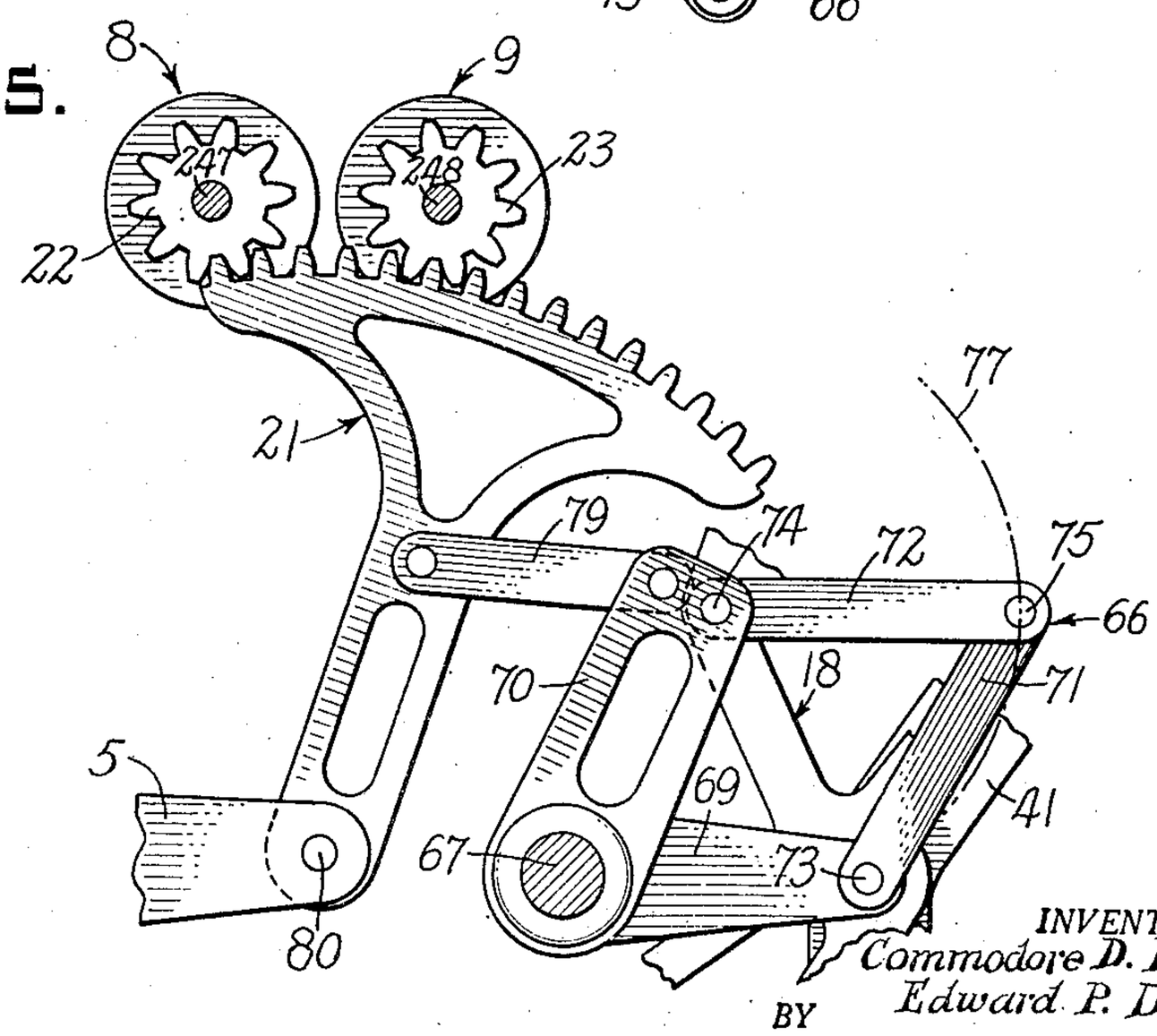

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Fig. 16.

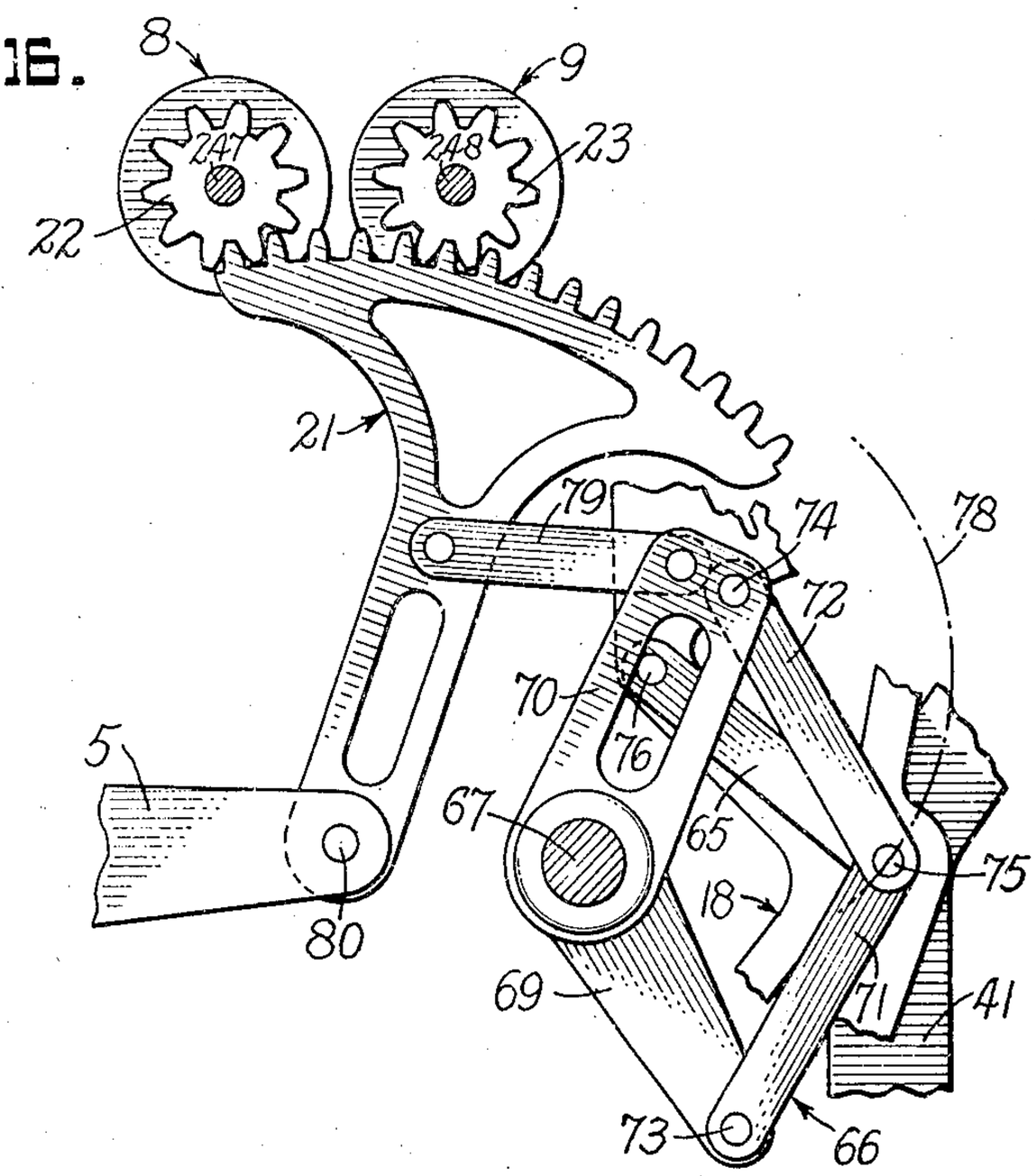

Fig. 17.

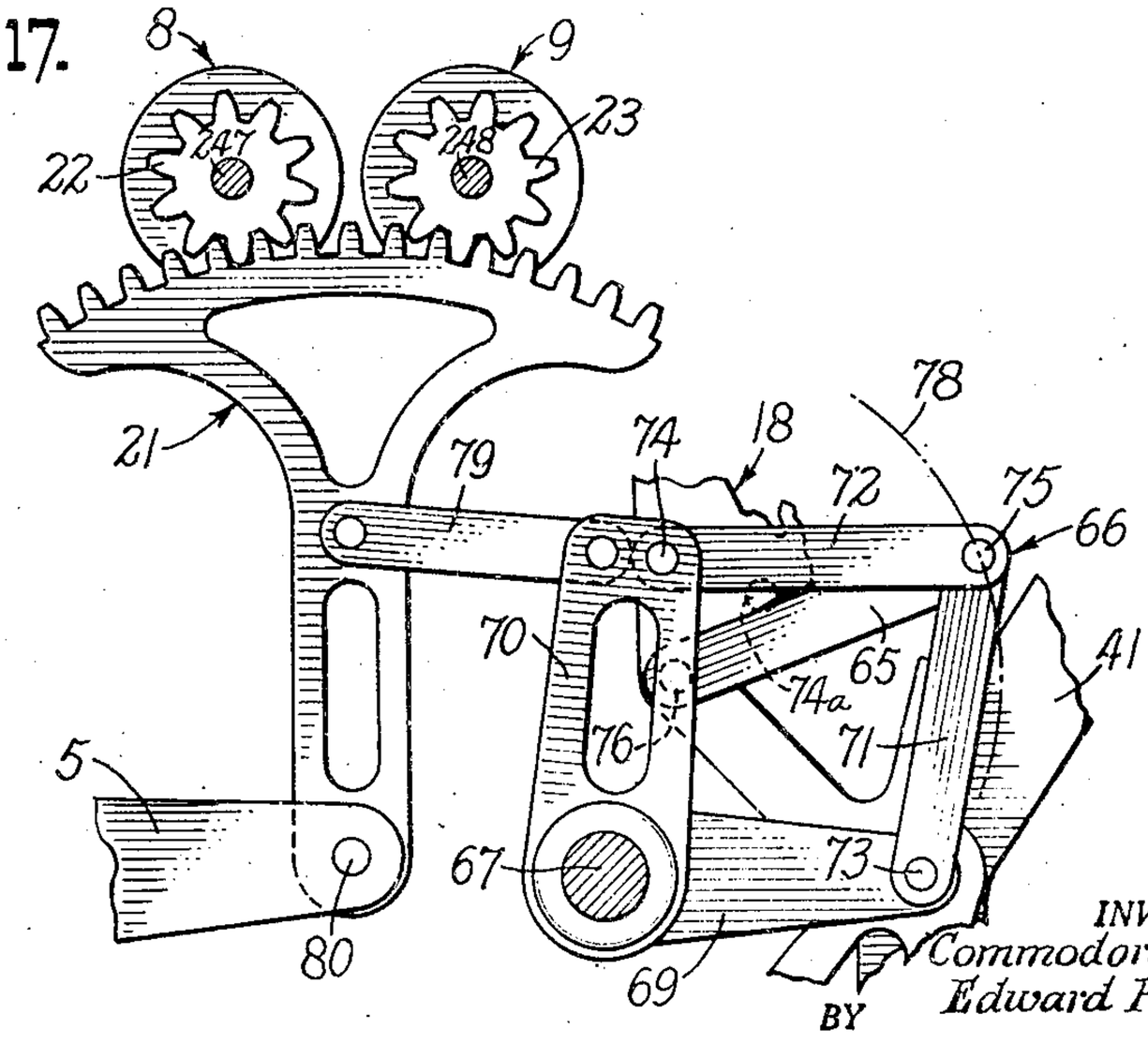

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FIG. 18.

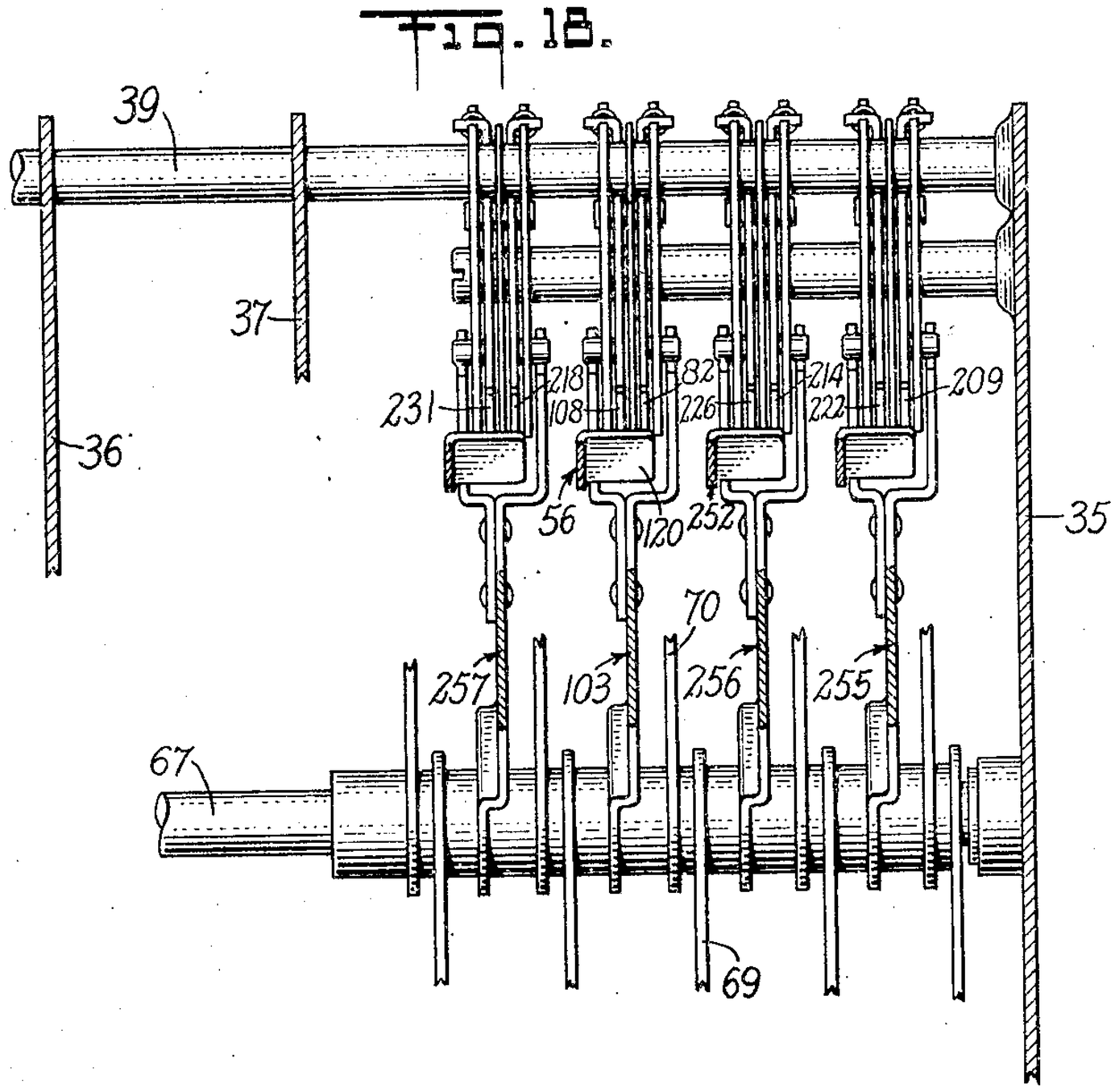

FIG. 19.

