Nov. 30, 1954 R. E. PARIS 2,695,558

RECORD CARD CONTROLLED PRINTING MECHANISM

Filed Dec. 31, 1951

7 Sheets-Sheet 1

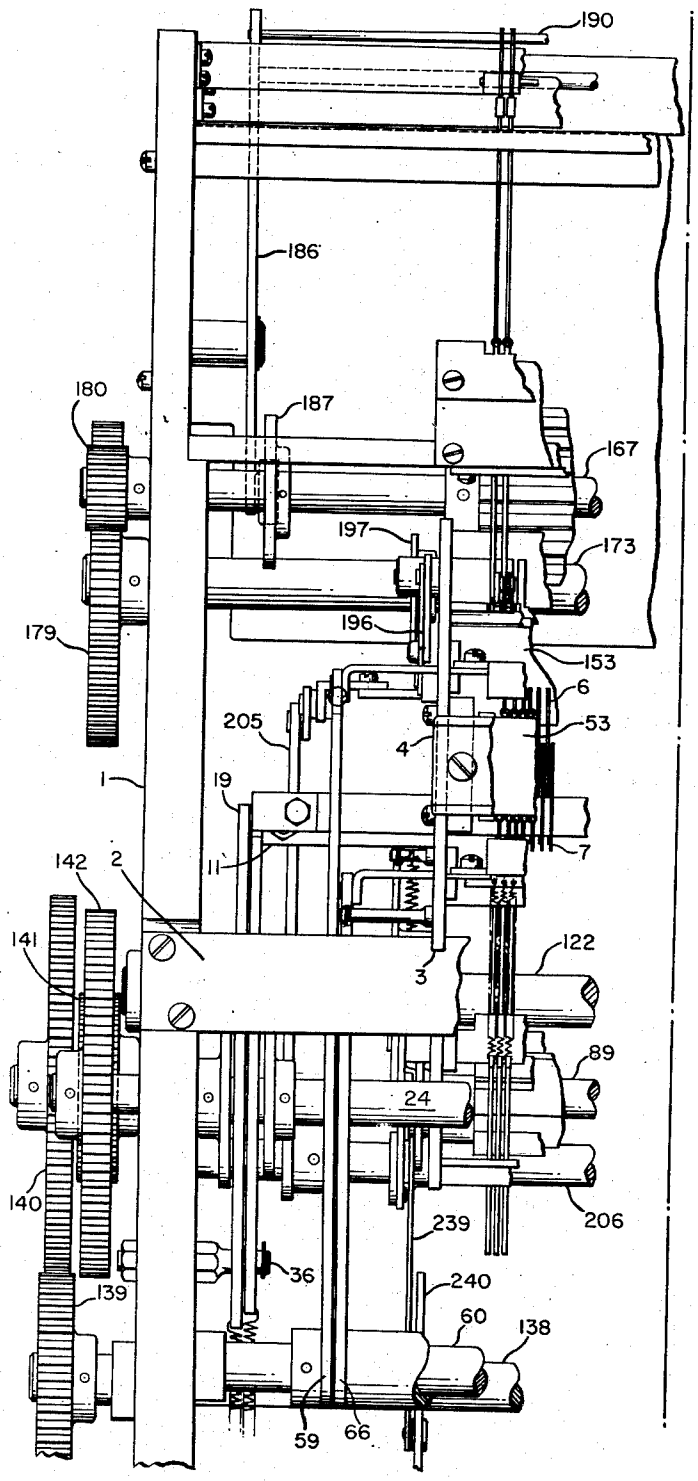


FIG. 1a

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RECORD CARD CONTROLLED PRINTING MECHANISM

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7 Sheets-Sheet 2

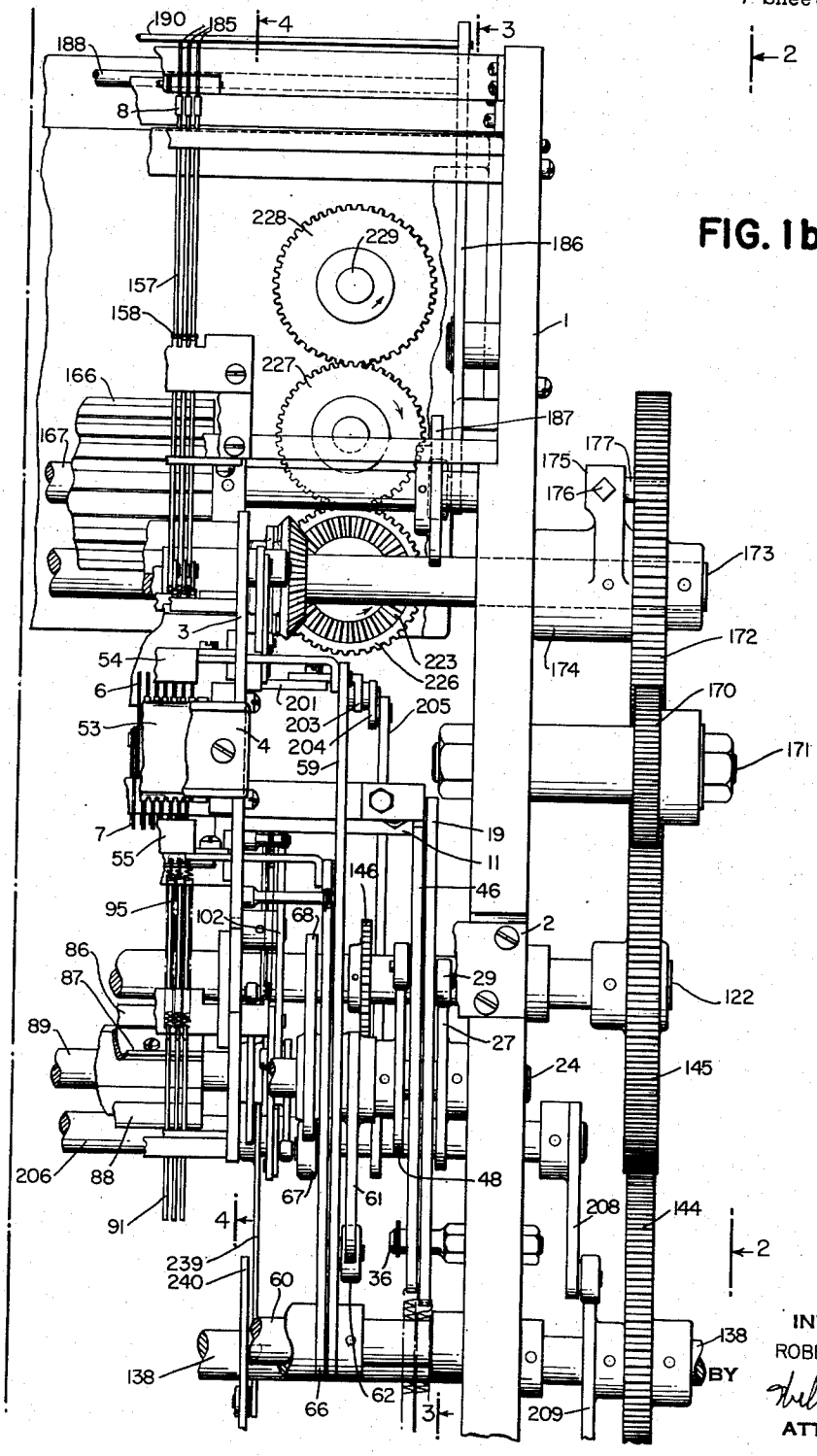


FIG. 1b

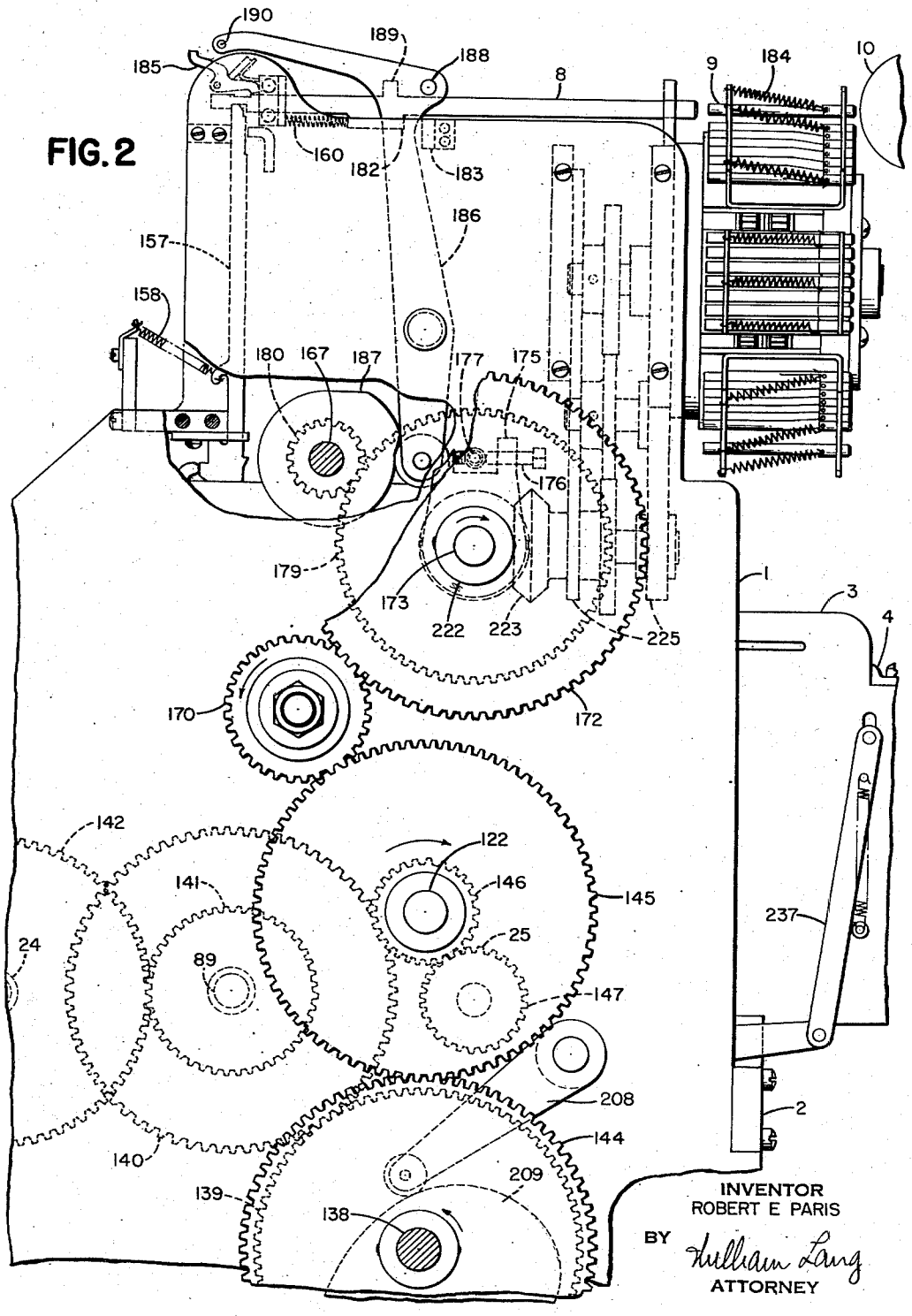
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RECORD CARD CONTROLLED PRINTING MECHANISM