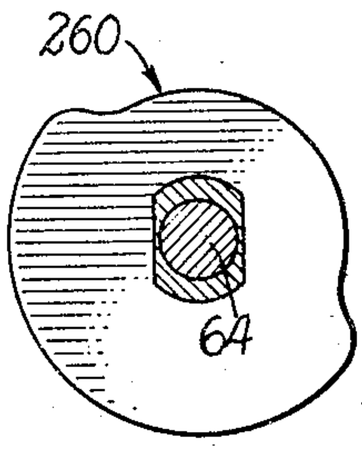

FIG. 20.

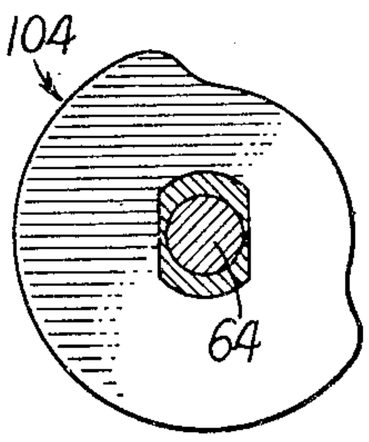

FIG. 21.

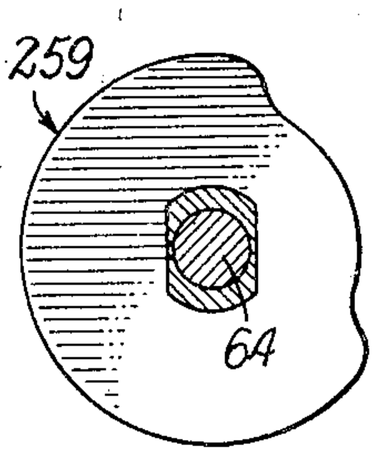

FIG. 22.

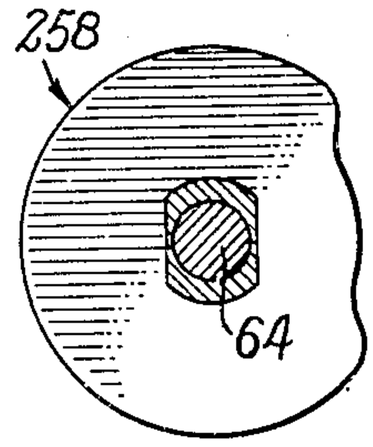

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FIG. 23.

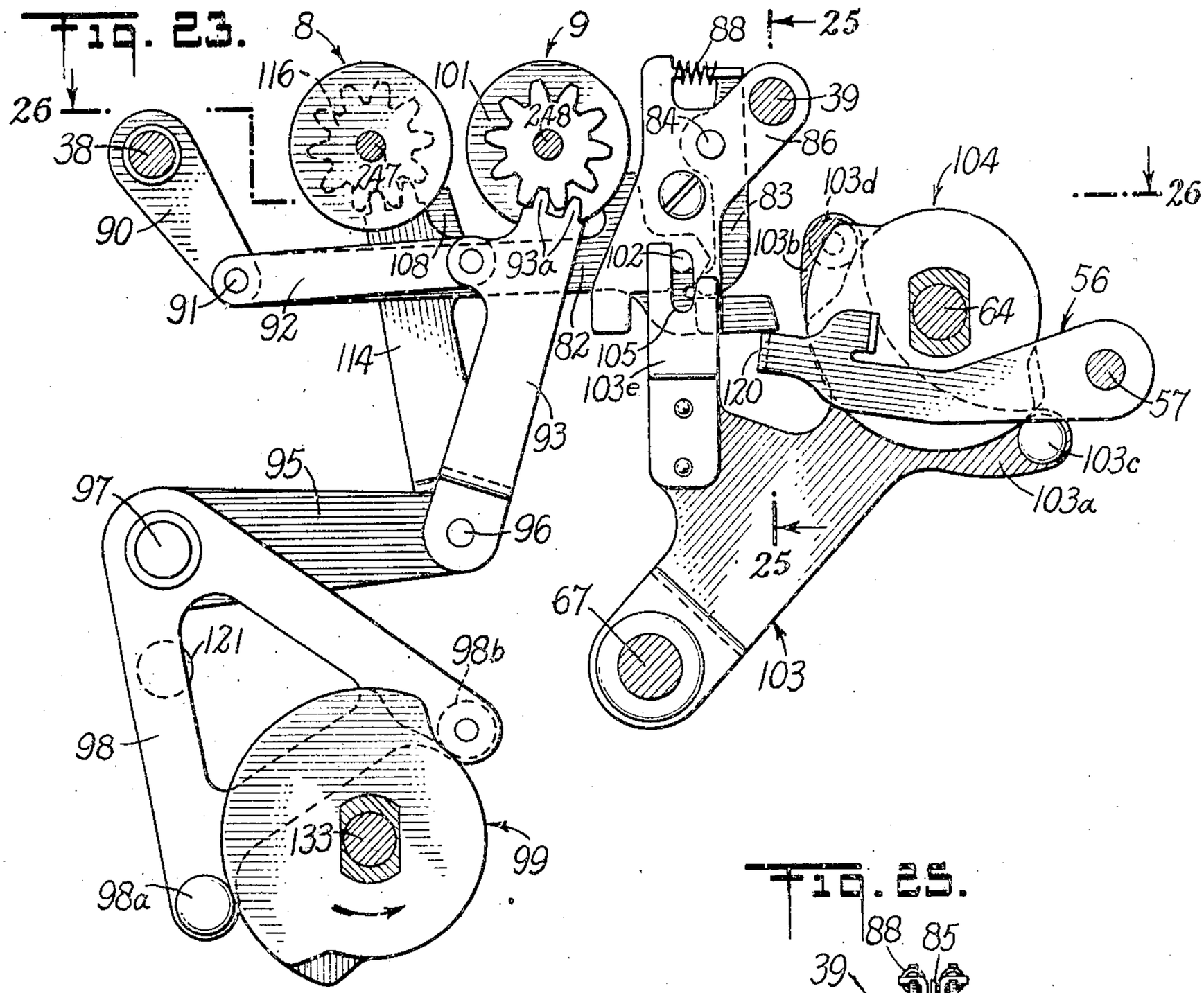


FIG. 25.

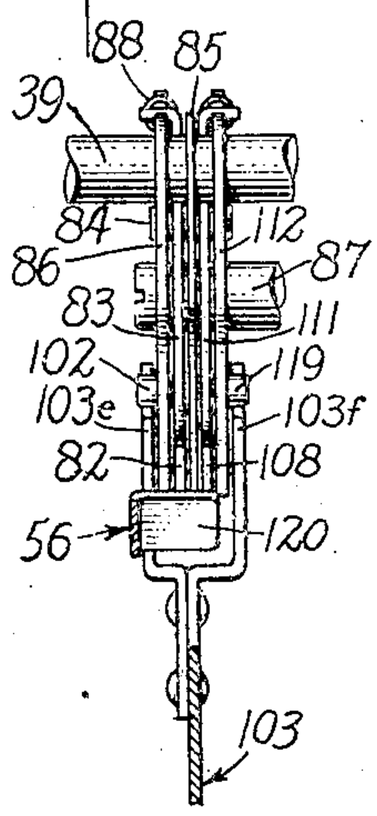
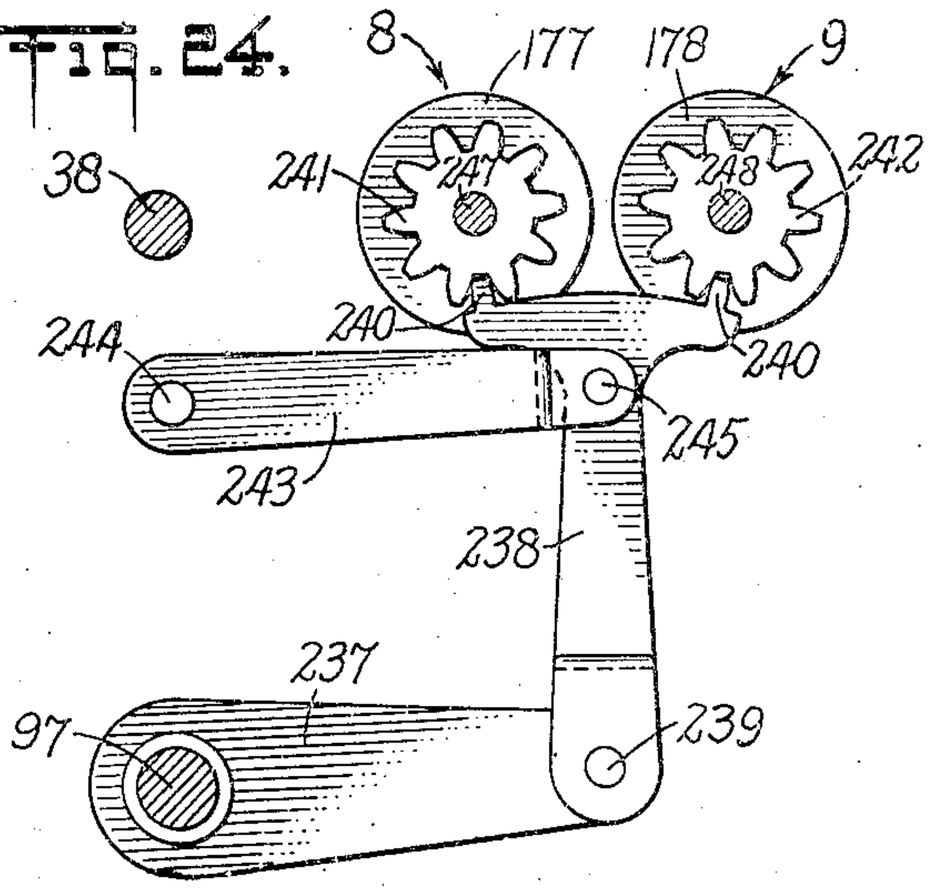


FIG. 24.



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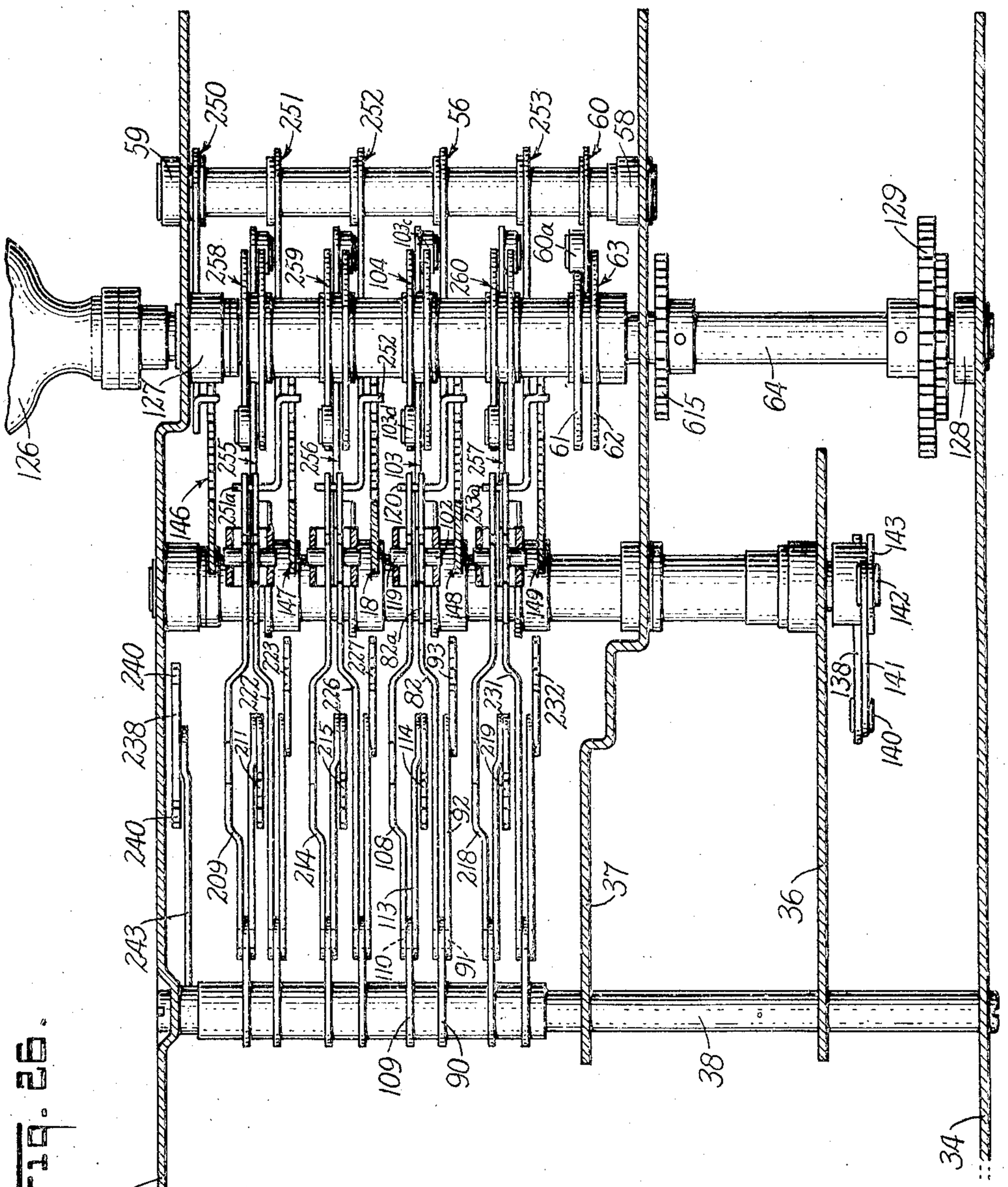

FIG. 26.

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Fig. 27.