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FIG. 2



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RECORD CARD CONTROLLED PRINTING MECHANISM

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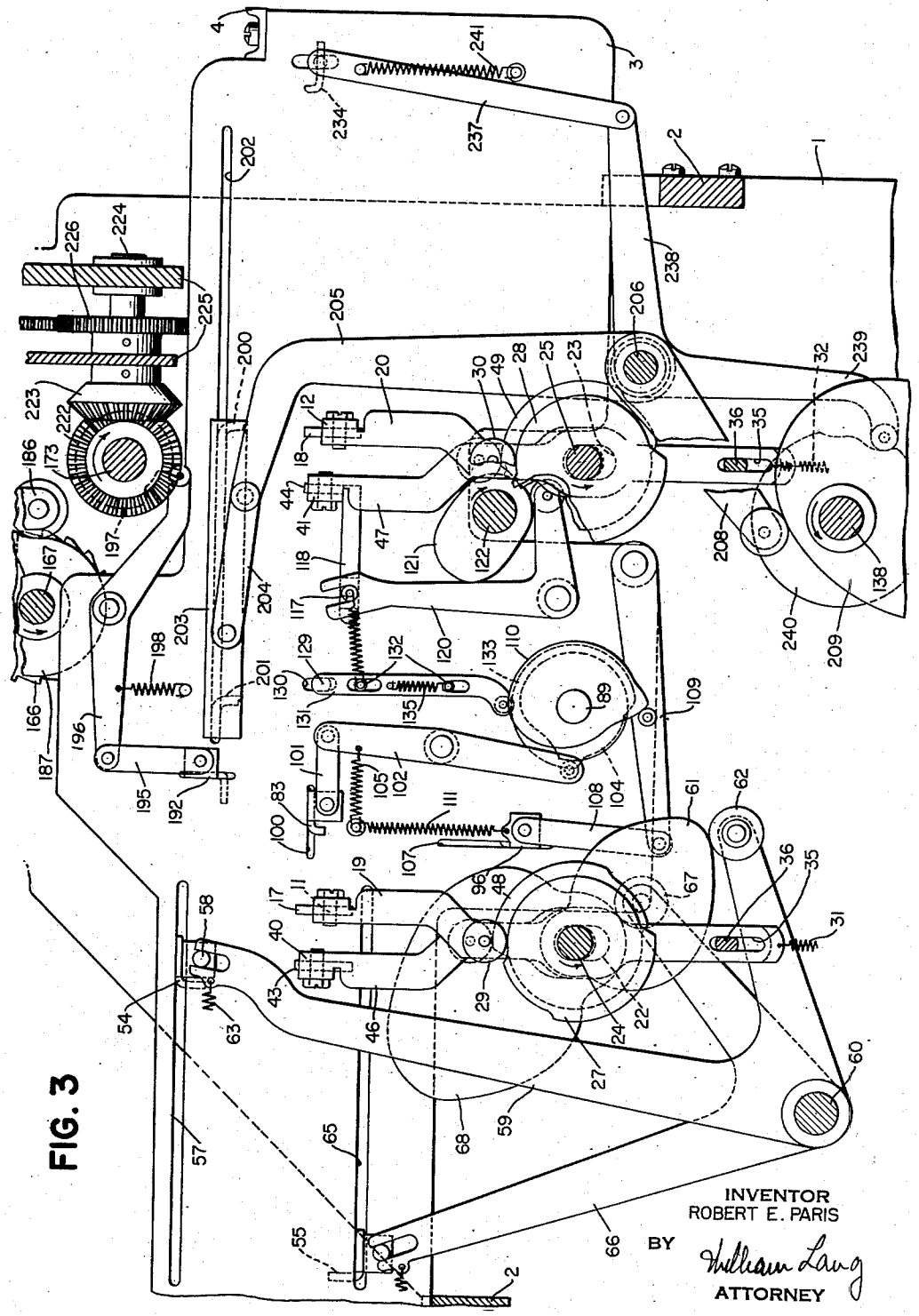


FIG. 3

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RECORD CARD CONTROLLED PRINTING MECHANISM

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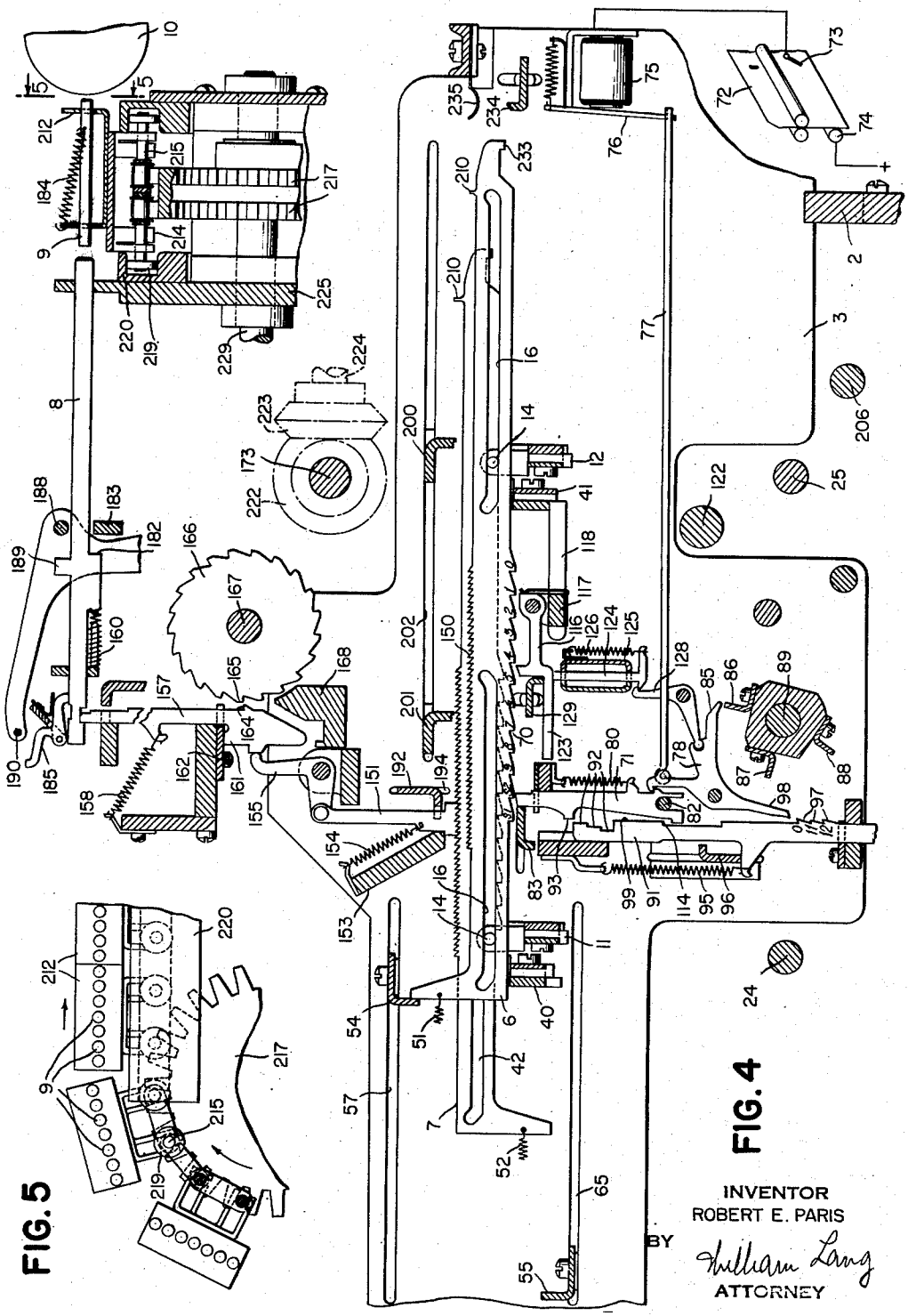


FIG. 4

FIG. 5

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RECORD CARD CONTROLLED PRINTING MECHANISM

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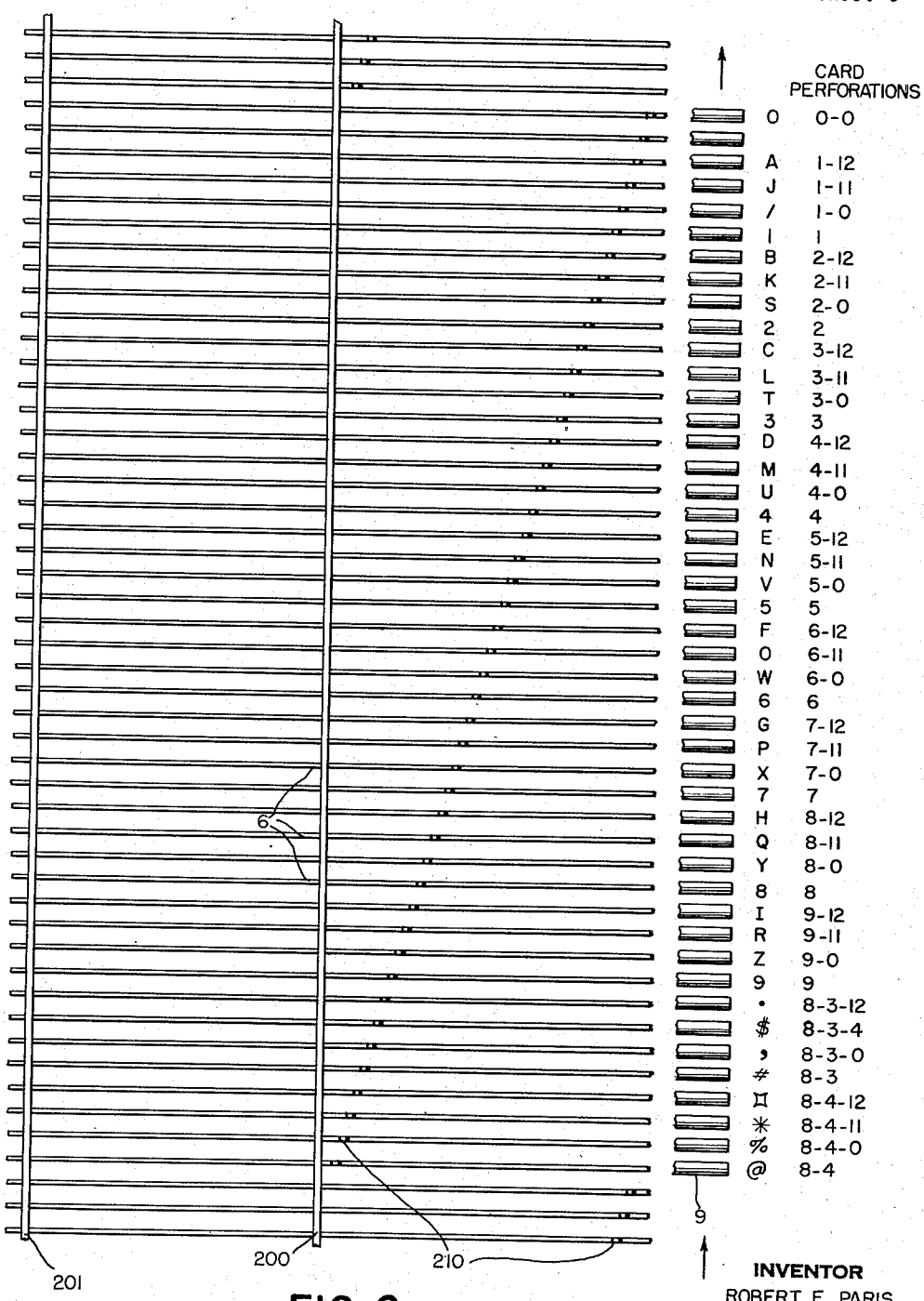