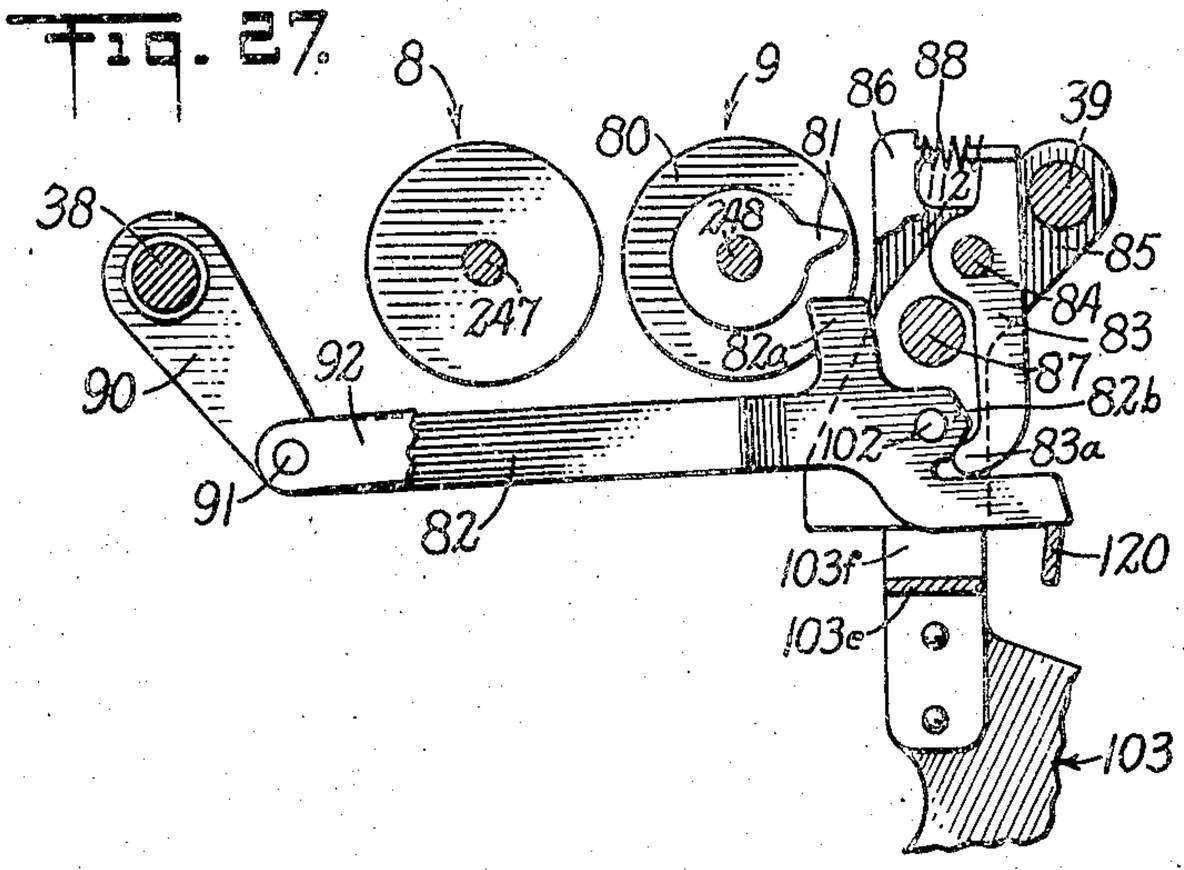

Fig. 28.

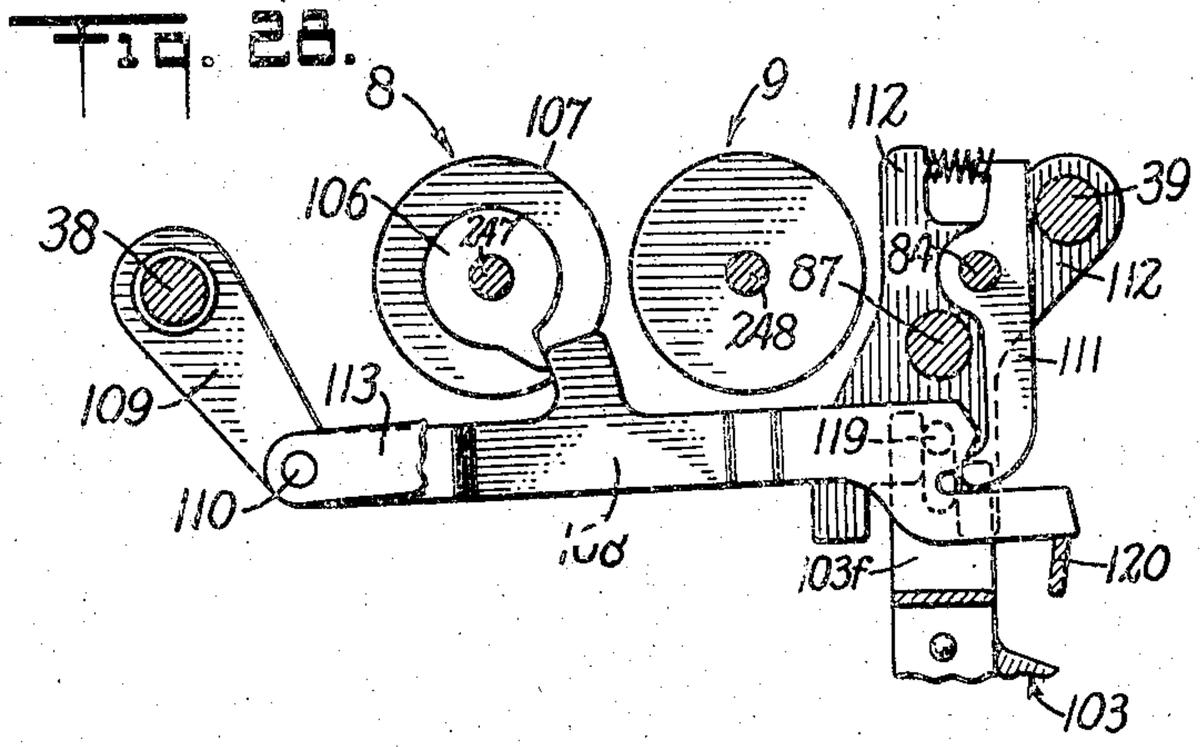

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Fig. 27A.

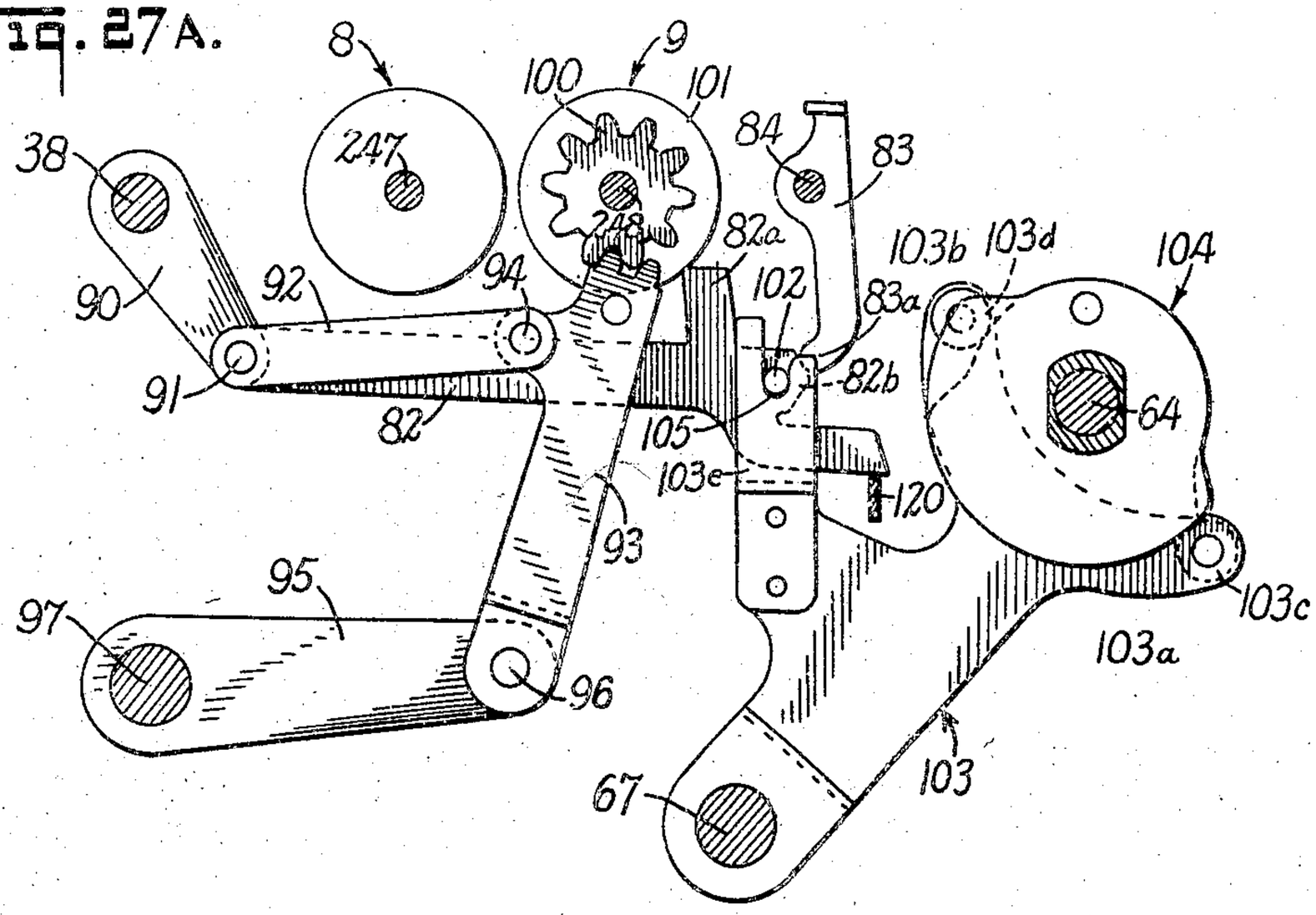

Fig. 28A.

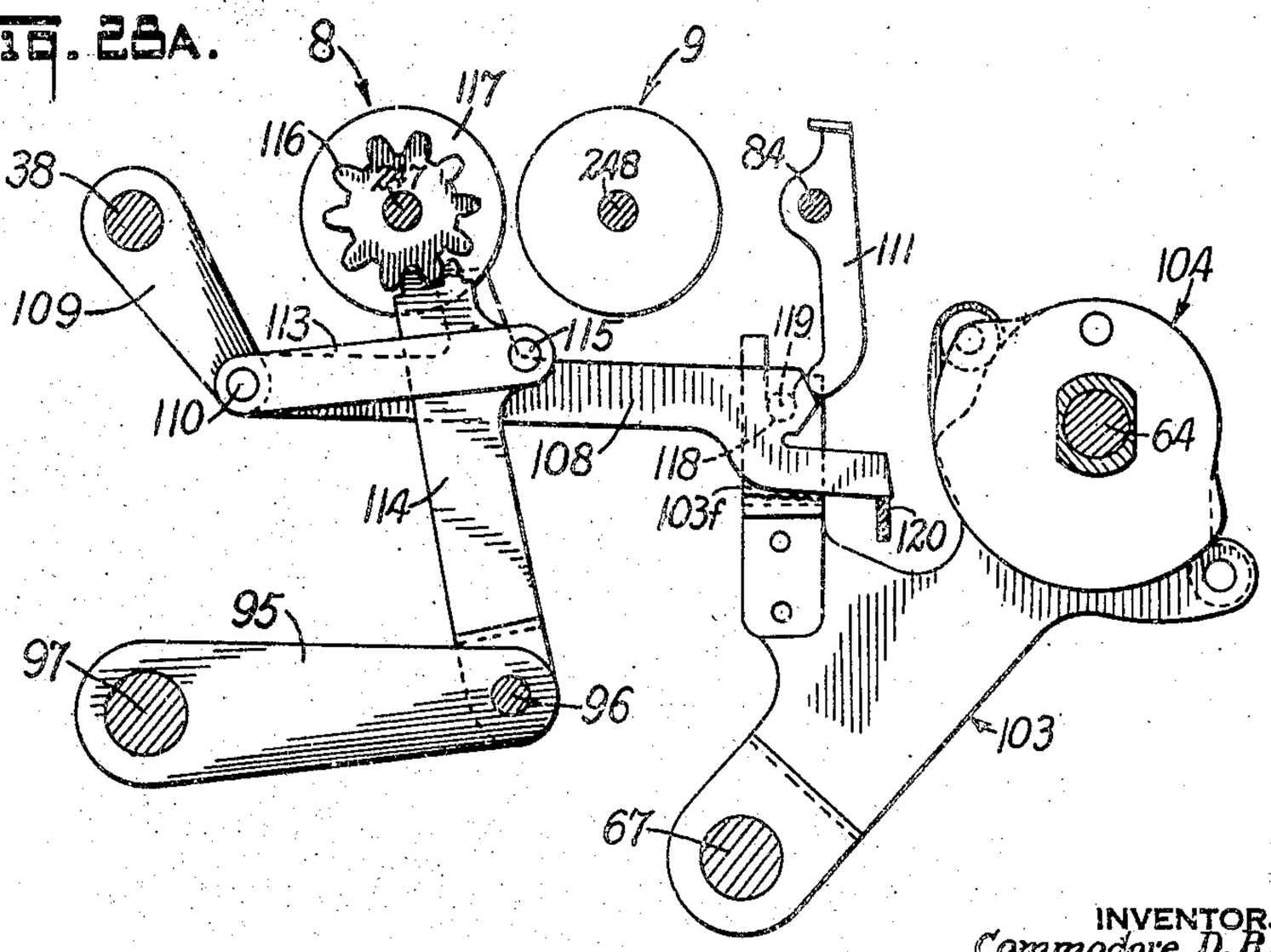

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Fig. 29.

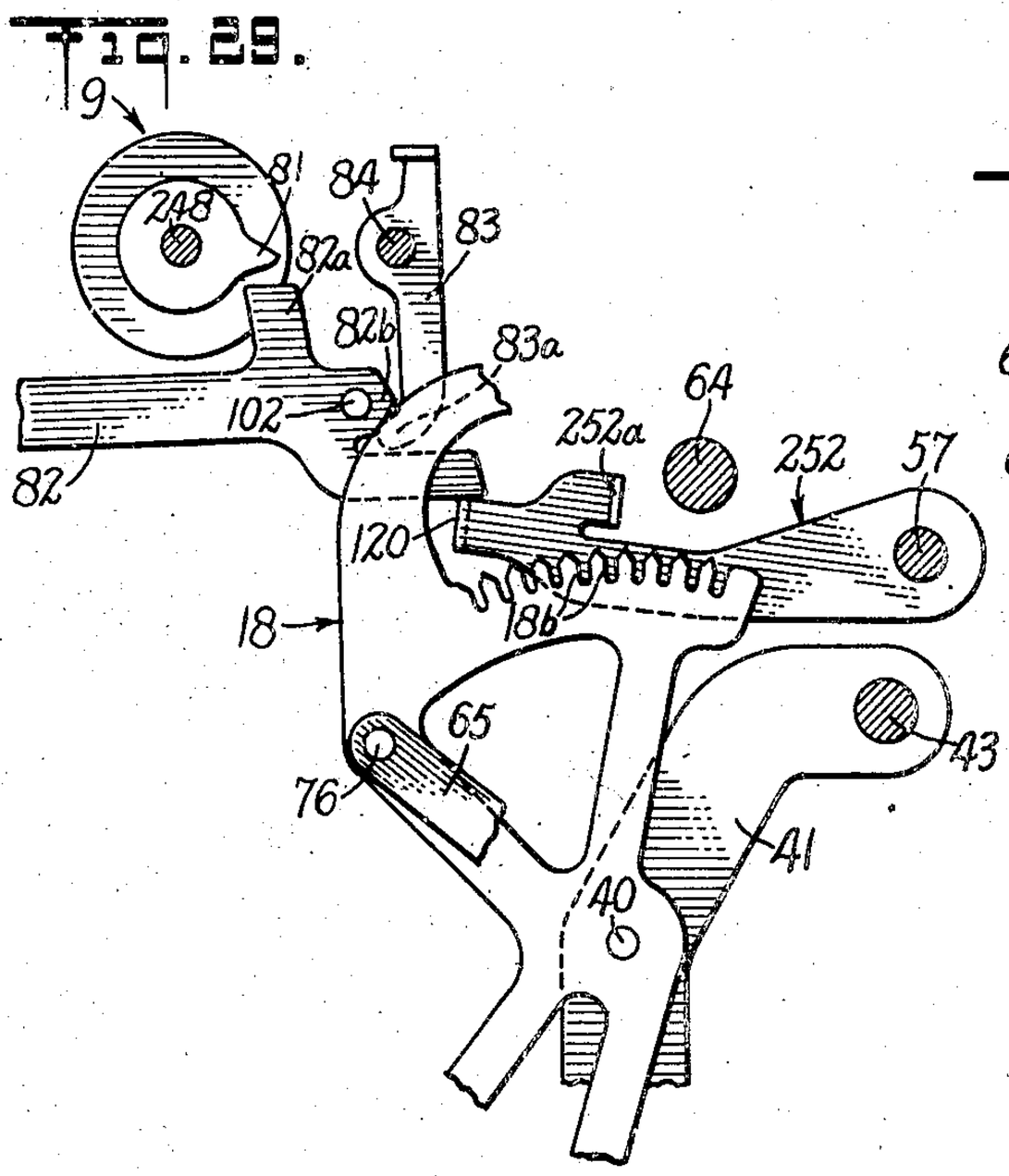


Fig. 29A.