FIG. 6

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RECORD CARD CONTROLLED PRINTING MECHANISM

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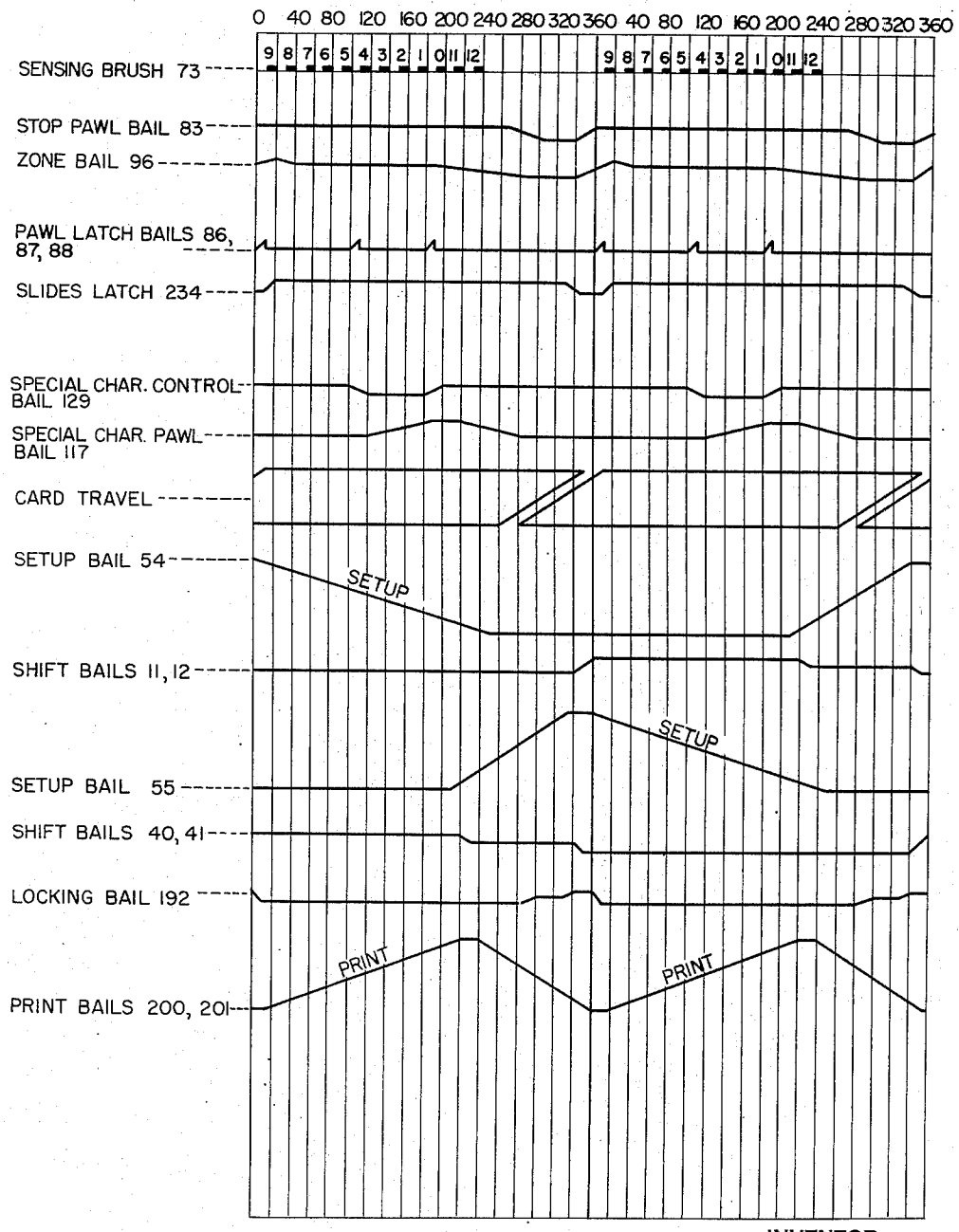


FIG. 7

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2,695,558

RECORD CARD CONTROLLED PRINTING MECHANISM

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Application December 31, 1951, Serial No. 264,290

12 Claims. (Cl. 101—93)

This invention relates to printing mechanisms, and more particularly to mechanisms which operate automatically to print data from the reading of perforated records.

Printing mechanisms which are responsive to perforated records ordinarily operate on the sensing of a perforation at any one of index points numbered 0 to 9 to print the digit corresponding to the number of the point sensed. A perforation may also be sensed at zone points 11 and 12 or the 0 point, which is usually considered as a zone point, in combination with a perforation at one of the points 1 to 9 to effect the printing of an alphabetic or special character. By arranging a printing mechanism so that it is responsive to the above sensing of perforations and is also operative on the sensing of a perforation at any one of the zone points in combination with perforations at more than one of the points 1 to 9, or is responsive to perforations at combinations of points 1 to 9 alone, then it is possible to obtain a printing of a larger number of characters.

The speed of a printer may also be increased by providing separate members or slides which are adjustable independently in response to the sensing of perforations, and which operate after being adjusted to effect printing. Either one of the slides may operate to cause printing while the other is being adjusted from the sensing of a record. With an arrangement of this type, the machine cycles may be shorter since there is no need to provide time for mechanical operations of the printer after the sensing of a record has been completed. The printing of data under the control of one slide may be completed during the same period of time that is required for the adjusting of the other slide from the sensing of another record.

In order that a single control means may determine the positioning of the slides from the sensing of holes, each slide is moved in different planes during sensing and printing operations. After a slide has moved in one plane where it is subjected to the operations of control means, it is shifted to another plane so that the other slide may be operated upon by the control means. The first slide is then moved to its home position in the second plane and effects a printing operation during this time.

An object of this invention is to provide an improved printing mechanism.

Another object is to provide a printing mechanism having improved means which is responsive to the sensing of perforations in a record for effecting an operation of the mechanism to print characters.

Still another object is to provide a printing mechanism which is responsive to the sensing of perforations at conventional zone points and certain combinations of subzone points as well as at subzone points alone or taken singly with a zone point.

Yet another object is to provide an improved printing mechanism having a pair of slides which may be positioned separately in response to the sensing of perforations for determining printing operations, one of the slides operating to effect printing of the data read in one cycle while the other slide is being positioned in accordance with the data that is read during the next cycle.

Another object is to provide a printing mechanism having a single control means which is operative in response to the sensing of perforations to determine independently the positioning of two members which are operable to effect the printing of characters.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Figs. 1*a* and 1*b* taken together constitute an end elevational view of the improved printing mechanism with parts broken away to facilitate illustration.

Fig. 2 is a side elevational view taken on the plane of the line 2—2 of Fig. 1*b*, and showing a portion of the machine with parts broken away.

Fig. 3 is a vertical sectional view taken on the plane of the line 3—3 of Fig. 1*b*.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 1*b*.

Fig. 5 is an end elevational view of the carrier for the printing elements, taken on the line 5—5 of Fig. 4.

Fig. 6 is a schematic diagram showing the arrangement of actuating means for slides to effect printing, and the positions of the printing elements for the different characters relative to the slides at the beginning of printing.

Fig. 7 is a timing diagram.

The improved printing machine comprises, as shown in Figs. 1*a* and 1*b*, a pair of side plates **1** which are connected together and held in upright positions by cross bars **2** (Fig. 3). Spaced inwardly from the plates **1** and mounted upon the cross bars **2** are plates **3** connected by cross members **4**.

Arranged between the plates **3** are pairs of slides, one slide of each pair being numbered **6** and the other being numbered **7**. Each pair of slides is operative, as will be described later, to control the firing of a hammer **8** (Fig. 4) against a printing element **9** for moving the latter against a record carried by a platen **10**. Extending transversely beneath the pairs of slides are two bails **11** and **12** having upright portions which carry studs **14** slidably fitting within slots **16** in each of the slides **6**. The bails **11** and **12** project through openings **17** and **18** (Fig. 3) in the plates **3** and are connected at their ends to members **19** and **20** which are adapted to be moved vertically so as to effect a positioning of the slides **6** in different horizontal planes. Formed in the members **19** and **20** are slots **22** and **23** loosely receiving shafts **24** and **25** which are rotatably supported by the side plates **1**, and fixed to these shafts are cams **27** and **28** engaging rollers **29** and **30** on the members **19**, **20** for positioning the latter vertically. Springs **31** and **32** are connected between the lower ends of the members **19**, **20** and stationary elements, not shown, for holding the rollers in engagement with the cams. At the lower ends of the members **19** and **20** are slots **35** slidably receiving studs **36** on the side plates **1** for guiding the members so that they move only in a vertical direction.

Another pair of bails **40**, **41** extend transversely beneath the pairs of slides and are provided with studs slidably fitting within slots **42** in each of the slides **7**. These bails extend through slots **43**, **44** (Fig. 3) in the plates **3** and are connected to members **46**, **47** having slots which slidably receive the shafts **24**, **25**. Cams **48** and **49** on the shafts engage rollers on the members **46**, **47** for positioning the latter vertically against the action of springs in the same manner as described above for the members **19**, **20**.

Slide positioning means

The slides **6** and **7** are urged to the left in Fig. 4 by springs **51** and **52** which are connected between the left hand ends of the slides and a member **53** (Figs. 1*a* and 1*b*) extending between the plates **3**. Bails **54** and **55** are engageable with the left hand ends of the slides **6** and **7**, respectively, and control their movements to the left under the action of the springs **51**, **52**. The bail **54** extends through slots **57** in the plates **3** and has at each end, as shown in Fig. 3, a stud **58** fitting within a bifurcated portion of a bellcrank **59** which is pivotally mounted on a shaft **60** extending between the side plates **1**. Fixed to the shaft **24** is a cam **61** acting against a roller **62** carried by the bellcrank for rocking the latter about the shaft **60**. The roller is held against the cam by a spring **63** connected between the upper end of the bellcrank and a stationary abutment, not shown. Bail **55** extends

through slots 65 in the plates 3 and is operatively connected to a bellcrank 66 which is pivotally mounted on the shaft 60 and has a roller 67 engaging a cam 68 on the shaft 24.

The cams 61 and 68 are shaped so that they operate 180° out of phase in controlling the movements of the slides to the left. Formed along the lower edge of each slide are notches 70 (Fig. 4) numbered 9 to 0, as shown. Arranged below each pair of slides is a stop pawl 71 adapted to engage any one of the notches for stopping the movement of the slide to the left. Two other notches at the left hand end marked S1 and S2 are provided for receiving the stop pawl when the slide is adjusted to effect the printing of special characters. One of the slides is permitted to move to the left so that the notches 70 numbered 9 to 0 approach the stop pawl 71 in synchronism with the passing of corresponding numbered index points on a card 72 past a sensing brush 73. As soon as a perforation is sensed in the card, a circuit is completed from a contact roll 74 through the brush 73 and a magnet 75. An armature 76 of the magnet is connected by a link 77 to a latch 78 which normally engages the stop pawl for holding the latter retracted against the action of a spring 80.

As mentioned above, the slides may be supported in different horizontal planes by the bails 11, 12 and 40, 41. Just before a slide is moved to the left, it is dropped to a low horizontal position so that the stop pawl may engage the notches 70 when released. After a slide has been positioned in response to the sensing of a card, it is moved to an upper plane for effecting the operation of the hammer 8 through mechanism which will be described shortly. As shown in Fig. 4, the slide 6 is moving to the left in a low plane while the slide 7 is in its upper plane and operatively engages mechanism to effect the actuation of the hammer for printing a character represented by perforations in a card previously sensed.

The stop pawl is both slidably and pivotally supported at its lower end by a rod 82 extending between the plates 3. The upper end of the pawl is guided by a bail 83 during the complete sensing of each card. Each of the cards 72 has index points numbered 11 and 12 in addition to points 9 to 0, and the cards are fed past the brushes 73 so that the points are sensed in the order 9 to 0, 11 and 12. As soon as the sensing of a card has been completed, the bail 83 moves to the left in Fig. 4, and the stop pawl tends to follow the bail due to the action of the spring 80 as well as the action of the slide on the pawl if the latter engages one of the notches 70.

Formed upon the latch 78 is a tail portion 85 which is engageable by bails 86, 87 and 88 fixed to a rotatable shaft 89. The bail 86 engages the tail portion to assure a latching of the stop pawl before a slide starts its movement to the left. The bail 87 is engageable with the tail portion of the latch just after the Number 5 notch 70 has passed the stop pawl, and the bail 88 is engageable with the tail portion just after the Number 1 notch passes the stop pawl.

Associated with each stop pawl is a zone bar 91 having three stepped portions 92 engageable by a projecting portion 93 on the stop pawl for limiting pivotal movement of the latter in a counterclockwise direction. Each of the bars is urged upwardly by a spring 95, and its upward movement is controlled by a bail 96. Formed on the lower portion of each bar are three teeth 97 numbered 0, 11 and 12 and engageable by a tail portion 98 on the latch when the latter is rocked in a clockwise direction. An engagement of the tail portion 98 with the 0, 11 or 12 tooth results in a stopping of the zone bar to present the upper, middle or lower stepped portion 92 to the projecting portion 93 on the stop pawl. These stepped portions permit different pivotal movements of the stop pawl to the left in Fig. 4. If no one of the teeth 97 is engaged by the tail portion 98, the zone bar follows the bail 96 upwardly until a high portion 99 on the bar lies opposite the portion 93 on the pawl. With the zone bar in this position, the pawl is prevented from swinging in a counterclockwise direction.