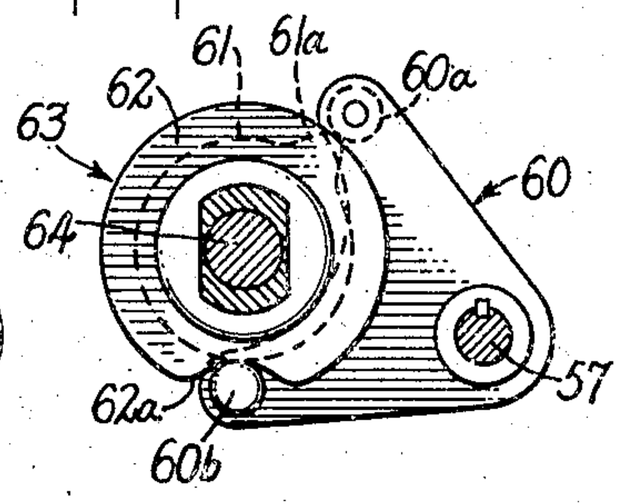


Fig. 30.

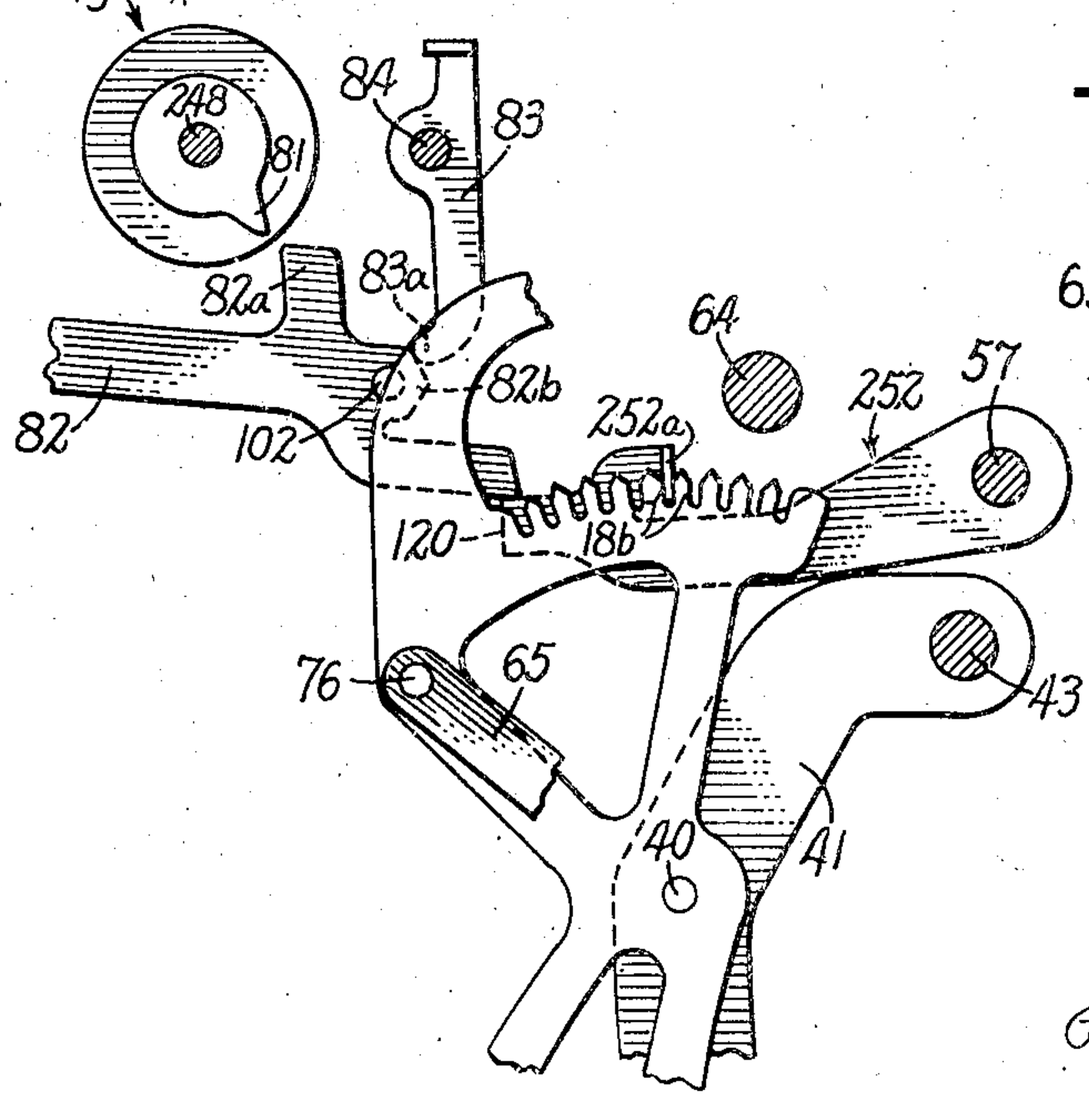
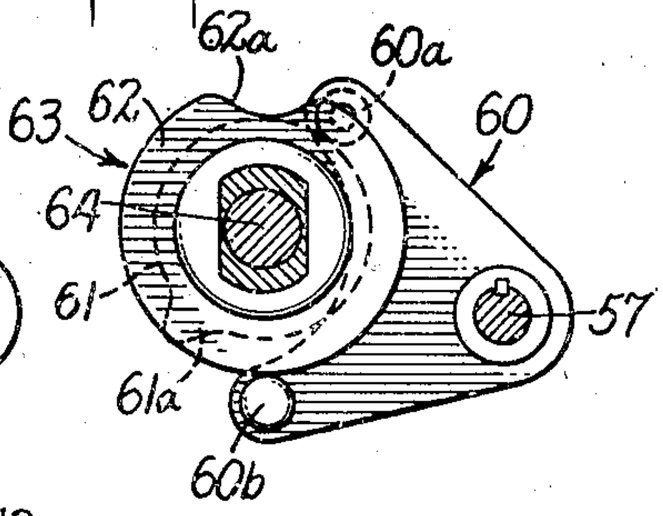


Fig. 30A.



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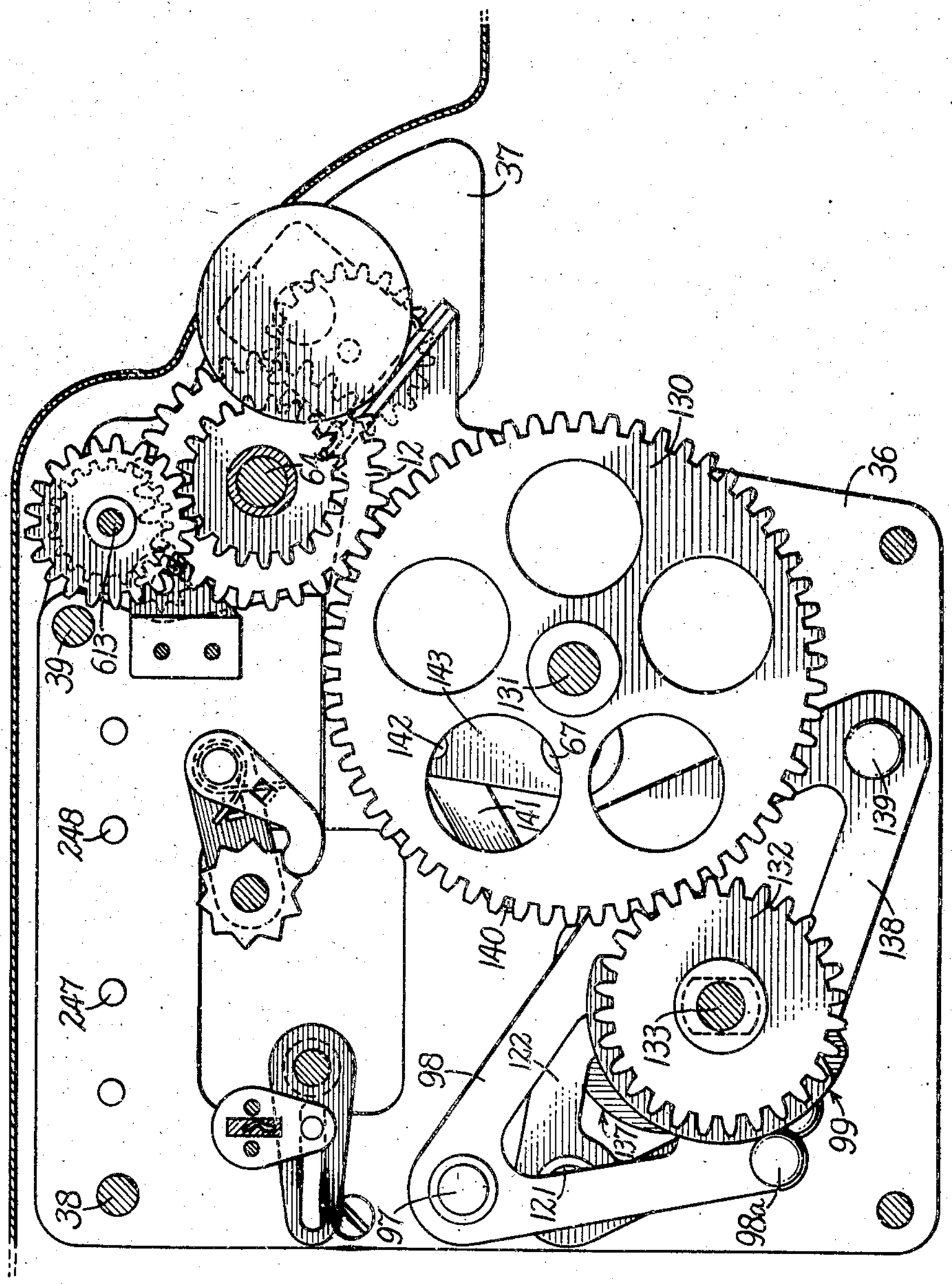

Fig. 21.

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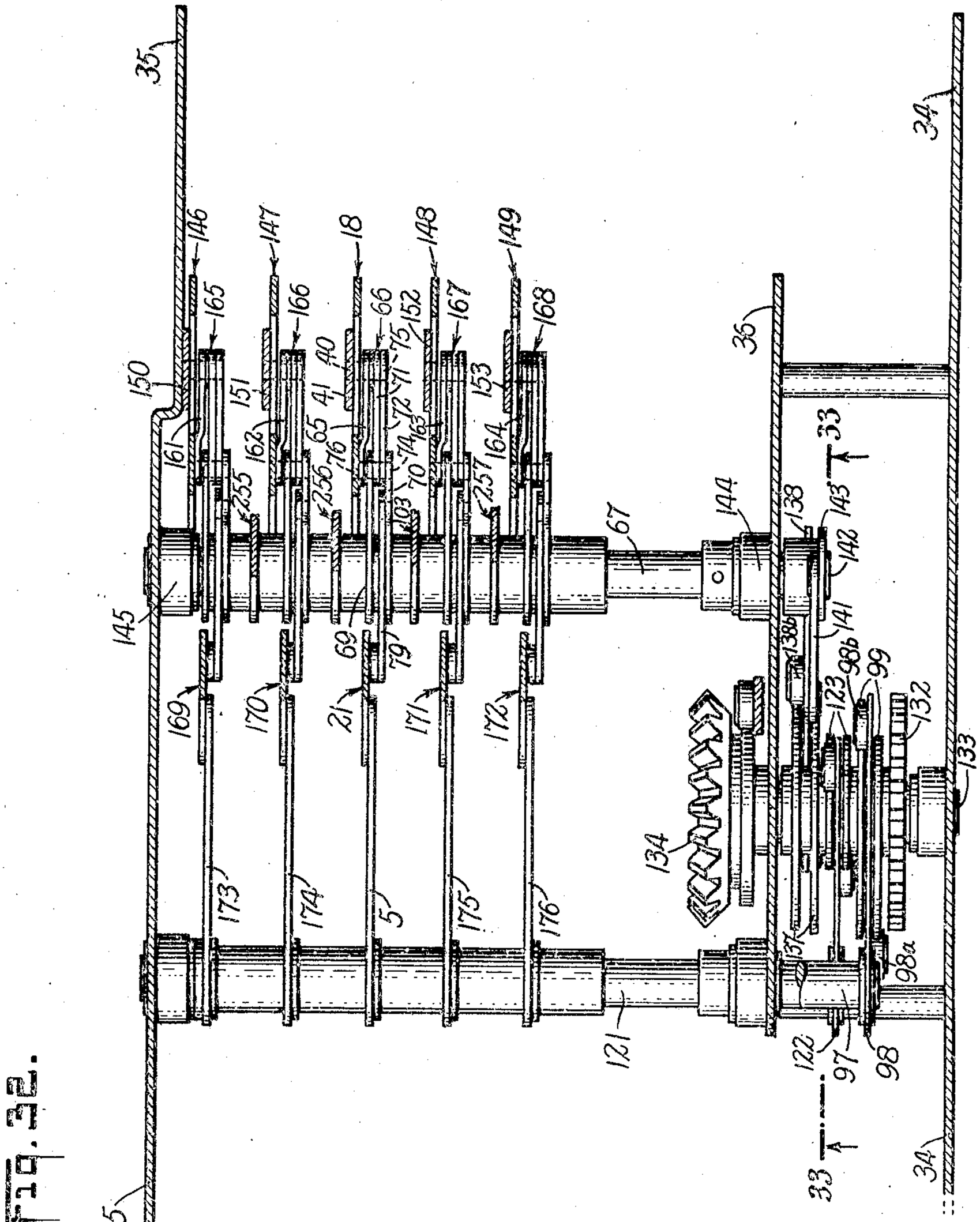

FIG. 32.