The bail 83 is slidably supported within slots 100 (Fig. 3) in the plates 3 and is connected at each end through a link 101 to a lever 102 which operatively engages a cam 104 on the shaft 89. A spring 105 holds the lever in engagement with the cam so as to effect a shifting of the bail 83 to the left in Figs. 3 and 4 after the sensing of the card has been completed. As shown in Fig. 7, the bail is moved again to the position shown in Fig. 4 at the beginning of each cycle.

Bail 96 is slidably supported within vertical slots 107 (Fig. 3) in the plates 3 and is connected at each end by a link 108 to a lever 109 which operatively engages a cam 110 on the shaft 89. A spring 111 tends to move the bail 96 upwardly, and the cam 110 is shaped to permit such upward movement so that the upper, middle and lower stepped portions 92 on the zoning bar come opposite the portion 93 on the stop pawl in synchronism with the sensing of the 0, 11 and 12 points of the card. If a perforation is sensed at any one of these points, the latch 78 is rocked to engage the latch portion 98 with the corresponding numbered tooth 97 on the zoning bar. This stops the upward movement of the bar in a position with one of the stepped portions 92 opposite the portion 93 on the pawl so that the latter may rock a predetermined amount when the bail 83 moves to the left. If no perforation is sensed at the 0, 11 or 12 points on the card, the zoning bar 91 follows the bail 96 upwardly until the high portion 99 on the bar is opposite the portion 93 on the stop pawl.

Formed on the zoning bar is a shoulder 114 which is engageable with the stop pawl for effecting a return of the pawl to its latched position when the zoning bar is moved downwardly. The bail 96 moves the zoning bar downwardly at the beginning of each cycle to a point where the stop pawl is latched and then the bail permits the zoning bar to move upwardly a short distance to the position of Fig. 4 so that it does not interfere with operations of the pawl to engage the notches 70.

Associated with the slide positioning means already described are further means for moving a slide to a position where the stop pawl engages one of the notches 70 marked S1 and S2, when predetermined combinations of perforations are sensed in a card. This means comprises a pawl 116 (Fig. 4) pivotally mounted on a bail 117 and adapted to engage a notch 70 in either one of a pair of slides. Each pair of slides in the printing mechanism has one of the pawls 116 associated with it. The bail 117 is guided at its ends within horizontal slots 118 in the plates 3 and is operatively connected, as shown in Fig. 3, to a bellcrank 120 which carries a roller cooperating with a cam 121 on a shaft 122. The cam 121 is shaped so as to move the bail 117 to the right just after the Number 4 index point on the card passes the brush 73 and to continue such movement during the sensing of the Numbers 3, 2 and 1 index points. As shown in Fig. 7, the bail 117 is held only a short time in its right hand position and is then returned to the position of Fig. 4 before the beginning of the next cycle. When the bail is in the position of Fig. 4, the nose of the pawl 116 lies approximately five and one half notches to the right of the pawl 71. The movement of the bail is sufficient to shift one of the slides to the right a distance of three notches.

Formed on the pawl 116 is a tail portion 123 having sliding engagement with a pin 124 which is reciprocably guided by a frame member 125 and is urged upwardly by a spring 126. A latch 128 is operatively connected to the latch 78, as shown in Fig. 4, and is engageable with the pin 124 for holding the latter normally in its lower position. Engaging the upper side of the tail portion 123 is a bail 129 which is movable upwardly to free the pawl 116 for actuation by the pin 124. This bail is slidably guided by vertical slots 130 (Fig. 3) in the plates 3 and is connected at each end to a member 131 guided for vertical movement by studs 132 on the plate 3. Mounted upon the lower end of the member is a roller which cooperates with a cam 133 on the shaft 89. A spring 135 is connected between one of the studs 132 and a stud on the member 131 for holding the latter in engagement with the cam. Bail 129 is moved to its upper position just as the Number 4 index point on the card passes the brush 73 and is held in its upper position until the No. 1 index point passes the brush. It is then moved downwardly to return the pin 124 to a position where it may be engaged again by the latch 128.

With the structure described, it is possible to obtain a positioning of a slide in response to the sensing of a perforation at any one of the 9 to 0 index points alone, the sensing of perforations at any of the 9 to 1 index points in combination with a perforation at one of the 0, 11 and 12 zone points, and the sensing of perforations at the No. 8 point and either the No. 4 or No. 3 point alone or in combination with another perforation at one of the

0, 11 and 12 points. If only one perforation is sensed at one of the 9 to 0 points, then the stop pawl **71** is released to engage the notch 70 corresponding to the point at which the perforation is located. The zone bar **91** is permitted to move upwardly later to a point where its portion **99** lies opposite the projection **93** on the stop pawl since there is no rocking of the latch **78** to engage its tail portion **98** with one of the teeth **97**. The stop pawl is then held against rocking movement in a counterclockwise direction when the bail **83** moves to the left in Fig. 4. If another hole had been sensed at one of the 0, 11 or 12 points, the zone bar would have been stopped to present one of the stepped portions **92** on the bar to the projection **93**. This would have permitted a rocking of the stop pawl to shift the slide a short distance to the left when the bail **83** was actuated.

If the card had been perforated at its No. 8 point and either its No. 3 or No. 4 point, then there would have been an additional shifting of the slide. Assuming that a card is perforated at its Nos. 8 and 4 index points, the operation of the mechanism to position the slide **6** as it moves to the left in Fig. 4 is as follows. Just before the No. 9 index point on the card reaches the brush **73**, the bail **86** engages the tail portion **85** on the latch **78** for assuring engagement of the latter with the pawl **71**. The slide is permitted to move to the left under the control of the bail **54** so that the different numbered notches in the slide arrive over the pawl **71** in synchronism with the passing of corresponding numbered index points under the brush **73**. When the perforation at the No. 8 point is sensed, the pawl **71** is released to engage the No. 8 notch and hold the slide against further movement with the bail **54**. At this time, the No. 2 notch lies just to the right of the pawl **116**.