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Fig. 33.

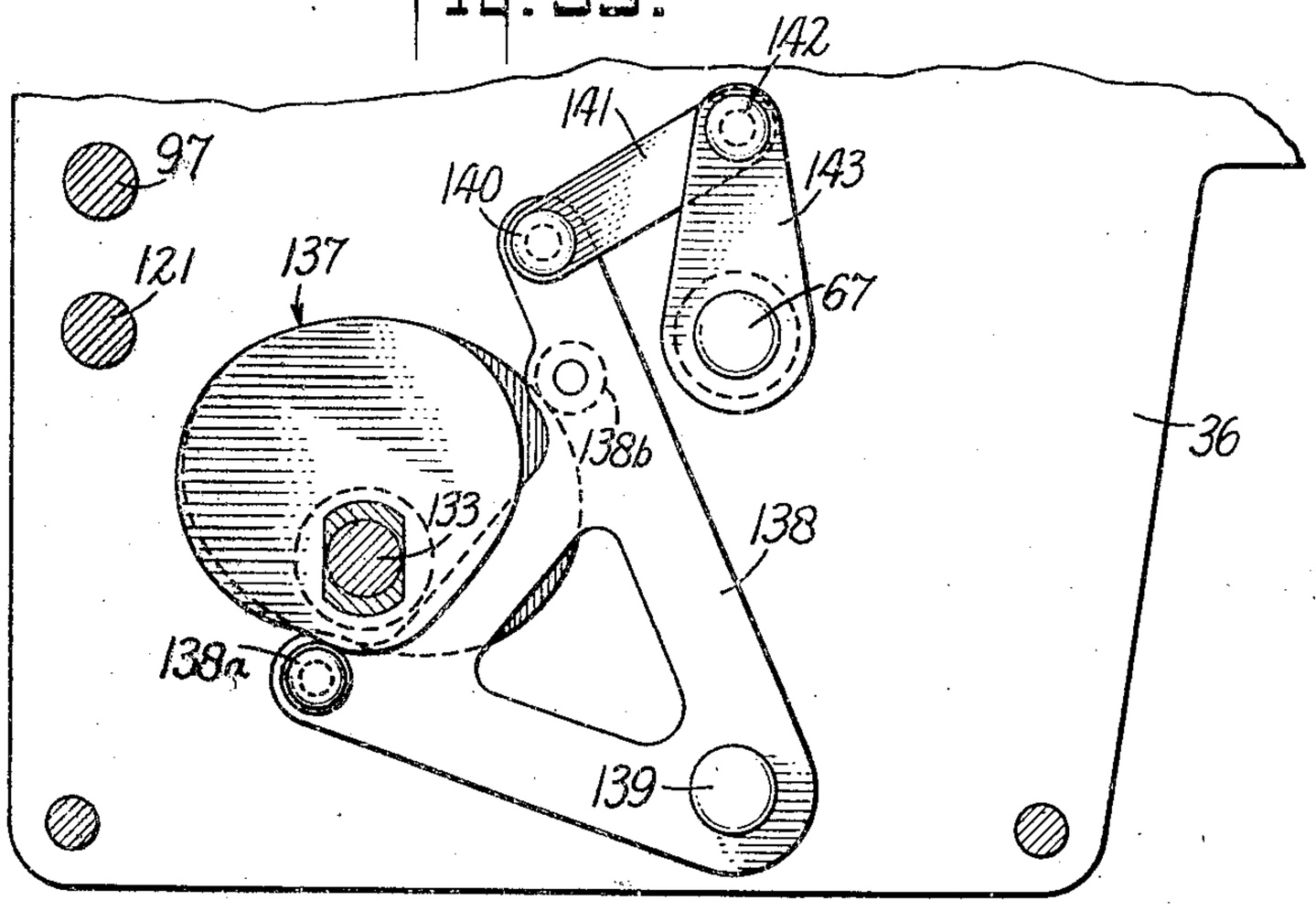

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Fig. 34A.

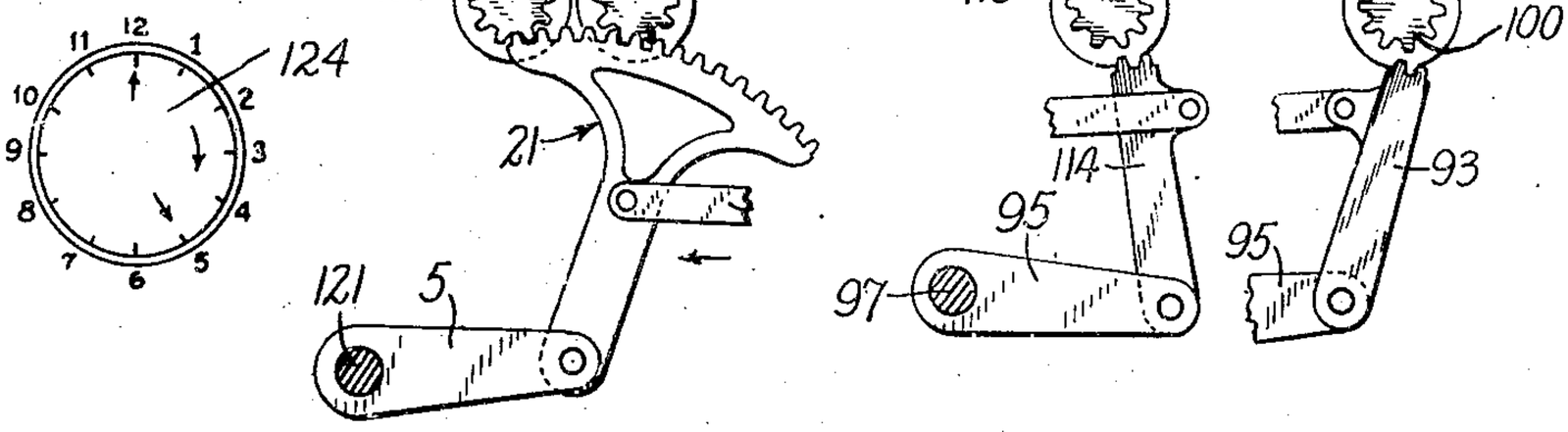


Fig. 34B.

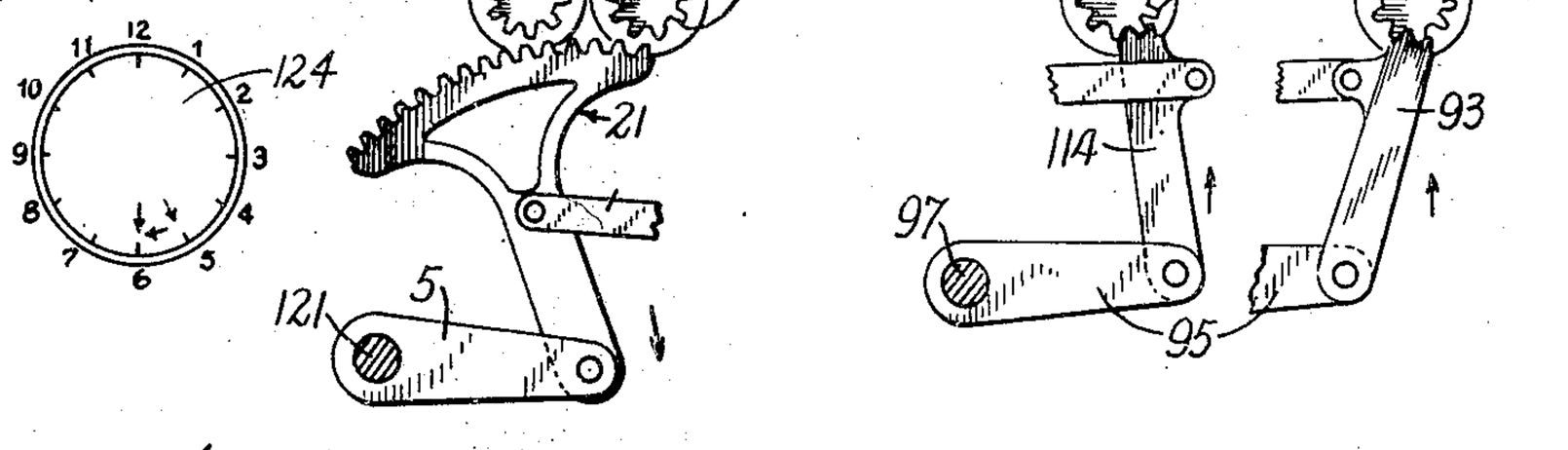


Fig. 34C.

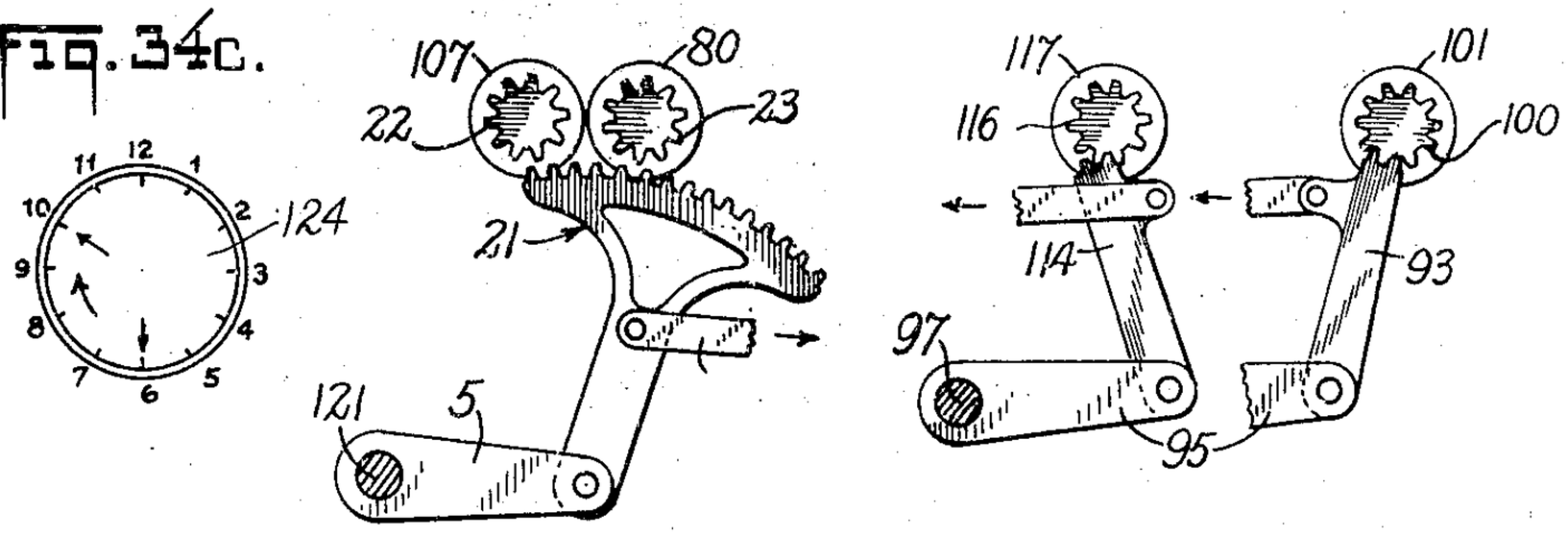
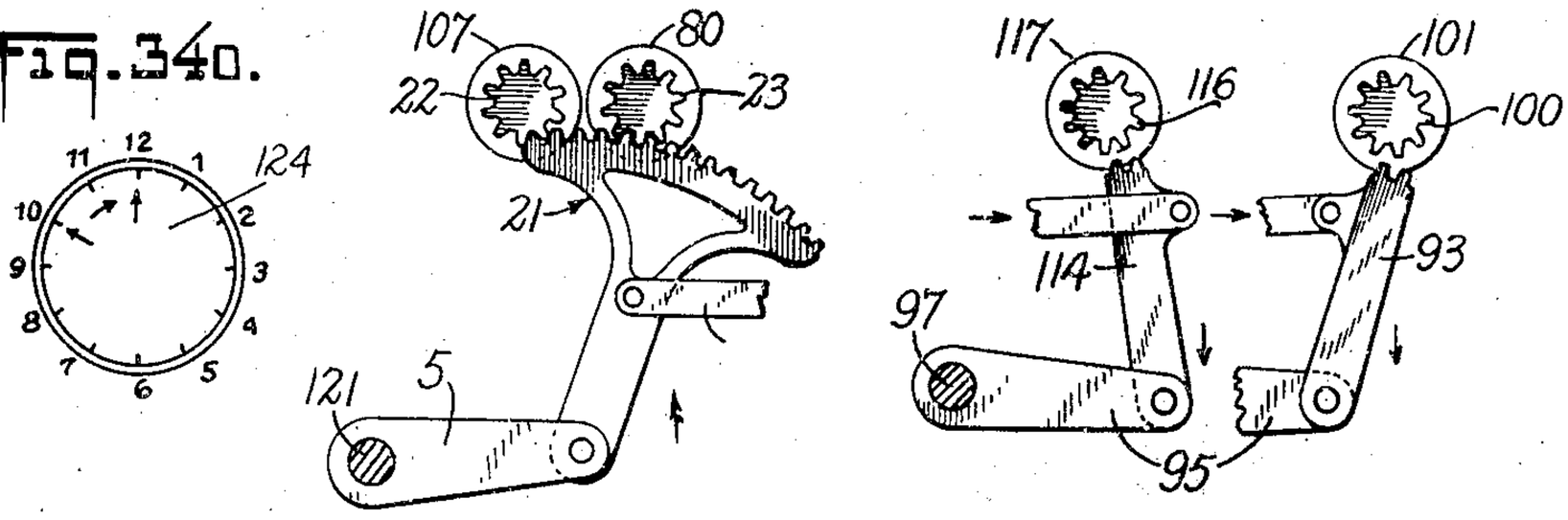


Fig. 34D.



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Patented Oct. 25, 1949

2,486,328

UNITED STATES PATENT OFFICE

2,486,328

REGISTERING MECHANISM

Commodore D. Ryan and Edward P. Drake, Los Angeles, Calif., assignors to Commercial Controls Corporation, a corporation of Delaware

Original application June 16, 1944, Serial No. 540,728. Divided and this application January 19, 1945, Serial No. 573,514

6 Claims. (Cl. 235—81)

1

This invention relates to registering mechanism and more particularly to mechanism of the above type for use in connection with a mail stamping machine or the like.

One of the objects of this invention is to provide registering mechanism which is simple, thoroughly practical, and durable in use. Another object is to provide a construction of the above character which will be efficient and accurate in operation. Another object is to provide a construction of the above character which may be manufactured from inexpensive materials without undue labor costs. Another object is to provide a machine of the above character which may be assembled or repaired with extreme ease and few tools. Another object is to provide accurate and efficient mechanism of the above character for registering the amount printed. Another object is to provide a construction of the above character which will be light in weight. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, all as will be illustratively described herein, and the scope of the application which will be indicated in the following claims.

Referring now to the accompanying drawings, in which is shown one of the various possible embodments of this invention,

Figure 1 is a top plan view of the machine with the housing removed;

Figure 2 is a front elevation of the machine, certain parts being removed for purposes of clarification;

Figure 3 is a rear elevation of the machine, certain parts being removed for purposes of clarification;

Figure 4 is a side elevation of one of the side plates of the machine;

Figure 5 is an end view of the supporting plate shown in Figure 6;

Figure 6 is a side elevation of a supporting plate;

Figure 7 is a side elevation of one of the side plates of the machine;

Figure 8 is a top plan view of the side plate shown in Figure 7;

Figure 9 is a side elevation of another supporting plate;

Figure 10 is a top plan view of the supporting plate shown in Figure 9;

Figure 11 is a perspective view of the mechanism mounted on the base of the machine;

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Figure 12 is a vertical section taken on the line 12—12 of Figure 1, certain parts being shown in section and others in elevation;

Figure 12*a* is a side elevation of a portion of the aligning mechanism taken from the line 12*a*—12*a* of Figure 12;

Figure 13 is a diagrammatic showing of one unit of the digit registering mechanism of the machine;

Figures 14 and 15 diagrammatically illustrate the operation of a portion of the digit registering mechanism when the setting lever of that unit is set at zero;

Figures 16 and 17 diagrammatically illustrate the operation of a portion of the registering mechanism when the setting lever is set to register and print a sum;

Figure 18 is a vertical section taken on the line 18—18 of Figure 1, certain parts of the machine being removed for purposes of clarification;

Figures 19, 20, 21, and 22 illustrate the relative positions of the cams which actuate the transfer mechanism;

Figure 23 is a diagrammatic showing of the transfer mechanism;

Figure 24 is a vertical section taken on the line 24—24 of Figure 1;

Figure 25 is a side elevation of a portion of the transfer mechanism taken substantially on the line 25—25 of Figure 23, certain parts being shown in section and others in elevation;

Figure 26 is a horizontal section taken through the machine substantially on the line 26—26 of Figure 23, certain parts being removed for purposes of clarification;

Figures 27 and 27*a* diagrammatically illustrate the operation of a portion of the transfer mechanism actuated by one of the counterwheels of the descending register;

Figures 28 and 28*a* diagrammatically show the operation of the portion of the transfer mechanism actuated by one of the counterwheels of the ascending register;

Figures 29, 29*a*, 30, and 30*a* diagrammatically illustrate the resetting of the transfer mechanism and the locking of the setting lever segment during an operating cycle;

Figure 31 is a vertical section taken substantially on the line 31—31 of Figure 1;

Figure 32 is a horizontal section taken on the line 32—32 of Figure 13, certain parts of the machine being removed for purposes of clarification;

Figure 33 is a vertical section taken on the line 33—33 of Figure 32; and

Figures 34*a*, 34*b*, 34*c*, and 34*d* diagrammati-

cally illustrate the relative positions of the counterwheel actuating and transfer mechanisms during an operating cycle.

Similar reference characters refer to similar parts throughout the several views of the drawings.

This application is a division of the copending application of Commodore D. Ryan and Edward P. Drake, which bears Serial No. 540,728, and which was filed on June 16, 1944.

It might here be noted that reference hereinafter to a "forward" direction signifies a direction to the right, as viewed in Figure 1, and that the end of the machine adjacent the printing head **17** (Figure 11) is the front of the machine. A "rearward" direction denotes the direction opposite to the forward direction described hereinabove. An "upward" direction refers to a direction upwardly from the bottom of the machine to its top, while a "downward" direction denotes the opposite direction thereto.

The registering mechanism is enclosed in a housing (not shown), which is secured and sealed to the framework of the machine in such a manner as to indicate its unauthorized removal. Projecting through the front of the machine are a series of setting knobs **11**, **12**, **13**, **14** and **15** (Figure 1). When these knobs are moved toward the rear of the machine, setting levers, such as setting lever **18** (Figure 13), on which the knobs are mounted act through gears and nested shafts, generally indicated at **19** (Figure 11), and racks, generally indicated at **20**, to set type wheels, generally indicated at **16**, in the rotatable printing head, generally indicated at **17**. Printing head **17** is mounted on a head shaft **26**, which is mounted on bearings **400** and **401** (Figures 1 and 11) on framework walls **29** and **30**.

Movement of each of the setting levers, such as setting lever **18** (Figure 13), also conditions linkage which, during the operating cycle of the machine, drives a counterwheel actuating member, such as member **21**, causing it in turn to drive counterwheels in the ascending and descending registers, generally indicated at **8** and **9**, the amount of the digit at which a setting knob is set. During the operation of the counterwheel actuating members, transfer means is conditioned as tens are accumulated in both the ascending and descending registers **8** and **9**, and during the last portion of the operating cycle, the transfer mechanism is actuated to transfer or carry over any tens which have been accumulated by any counterwheel to the next higher counterwheel in its register.

Referring now to the drawings in detail and to Figure 11 in particular, the machine includes a base plate **28** having front wall **29** and rear wall **30** extending upwardly therefrom. Front and rear walls **29** and **30** are connected to base plate **28** by reinforcing ribs **31**, **32**, and **33**. The portions of these ribs flanging upwardly, rearwardly, and forwardly from base plate **28**, wall **29**, and wall **30** serve as supports to which the left and right side plates **34** and **35** (Figures 1, 4, and 7) are connected in any suitable manner, such as by screws. Side plates **34** and **35**, together with supporting plates **36** and **37** (Figures 1, 6, and 9) and a plurality of spacing rods, such as rods **38** and **39** (Figure 1) form the framework (Figures 2 and 3) on which the registers and counterwheel actuating and transfer mechanism are mounted.

As the trains of mechanism leading from each setting knob to the value printing wheel associated with it in the rotatable printing head **17**

(Figure 11) and for registering (Figure 12) the amount printed by its type wheel is substantially similar for each of the setting knobs, the mechanism associated with setting knob **13** (Figure 1) will first be described in detail.

Setting knob **13** actuates setting lever **18** (Figure 29) which is pivotally mounted by a pin **40** on a supporting plate **41** (Figures 2, 13, and 29). Supporting plate **41** is rigidly mounted on a pair of spacing rods **42** and **43** connected to side plate **35** (Figure 2) and to supporting plate **37**. Supporting plate **41** is parallel to the sides of the machine, thus insuring movement of setting lever **18** in a plane parallel to the side plates. The lower end of setting lever **18** (Figure 13) has a plurality of teeth **44** thereon which mesh with and turn a spur gear **45**. Spur gear **45** (Figure 11) is connected by a sleeve to a gear **47** which meshes with the teeth of rack bar **48**. Rack bar **48** has an upwardly extending arm thereon with teeth on its upper end which mesh with teeth on a setting bar **51**. As gear **47** moves rack bar **48** during setting, setting bar **51** is moved longitudinally with respect to head shaft **26** and the type wheel in head **17** associated with setting bar **51** is set. Rack and detent means, generally indicated at **50** (Figure 11), is provided for each of the rack bars mounted on base plate **28** and these, acting through the gears connecting each rack bar to its setting lever, yieldingly hold the setting levers at the digit at which each setting lever is set.

To assure alignment of setting lever **18** (Figure 13) on a digit during an operating cycle, a mechanically operated aligning arm, generally indicated at **252** is provided. This arm is secured to a shaft **57** (Figures 2 and 26) which is rotatably mounted in a pair of bearings **58** and **59** secured to supporting plate **37** and side plate **35**, respectively. A cam yoke **60** (Figure 29*a*) is connected to shaft **57** in any suitable manner adjacent the left-hand end thereof, as viewed in Figure 26. This cam yoke has a pair of cam rollers **60***a* and **60***b* (Figure 29*a*) which coact with the two cam discs **61** and **62** (Figures 26 and 29*a*) of a double cam, generally indicated at **63**. Double cam **63** is connected to a shaft **64** which is turned by a crank **126** (Figure 1) or is driven through a single revolution during each cyclic operation of the machine.

Referring to Figure 29*a*, it will be seen that the peripheries of cams **61** and **62** are provided with raised and recessed portions **61***a* and **62***a* which coact with the cam rollers on cam yoke **60** to rock shaft **57**. Cam discs **61** and **62** are so positioned on shaft **64** that at the beginning of a cycle as shaft **64** turns, shaft **57** is turned in a counterclockwise direction, as viewed in Figure 29, a sufficient distance to move a finger **252***a* (Figures 26 and 30) on aligning arm **252** between two of the teeth **18***b* on setting lever **18**. Double cam **63** then acts through yoke **60**, shaft **57**, arm 252, and finger **252***a* to hold setting lever **18** in its set position until the end of the operating cycle is reached. At this time, cam **63** acts upon yoke **60** to turn shaft **57** in a clockwise direction and thus disengage finger **252***a* from teeth **18***b*. At the end of the cycle of operation finger **252***a* is out of engagement with teeth **18***a* thus permitting setting lever **18** to be reset.

Referring to Figure 29, when setting lever **18** is moved in a counterclockwise direction about its pivotal connection **40** to supporting plate **41**, it positions link **65** (Figures 13 and 32) to condition the variable drive linkage, generally indicated at

66, so that when shaft 67 is rocked in a counterclockwise direction (Figure 13) during an operating cycle, counterwheel actuating member 21 is driven through link 79 to register the amount of the digit at which setting lever 18 is set. Referring to Figure 14, shaft 67 has an arm 69 connected thereto in any suitable manner. Link 70 of variable drive linkage 66 is pivotally mounted on shaft 67. Links 71 and 72 are pivotally connected to the outer ends of arm 69 and link 70 by pivot pins 73 and 74 and are pivotally connected to each other and to link 65 (Figures 13, 14, and 32) by a pivot pin 75. Referring to Figure 16, the distance from the center of pin 75 to the center of pin 74 is the same as the distance from the center of pin 75 to the center of the pin 76 which pivotally connects link 65 to setting lever 18. The distance between the center of pin 74 (Figure 14) and the axis of shaft 67 and the distance between the centers of pins 73 and 75 is the same, and the center of pin 73 and the axis of shaft 67 and pins 74 and 75 are also equidistantly spaced. Accordingly, considering the pivotal points of connection of arm 69, links 70, 71, and 72, these links and arm 69 form a parallelogram.

During the first portion of the cycle of operation of the machine, shaft 67 is rocked by means to be described hereinafter to move arm 69 from the position shown in Figure 14 to the position shown in Figure 15, and during the last half of the cycle of operation, shaft 67 moves arm 69 downwardly to return it to the position shown in Figure 14. If the setting knob of setting lever 18 is set at zero, then link 65 (Figure 16) is positioned beneath and in alignment with link 72 (Figure 14). Then during the operating cycle when arm 69 moves upwardly, as viewed in Figure 14, it acts through link 71 to raise link 72 (Figure 15). During this time, the center of rivet 75 follows the curve of dotted line 77 as links 72 and 65 (Figure 16) are of the same length (Figure 15) and thus the only portion of the variable drive linkage which moves at this time consists of arm 69, link 71, and link 72, with link 65 pivoting in alignment with link 72.

When setting lever 18 (Figure 16) is positioned on a digit between one and nine, the pin 76 connecting lever 18 to link 65 is moved downwardly toward the center of shaft 67. During a cyclical operation after link 65 is set in the position shown in Figure 16, the effective length of link 65 causes pin 75 to follow the curved line 78. It will be noted that as pin 75 follows line 78 upwardly during a cycle of operation to the position shown in Figure 17, the distance between pin 75 and the rest position 74*a* of pin 74 is continually being shortened. During the upward movement, pin 74 is thus forced to move from position 74*a* (Figure 17) to the position it occupies in Figure 17 and as it moves to this position, it acts through links 70 and 79 to move counterwheel actuating member 21 in a counterclockwise direction about pivot point 80. As at this time member 21 is in mesh with the gears 22 and 23 of counterwheels on both the ascending and descending registers 8 and 9, these registers are moved in proportion to the amount of counterclockwise movement of link 70 about shaft 67 as a pivot.

Thus, as setting lever 18 is moved to any setting between one and nine (Figure 1), pin 76 (Figure 16) moves with it. The farther pin 76 moves downwardly away from pin 74 during setting, the greater will be the drive given to member 21 by arm 69 (Figure 17) during its upward movement

as the line of movement of pin 75 will continually come nearer to the rest position 74*a* of rivet 74, thus increasing the degree of movement of pin 74. The degree of movement of member 21 is always proportional to the amount which pin 76 is moved downwardly, as viewed in Figure 24. Thus linkage 66, together with controlling link 65, driving link 79, and member 21 (Figure 16), feeds the amount of the digit selected into counterwheels on both registers.

Referring now to Figures 23 through 28*a*, in which the counterwheel transfer mechanism for both the ascending and descending registers is shown, each counterwheel, such as counterwheel 80 (Figure 27), has a cam member 81 connected to it. This cam each time it makes a revolution acts upon a raised portion 82*a* of a transfer bar, generally indicated at 82, to move the transfer bar 82 downwardly. To the right of counterwheel 80 a detent 83 is pivotally mounted by a pivot pin 84 on a pair of supporting plates 85 and 86 (Figure 25) mounted on spacing rods 39 and 87. The nose 83*a* (Figure 27) of detent 83 is resiliently urged into contact with the right-hand end of transfer bar 82 by a spring 88 which acts between supporting plate 86 and the upper end of detent 83. The right-hand end of transfer bar 82, as viewed in Figure 27, is shaped so that when the end 82*b* of bar 82 is positioned above detent 83, the nose of detent 83 holds the transfer bar in a raised position and then when cam member 81 acts on raised portion 82*a* of bar 82, the end 82*b* of bar 82 is moved downwardly past the nose 83*a* of detent 83 in which position it is also held by the nose of the detent.

Transfer bar 82 is pivotally connected by a pin 91 to an arm 90 at its left-hand end, as viewed in Figures 27 and 27*a*, and this arm 90 is pivotally mounted on spacing rod 38 (Figure 3). Pin 91 (Figure 26) also connects arm 90 to a link 92 (Figure 27*a*) which is pivotally connected to and actuates the transfer member 93 through pin 94. Transfer member 93 is pivotally connected to a transfer arm 95 by pivot pin 96 and arm 95 in turn is connected to transfer control shaft 97 (Figures 3 and 27*a*). Transfer control shaft 97 (Figure 23) is turned first counterclockwise and then clockwise during a cyclical operation of the machine by a cam yoke 98 having cam rollers 98*a* and 98*b* thereon which coact with a double cam, generally indicated at 99. Cam 99 acting through yoke 98, shaft 97, and arm 95 controls the time and length of engagement of the teeth 93*a* of transfer member 93 with a transfer gear 100 (Figure 27*a*) connected to the counterwheel 101 (Figure 27) to which the carry-over is being made from counterwheel 80 (Figures 1 and 27). As will be described more fully hereinafter, the transfer members, such as transfer member 93, are moved into contact with the transfer gears of their related counterwheels during the last portion of the cycle of operation of the machine or after the digits at which the setting knobs are set have been fed into the counterwheels.

Referring to Figures 27 and 27*a*, bar 82 has a pin 102 thereon which extends to the left thereof, as viewed in Figure 25. This pin forms the driving connection between a transfer actuating member, generally indicated at 103, and bar 82 to effect the actual carry-over of a digit from counterwheel 80 to counterwheel 101 (Figure 1) when bar 82 is moved downwardly (Figure 27*a*) by cam member 81 (Figure 27). Transfer actuating member 103 (Figures 23 and 27) is piv-

otally mounted on shaft 67 and includes a pair of arms 103*a* and 103*b* having cam rollers 103*c* and 103*d*. Rollers 103*c* and 103*d* follow the peripheries of the two sections of a double cam 104, and these sections are so shaped that during the last portion of the cycle of operation, transfer actuating member 103 is moved a short distance in a counterclockwise direction and then returned to the position shown in Figure 23.

When counterwheel 80 (Figure 27) is moved a sufficient distance during the feeding of a digit into this counterwheel, cam 81 moves bar 82 downwardly so that its end 82*b* is cammed past nose 83*a* of detent 83. At this time pin 102 is positioned in a pocket 105 (Figure 27*a*) on arm 103*e* of transfer actuating member 103. Later during the same cyclical operation, cam 104 moves member 103 in a counterclockwise direction, and as pin 102 is seated in pocket 105, bar 82 is moved rearwardly. Referring to Figure 26, as bar 82 moves rearwardly, it acts through pin 91 to move link 92 (Figure 27*a*) in a rearward direction. This link acts through pin 94 to move transfer member 93 a sufficient distance to turn counterwheel 101 the distance of one digit, thus effecting a carry-over.

If cam member 81 (Figure 27) does not move bar 82 downwardly during the period which digits are fed into the counterwheels, then bar 82 remains in the position shown in Figure 27. Accordingly, as a driving connection is not established through pin 102 between bar 82 and member 103, when member 103 moves in a counterclockwise direction during the carry-over period of the operating cycle, bar 82 is not moved rearwardly in the machine and a carry-over is not effected.

The carry-over between counterwheels of the ascending register 8 (Figure 1) is effected in the same manner. A cam member 106 (Figure 28) connected to a counterwheel 107 acts upon a bar 108 (Figures 26 and 28) pivotally connected to an arm 109 by a pivot pin 110. Arm 109 is pivotally mounted on spacing rod 38. The right-hand end of bar 108, as viewed in Figure 28, is engaged by a detent 111 similar in construction and operation to detent 83 (Figure 27) and mounted between supporting plates 85 and 112 (Figure 25). Bar 108 (Figures 26, 27, and 28*a*) is also connected to a link 113 through pin 119 and link 113 is pivotally connected to a transfer member 114 by a pivot pin 115. The lower end of member 114 is pivotally connected to transfer arm 95 by pin 96, and accordingly member 114 moves upwardly to engage the teeth on its upper end with the transfer gear 116 of counterwheel 117 at the same time that member 93 (Figure 27*a*) moves into engagement with transfer gear 100.

Transfer actuating member 103 has a portion 103*f* (Figures 25 and 28*a*) having a pocket 118 therein adapted to receive transfer bar pin 119 when transfer bar 108 is cammed downwardly by cam member 106 (Figure 28). The action of bar 108 is substantially similar to that of bar 82 (Figures 27 and 27*a*). During the transfer portion of the cycle of operation, if bar 108 (Figure 28*a*) has been moved downwardly into operative position, when member 103 is actuated by double cam 104, it moves bar 108 rearwardly (Figure 28*a*) to effect a transfer through link 113 and transfer member 114. If bar 108 is not moved downwardly, then a driving connection is not established between arm 103 and bar 108 and thus a carry-over is not effected between

counterwheels 107 and 117 (Figures 28 and 28*a*).

Referring to Figures 25 and 26, it will be noted that bars 82 and 108 are both actuated by transfer actuating member 103 acting through pins 102 and 119. Each of bars 82 and 108 has its own detent, namely, detents 83 and 111, and each bar and mechanism immediately associated with it operates independently of the other bar. Thus, a carry-over may be made in either of the registers without affecting the position of the counterwheels in the other. When a carry-over is not being made from either counterwheel 80 or 107, then transfer members 93 and 114 prevent rotation of counterwheels 101 and 117 during the transfer portion of a cycle of operation of the machine.

If either or both of transfer bars 82 and 108 are cammed downwardly during a cyclical operation, they are moved upwardly or reset by a finger 120 (Figures 25 and 26) on the rear end of aligning arm 56. As described hereinabove, at the end of an operating cycle, aligning arm 252 (Figure 30) moves upwardly to the position shown in Figure 29 to move finger 252*a* out of engagement with the teeth 18*b* on setting lever 18. Aligning arm 56 (Figures 23 and 26) is similar in construction and operation to arm 252 and at the end of a cycle, it moves upwardly to move finger 120 to the position shown in Figure 23. This moves the right-hand ends of bars 82 and 108 (Figures 27 and 28) upwardly with it if either or both of them have been cammed downwardly during an operating cycle. When either or both of the bars are moved up by finger 120, they are retained in their raised positions by their detents 83 and 111. Arm 56 remains raised at the end of a cycle of operation to permit adjustment of setting lever 18 and also holds bars 82 and 108 in a raised position to prevent their being accidentally moved downwardly between operating cycles. Then at the beginning of the next operating cycle it moves downwardly. Thus, arm 56 both prevents movement of setting lever 148 (Figure 26) during an operating cycle and also resets the transfer bars 82 and 108 (Figures 27 and 28) after a transfer has been accomplished.

Thus, to summarize the operation of the bank of the machine described hereinabove, as setting knob 13 is moved to the digit it is desired to register and print, it acts through setting lever 18 (Figure 13) to turn spur gear 45. Gear 45 (Figure 11) acts through gear 47 to move rack bar 48 longitudinally of the machine. As rack bar 48 is moved, it moves setting bar 51 longitudinally of the head shaft in which it is mounted and this movement acts through gearing (not shown) to set one of the value printing wheels in printing drum 17 (Figure 11). At the same time lever 18 (Figure 13) is setting its related value printing wheel in the printing drum 17, lever 18 also adjusts link 65 with relation to variable drive linkage 66 (Figures 16 and 17) thus determining the amount to be registered on the counterwheels of the ascending and descending registers associated with counterwheel actuating member 21.

Referring now to Figures 34*a* through 34*d*, in which the movement of counterwheel actuating member 21 (Figure 13) and tranfer members 93 and 114 (Figures 27*a* and 28*a*) during an operating cycle is diagrammatically shown, at the beginning of an operating cycle member 21 is in engagement with gears 22 and 23 of counterwheels 80 and 107. At this time transfer members 93 and 114 are positioned downwardly from

and thus out of engagement with the transfer gears 100 and 116 of counterwheels 101 and 117. Counterwheels 101 and 117 are the next higher counterwheels in the descending and ascending registers above counterwheels 80 and 107. The clock 124 diagrammatically illustrates in Figures 34*a* through 34*d* the sequence of operations in one operative cycle. The vertical position of members 21, 93, and 114 is not changed by movement of control shafts 121 and 97 (Figures 3 and 12) from 12 o'clock to 5 o'clock (Figure 34*a*). During this time the variable drive linkage 66 (Figure 13) acts through link 79 to move member 21 to the left if lever 18 is set at a digit between one and nine. This movement of member 21 turns counterwheels 80 and 107 to register the digit for which the setting knob was set before the cycle of operation began.

After this part of the cyclical operation has been completed, transfer control shaft 97 is rocked in a counterclockwise direction, as viewed in Figure 34*b*, moving transfer members 93 and 114 upwardly into engagement with gears 100 and 116. After members 93 and 114 engage their respective gears, then control shaft 121 turns counterclockwise to move counterwheel actuating member 21 out of engagement with gears 22 and 23. This change in the vertical position of members 93, 114, and 121 takes place between 5 and 6 o'clock as indicated on the clock 124. During the next portion of the cycle, namely, that portion between 6 and 10 o'clock, members 21, 93, and 114 do not move vertically. However, during this period the variable drive linkage shown in Figure 14 acts through link 79 to move member 21 to the right, as viewed in Figure 34*c*. At the same time member 103 moves rearwardly (Figures 27*a* and 28*a*) and it may act through the transfer mechanism connected to either or both links 92 and 113 (Figure 34*c*) to turn counterwheels 101 and 117 a distance of one digit.

After a carry-over, if any, has been completed, the control shaft 121 rocks moving member 21 (Figure 34*d*) into engagement with counterwheel gears 22 and 23. After member 21 has been moved upwardly, then shaft 97 rocks to move members 93 and 114 downwardly out of engagement with gears 100 and 116, and then these members are moved forwardly by the transfer mechanism acting through links 92 and 113. The operation described immediately hereinabove takes place between 10 and 12 o'clock and at 12 o'clock the operating cycle is complete.

At the beginning of a cycle of operation, the first action in the machine is the locking of setting lever 18 by finger 252*a* (Figure 13) on aligning arm 252 as aligning arm 252 moves to the position shown in Figure 30. At the end of the cycle, aligning arm 56 (Figure 23), the arm adjacent to arm 252, moves upwardly to the position shown in Figure 23. This movement resets the transfer bars 82 and 103 of the transfer mechanism if they have been cammed downwardly. If the setting lever is not moved at the end of a cycle, the rack and detent mechanism 50 retains rack bar 48 in its adjusted position, thus insuring the same digit being printed over and over again until the setting of lever 18 is changed.

The machine is driven either through a coupling 125 (Figure 12) on the left-hand end of the head shaft 26 or by crank 126 (Figures 1 and 26) which turns drive shaft 64 (Figure 12). As described hereinabove, the machine is designed for cyclical operation and drum 17 (Figure 11) makes a complete revolution during each operation. If the drive is through crank 126 and shaft 64, crank 126 turns shaft 64 a complete revolution during each cycle of operation of the machine. Shaft 64 is mounted on bearings 127 and 128 (Figure 26) on side plates 34 and 35 and has a spur gear 129 pinned thereto. Spur gear 129 (Figure 31) is positioned at the opposite end of shaft 64 from crank 126 and engages an idler gear 130 mounted on a stud shaft 131 connected to side plate 34 (Figure 2). Gear 130 engages and drives a spur gear 132 (Figures 31 and 32) mounted on and connected to a cam shaft 133. Cam shaft 133 is mounted in bearings on supporting plate 36 (Figure 2) and side plate 34. Gear 132 (Figure 31) has the same number of teeth as gear 129 and accordingly each time gear 129 makes a revolution, gear 132 makes a revolution. Cam shaft 133 (Figure 32) has a miter gear 134 connected to its inner end and this miter gear 134 (Figure 32) engages a miter gear 135 (Figures 11 and 12), pinned to head shaft 26. Thus as cam shaft 133 (Figure 31) makes a revolution each time shaft 64 makes a revolution and as shaft 133 is geared through miter gears 134 and 135 (Figures 12 and 32) to head shaft 26, head shaft 26 (Figure 11) and thus drum 17 makes a revolution each time the crank is turned through a complete revolution. If the drive is through coupling 125 (Figure 12), then each time head shaft 26 is turned a single revolution through the same gearing, shaft 64 is turned a revolution.

Cam shaft 133 (Figure 32) has three double cams 99, 123, and 137. Cam 99 coacts with yoke 98 (Figure 23) to rock transfer control shaft 97 and thus move the transfer members connected to shaft 97 through their respective arms, such as arm 95, into and out of engagement with the counterwheels they transfer digits to. Cam 123 (Figure 32) coacts with yoke 122 (Figure 13) to rock control shaft 121 first counterclockwise and then clockwise. As control shaft 121 is rocked, it moves the counterwheel actuating members, such as actuating member 21, into and out of engagement with counterwheels on the ascending and descending registers. As described hereinabove, the rocking movement of shaft 121 is transferred to the members, such as member 21, through arms, such as arm 5, connected to shaft 121.

Double cam 137 (Figure 32) acts upon the cam rollers 138*a* and 138*b* (Figure 33) of a cam yoke 138 to move cam yoke 138 with a rocking movement about its pivotal connection 139 to supporting plate 36. One of the arms of yoke 138 is pivotally connected by a pivot pin 140 to a link 141. Link 141 is pivotally connected by pin 142 to a crank 143 and crank 143 is pinned or otherwise connected to shaft 67. Shaft 67 (Figure 32) extends transversely across the machine and is mounted in bearings 144 and 145 mounted on supporting plate 36 and side plate 35. Referring to Figures 32 and 33, as the rollers on yoke 138 follow cam 137, crank 143 is moved with a rocking action through the connecting link 141. Crank 143, through its connection to shaft 67, rocks shaft 67 to move arms, such as arm 69 (Figures 13 and 14) of the variable drive linkage 66 first upwardly and then downwardly during an operative cycle as described hereinabove. This drive is the one which during the first portion of an operative cycle moves the counterwheel actuating members, such as member 21 (Figure 13), rearwardly to register the digit at which each setting knob is positioned in

both the ascending and descending registers and then returns the counterwheel actuating members at the end of the cyclical operation to their original positions.

Referring now to Figure 1, setting levers 146, 147, 148, and 149 (Figure 1) are mounted on supporting plates 150, 151, 152, and 153 (Figure 2) in the same manner as setting lever 18 is mounted on plate 41 (Figure 30). The upper portion of each of the setting levers includes a gear segment similar to gear segment 154 (Figure 13) on setting lever 18. Gear segment 154 engages a gear 155 connected to an indicator wheel 156 and thus as lever 18 is moved, gear segment 154 drives indicator wheel 156 through gear 155. In a similar manner, setting levers 146, 147, 148, and 149 (Figure 1) actuate and set indicator wheels 157, 158, 159, and 160 through their respective gear segments. These indicator wheels are provided with numerals which are visible through a window (not shown) in the housing and which at all times indicate the setting of their related setting knobs.

As each of setting levers 146, 147, 148, and 149 (Figure 1) is moved during setting of the value printing wheels 16 in printing head 17 (Figure 11), each one conditions variable drive linkage, similar to variable drive linkage 66 (Figure 13), so that counterwheel actuating members 169, 170, 171, and 172 (Figure 1) turn the counterwheels associated with them to register the digits at which their respective setting levers are set. The variable drive linkages of levers 146, 147, 148, and 149 (Figure 32) are generally indicated at 165, 166, 167 and 168 and each includes a link, namely, links 161, 162, 163, and 164 similar in construction and operation to link 65 (Figures 13 and 16). Counterwheel actuating members 169, 170, 171, and 172 are pivotally connected to arms 173, 174, 175, and 176 (Figure 3) which in turn are connected to control shaft 121 and are similar in construction and operation to arm 5 (Figure 13). Thus as control shaft 121 rocks, as described hereinabove, all of the counterwheel actuating members are moved into and out of engagement with their respective counterwheels in unison during the first portion of the operating cycle.

Referring to Figure 1, counterwheel actuating member 169 meshes with and drives counterwheels 177 and 178 through gears 179 and 180. Actuating member 170 drives counterwheels 181 and 182 through gears 183 and 184. Actuating member 21 drives counterwheels 187 and 80 through gears 22 and 23. Actuating member 171 drives counterwheels 117 and 191 through gears 189 and 190, and actuating member 172 drives counterwheels 191 and 192 through gears 193 and 194.

In the descending register 9 counterwheel 192 carries over accumulated tens to counterwheel 195 through a standard Geneva transfer pinion 196 and a Geneva drive member 197 connected to counterwheel 192. The drive from counterwheel 195 to counterwheel 197 and from counterwheel 197 to counterwheel 198 is through Geneva transfer pinions 199 and 199*a*. In the ascending register 8 the drive from counterwheel 191 to counterwheel 200 is through standard Geneva transfer pinion 201 and a Geneva transfer pinion drive member 202 connected to counterwheel 191. The carry-over from counterwheel 200 to counterwheel 203, from counterwheel 203 to counterwheel 204, and from counterwheel 204 to counterwheel 205 is through standard Geneva transfer pinions 206, 207, and 208. Thus, in operation, the counterwheel actuating members 169, 170, 21, 171, and 172 each drives a counterwheel in both the ascending and descending registers during the cyclical operation if their related setting knob has been set at any digit above zero. Additional counterwheels are provided in both the ascending and descending registers to which carry-overs may be made from the lower denomination counterwheels in each register as they occur. All of the ascending counterwheels are mounted on shaft 247 (Figure 23) and the descending counterwheels are mounted on shaft 248.

Referring now to Figures 1 and 26, transfer mechanism similar to the transfer mechanism described with respect to counterwheels 80, 101, 187, and 117 is provided to carry over accumulated tens from each counterwheel to the next higher one. Thus, transfer bar 209 is actuated by tripping cam 210, and a transfer member 211 effects a carry-over through a transfer gear 212 connected to counterwheel 181. The tripping cam 213 of counterwheel 181 acts upon a transfer bar 214 to effect a carry-over to counterwheel 187 through a transfer member 215 and a transfer gear 216 connected to counterwheel 187. Tripping cam 186 which is connected to counterwheel 187 described hereinabove acts through bar 188 and member 114 to effect a carry-over to counterwheel 117. Counterwheel 117 acts through its tripping cam 217, bar 218, and member 219 to turn transfer gear 220 which is connected to counterwheel 191 and thus effect a carry-over from counterwheel 117 to counterwheel 191.

In the descending register 9, counterwheel 178 has a tripping cam 221 which acts through bar 222 and member 223 which actuates transfer gear 224 to effect a carry-over between counterwheels 178 and 182. The tripping cam 225 of counterwheel 182 acts through transfer bar 226, member 227, and transfer gear 228 of counterwheel 80 to effect a carry-over between counterwheel 80 and 101 as described hereinabove. Counterwheel 101 acts through its tripping cam 230, transfer bar 231, and member 232 to turn the transfer gear 233 of counterwheel 192 and thus effect a carry-over between counterwheels 191 and 192.

The time and length of engagement of the transfer members with the transfer gears is controlled by shaft 97 (Figure 23) through arms similar to arm 95. Thus, transfer members 211 and 223 (Figures 3 and 26) are pivotally connected at their lower ends to transfer arm 234 and transfer members 215 and 227 are pivotally connected at their lower ends to arm 235. Transfer arms 219 and 232 are pivotally connected at their lower ends to transfer arm 236. Thus during a cyclical operation, as shaft 97 (Figures 3 and 23) is rocked by cam 99 acting through yoke 98, the teeth on the upper ends of the transfer members described hereinabove are moved into and out of engagement with the counterwheel gears so that they may effect a carry-over when it occurs.

To lock counterwheels 177 and 178 (Figure 1) against rotation during the transfer period, a locking member 238 (Figure 24) is provided.

At the left end of shaft 97, as viewed in Figure 3, an arm 237 (Figures 3 and 24) connected to shaft 97 extends forwardly in the machine in alignment with the other arms such as arm 95 (Figure 23) mounted on shaft 97. Arm 237 (Figure 24) is pivotally connected to locking member 238 by pivot pin 239 and member 238 is pivotally

connected to side plate 35 by a link 243 and pivot pins 244 and 245. As shaft 97 is rocked to move the transfer members, it raises and lowers locking member 238 so that teeth 240 thereon engage and disengage gears 241 and 242 on the ascending and descending registers 8 and 9 (Figures 1 and 23). These gears are connected to counterwheels 177 and 178 and with locking member 238 (Figure 24) they hold counterwheels 177 and 178 stationary during the transfer or carry-over period of an operating cycle.

Ascending register counterwheels 177, 181, 187, 117, and 191, which are rotatably mounted on shaft 247, and descending register counterwheels 178, 182, 80, 101, and 192, which are rotatably mounted on shaft 248, at all times are in engagement either with the transfer members associated with them, such as transfer members 93 and 114 (Figure 23) or with their counterwheel actuating members, such as counterwheel actuating member 21 (Figure 13). Thus, the counterwheels can never be moved except by the mechanism of the machine as it is always in engagement with them. The higher counterwheels in both the ascending and descending registers, namely, counterwheels 195, 197, 198, 200, 203, 204, and 205 are prevented from turning except during a transfer by the transfer pinions associated with them.

Referring now to Figures 18 and 26, a transfer actuating member, similar to member 103 (Figure 27*a*) is provided for each pair of transfer bars and these members actuate their respective bars as described hereinabove with respect to member 103 and bars 82 and 108 (Figures 27 and 28). Transfer actuating member 255 drives bars 209 and 222, member 256 drives transfer bars 214 and 226, and transfer actuating member 257 drives bars 218 and 231. These transfer actuating members are all pivotally mounted upon shaft 67 (Figures 23 and 26) and are actuated by double cams 258, 259, and 260, similar to cam 104, respectively, as these cams turn with shaft 64. These members effect a carry-over through their related transfer mechanisms whenever one of their transfer bars has been cammed downwardly during the first portion of the cycle of operation when digits were being fed into the counterwheels.

Referring to Figures 19, 20, 21, and 22, the actuating surfaces of cams 260, 104, 259, and 258 are in staggered relationship with respect to each other so that members 255, 256, 103, and 257 (Figure 18) are actuated in series during a cycle, one after another, beginning first with member 255. Thus, if the carry-over from a lower counterwheel to a higher counterwheel should trip the transfer bar associated with the higher counterwheel into operative position, then the transfer mechanism associated with that counterwheel can effect a carry-over to the next higher counterwheel because the transfer actuating member associated with the transfer bar cammed down would not move until the transfer action preceding it was completed. Accordingly, staggering the operation of the transfer mechanisms has a material effect on the keeping of an accurate and efficient record by the registers.

Resetting of all of the transfer bars occurs at the end of an operating cycle as shaft 57 rocks and is accomplished in a manner similar to the resetting of bars 103 and 82 (Figures 26 and 27) by arm 56. Aligning arms 251, 252, 56, and 253 (Figure 26) have resetting fingers 251*a*, 252*b*, 120 and 253*a* which, when cam 63 acts through yoke 60 (Figure 29) to turn shaft 57 in a clockwise direction, resets the setting bars (Figure 26) positioned above them. These arms and arm 250 also have fingers extending across setting levers 146, 147, 148, and 149 which engage gear segments on the levers during an operating cycle to hold the levers stationary in a manner similar to the coaction of lever 18 and finger 252*a* (Figures 29 and 30) as described hereinabove. Thus, the aligning arms mounted on shaft 57 (Figures 26 and 30) both hold the setting levers in set positions during an operating cycle and also reset the transfer mechanism at the end of the cycle.

To assure that all parts will be returned at the end of a cyclical operation to the same positions they were in when the cyclical operation began, a disc 297 (Figures 1, 11, and 12) is connected to head shaft 26 adjacent the rear end therof. An arm 298 pivotally mounted on a stud shaft 299 (Figure 11) has a roller 300 mounted on its end which engages the periphery of disc 297 (Figures 1 and 11). Arm 297 is resiliently urged in a counterclockwise direction (Figure 12*a*) by a spring 301 (Figures 1 and 11) to hold roller 300 in engagement with the periphery of disc 297. Disc 297 (Figure 12*a*) is provided with a recessed portion 297*a* in which roller 300 is positioned when the machine is in "home" or "rest" position.

Thus during each cyclical operation of the machine the digits at which the setting levers 11, 12, 13, 14, and 15 are set are fed into the ascending and descending register counterwheels associated with them. This occurs during the first portion of the operating cycle and during the last portion of the cycle accumulated tens are fed into the next higher order counterwheels. It will be noted that the counterwheels of each register are always engaged with either the actuating or transfer mechanisms, and thus accuracy in operation is assured. Accordingly, it will be clear that a thoroughly practical and efficient registering mechanism has been described and that the several objects hereinabove set forth as well as many others have been successfully accomplished.

As many possible embodiments may be made of the mechanical features of this invention, and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In registering mechanism, in combination, a frame work, a register mounted on said framework, a setting lever, linkage means including four links quadrangularly positioned with respect to each other, pivot means pivotally connecting said links at the four corners of the quadrant they form, the effective lengths of links on opposed sides of said quadrant of links being of the same length between the axes of the pivot points connecting them to the other links, whereby opposed links of said quadrant are always parallel with respect to each other, one of said pivot points being fixed with respect to said framework, means for reciprocating one of the links connected to said fixed pivot point through a predetermined angle during each cycle of operation, said last mentioned link being the driving link of said quadrant of links, the link parallel to said driving link in said quadrant of links being the driven link, a guiding link pivotally connected to the pivot point of said quadrant of links diagonally positioned with respect to said fixed pivot point, said guiding link being of the same effective length as said driven link, means pivotally connecting said setting lever to the

other end of said guiding link, said last mentioned pivotal connection when said guiding link is in nonregistering position being aligned axially with the pivot point in said quadrant of links at the end of said driven link opposite to the one the guiding link is connected to, said guiding link being capable of being moved by said setting lever so that it is angularly positioned with respect to said driven link, whereby, when said driving link is driven, said driven link is driven transversely with respect to said driving link in proportion to the angular position of said guiding link with respect to said driven link, and means connecting said quadrant of links to one of the counterwheels of said register to drive said counterwheel during movement of said driving link in one direction.

2. In registering mechanism, in combination, a frame work, a register mounted on said framework, a setting lever, linkage means including four links quadrangularly positioned with respect to each other, pivot means pivotally connecting said links at the four corners of the quadrant they form, the effective lengths of links on opposed sides of said quadrant of links being of the same length between the axes of the pivot points connecting them to the other links, whereby opposed links of said quadrant are always parallel with respect to each other, one of said pivot points being fixed with respect to said framework, means for reciprocating one of the links connected to said fixed pivot point through a predetermined angle during each cycle of operation, said last mentioned link being the driving link of said quadrant of links, the link parallel to said driving link in said quadrant of links being the driven link, a guiding link pivotally connected to the pivot point of said quadrant of links diagonally positioned with respect to said fixed pivot point, said guiding link being of the same effective length as said driven link, means pivotally connecting said setting lever to the other end of said guiding link, said last mentioned pivotal connection when said guiding link is in non-registering position being aligned axially with the pivot point in said quadrant of links at the end of said driven link opposite to the one the guiding link is connected to, said guiding link being capable of being moved by said setting lever so that it is angularly positioned with respect to said driven link, whereby, when said driving link is driven, said driven link is driven transversely with respect to said driving link in proportion to the angular position of said guiding link with respect to said driven link, an actuating member for driving one of the counterwheels of said register, and link means connecting said quadrant of links and said actuating member, the degree of drive given by said quadrant of links to said last mentioned link depending on the setting of said guiding link by said setting lever.

3. In mechanism of the type described in claim 2 in which the link connecting the quadrant and the actuating member is pivotally connected to said quadrant of links adjacent one end of the driven link of the quadrant of links.

4. In a registering mechanism, in combination a register, a setting lever, a quadrant formed of four pivotally connected links, links on opposite sides of said quadrant being parallel, one of the pivot points in said quadrant being fixed with relation to said machine, means for driving one of the links connected to said fixed pivot point with a reciprocating action, a guiding link pivotally connected to the pivot point diagonally opposite to said fixed pivot point, said guiding link being of the same length as the driving link of said quadrant and when in rest position being parallel to said driving link and overlying the link opposite to said driving link, means pivotally connecting said setting lever to the free end of said guiding link, movement of said setting lever to a registering position angularly positioning said guiding link with respect to said driving link, and means operatively connecting said quadrant of links to one of the counterwheels of said register, the degree of drive given by said quadrant of links to said counterwheel being determined by the setting of the guiding link by the setting lever.

5. In a registering mechanism, in combination a register, a setting lever, a quadrant formed of four pivotally connected links, links on opposite sides of said quadrant being parallel, one of the pivot points in said quadrant being fixed with relation to said machine, means for driving one of the links connected to said fixed pivot point with a reciprocating action, a guiding link pivotally connected to the pivot point diagonally opposite to said fixed pivot point, said guiding link being of the same length as the driving link of said quadrant and when in rest position being parallel to said driving link and overlying the link opposite to said driving link, means pivotally connecting said setting lever to the free end of said guiding link, movement of said setting lever to a registering position angularly positioning said guiding link with respect to said driving link, an actuating member for driving one of the counterwheels of said register, means for moving said actuating member into engagement with said counterwheel during movement of said driving link in one direction and for disengaging said actuating member from said counterwheel during the return movement of said driving link, and link means connecting said quadrant of links and said actuating member, the degree of drive given by said quadrant of links to said actuating member being governed by the angular position of said guiding link with respect to said driving link.

6. In a registering mechanism, in combination, a register including ordinal pinions, an ordinal series of settable value indexing levers, adjustable differential actuating means including oscillatable gear sectors moveable into and out of engagement with said register pinions, means operatively connecting said actuating means with said indexing levers for adjustment thereby, means for moving said gear sectors into and out of engagement with said pinions, cyclic drive means for oscillating said gear sectors consonant with the adjustment of said actuating means to rotate said pinions in accordance with the value indexed by said levers, and tens transfer means, said transfer means including an ordinal series of oscillatable toothed levers moveable into and out of engagement with said pinions, means operable in synchronism with said cyclic drive means for oscillating said levers, means for moving said levers into and out of engagement with said pinions, said oscillating means for said gear sectors and for said toothed levers being operable in sequence, and said engaging means for said gear sectors and said toothed levers being synchronized to cause complete engagement of said toothed levers with said pinions while said gear sectors are fully engaged with said pinions and prior to disengagement of said gear sectors therefrom and to cause complete reengagement of said gear sectors with said

pinions while said toothed transfer levers are fully engaged with said pinions and prior to disengagement of the toothed levers therefrom.

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