Just before the perforation at the No. 4 point reaches the brush **73**, the bail **87** engages the tail portion **85** on the latch **78** to assure an engagement of the latch **128** with the pin **124**. At the same time, the bail **129** moves upwardly to free the pawl **116** for actuation by the pin **124**. The sensing of the perforation at the No. 4 point results in an operation of the latch **128** to release the pin **124** so that it swings the pawl **116** upwardly into the No. 2 notch. Bail **117** then moves to the right and causes the slide to move with it, the notches at the left hand end sliding over the pawl **71** during this time until the notch S1 at the left hand end engages the pawl **71**. Bail **129** moves the pawl **116** away from the slide as soon as the No. 1 index point on the card passes under the brush **73**, and then the bail **117** returns the pawl **116** to the position shown in Fig. 4. Pawl **71** holds the slide by its engagement with the notch S1. The zoning bar **91** moves upwardly while the 0, 11 and 12 index points pass under the brush **73** and, since no perforation is sensed at the latter points, the zoning bar continues to move upwardly until its high portion **99** comes into a position to prevent a rocking of the pawl **71** to the left when the bail **83** is actuated after the No. 12 point passes the brush. The slide is then in a position to effect the printing of the character "@," as indicated by Fig. 6.

If a perforation had been sensed also at either the 0, 11 or 12 point, then the zoning bar would have been stopped in a position to permit the pawl **71** to rock so as to effect a shifting of the slide either ¼, ½ or ¾ of the distance between two adjacent notches. The slide would then be positioned to effect the printing of different characters, as indicated by Fig. 6. If a perforation had been sensed at the No. 3 index point instead of the No. 4 point, then the bail **117** would have moved the distance of one notch to the right before the pin **124** was released to actuate the pawl **116**. This would cause the pawl to engage the No. 1 notch and move the slide to the right until the pawl **71** was received in the notch S2. The slide would then be in a position to effect the printing of the character "#." If the pawl **71** was permitted to rock due to the sensing of a perforation at one of the 0, 11 or 12 points, then different characters would be printed.

For driving the various cams described above, there is provided a shaft **138** which is rotatably supported by the side plates **1** and is adapted to be driven by any suitable means, not shown. Connected to the left hand end of this shaft in Fig. 1*a* is a gear **139** meshing with a gear **140** on the shaft **89** (see Fig. 2) for driving the latter in a clockwise direction. Another gear **141** on the shaft **89** meshes with a gear **142** on the shaft **24** for driving it in a counterclockwise direction. At the right hand end of the shaft **138** in Fig. 1*b* is a gear **144** meshing with a gear **145** on the shaft **122**. Fixed to the shaft **122** is a gear **146** (Fig. 2) meshing with a gear **147** on the shaft **25** for driving the latter in a counterclockwise direction.

Hammer actuating means

Formed along a portion of the upper edge of each slide are teeth **150** which are engageable with similar teeth on a locking link **151** when the slide is moved to its upper horizontal plane. Adjacent the lower end of the link is a stop plate **153** which is engageable with a shoulder on the link for holding the latter in a position to be engaged by the slide. A spring **154** tends to hold the link in engagement with the stop plate and to move the link vertically when it is released from the stop plate. Pivotally connected to the upper end of the link is a bellcrank **155** cooperating with the lower end of an interposer **157** which is normally held by a spring **158** in a position to engage its upper end with a notch in the hammer **8** so that the latter is held in a retracted position against the action of a spring **160**. Formed on the interposer is a shoulder **161** which is engageable with a plate **162** to limit upward movement of the interposer by the spring **158**.

If one of the slides is moved to the right in Fig. 4 while its teeth **150** engage the lower end of the link **151**, the link is shifted and released from the stop plate **153** and is moved upwardly by the spring **154**. This effects a rocking of the bellcrank **155** for moving the lower end of the interposer to the right until a tooth **164** thereon is engaged by one of a plurality of teeth **165** on a member **166** fixed to a shaft **167** which is rotated in a counterclockwise direction. Engagement of a tooth **165** with the tooth **164** causes the interposer **157** to be moved downwardly until its lower end is cammed to the left by a member **168** out of engagement with the member **166**. The spring **158** then returns the interposer to the position shown in Fig. 4.

For driving the shaft **167**, there is provided, as shown in Figs. 1*b* and 2, an idler gear **170** mounted on a stub shaft **171** which is fixed to one of the side plates **1**. This gear is driven by the gear **145** of the shaft **122** and meshes a gear **172** freely mounted on a shaft **173** that is rotatably supported by the side plates **1**. Fixed to the shaft **173** adjacent the gear **172** is a sleeve **174** having arm portions **175** carrying bolts **176** which act on opposite sides of a stud **177** projecting from the gear **172**. It will be seen that the bolts operate on the stud for connecting the gear **172** and the shaft **173** so that they rotate together. By adjusting the bolts, the gear may be moved to any desired position relative to the shaft so that the correct timing of the driven mechanisms is obtained. Fixed to the left hand end of the shaft **173** in Fig. 3 is a gear **179** meshing with a gear **180** on the shaft **167**.

When the interposer **157** is moved downwardly to release the hammer **8**, the spring **160** drives the hammer to the right until a shoulder **182** on the hammer engages an abutment **183**. This action of the hammer causes a printing element **9** to be driven toward the platen **10** against the action of a spring **184**. Adjacent the rear end of the hammer is a latch **185** which is engageable with a notch in the hammer for limiting the rebound of the latter to prevent a recompressing of the spring **160** with another firing of the hammer before it is time for it.

For returning the hammer to their latched positions after each printing operation, there are provided levers **186** pivotally mounted upon the plates **1** at their adjacent sides and cooperating with cams **187** fixed to the shaft **167**. Extending between the levers is a rod **188** which is engageable with projecting portions **189** on the hammers. Just before the rod **188** engages the projections **189**, another rod **190** engages tail portions on the latches **185** for releasing the latter from the hammers so that they may be moved to retracted positions by the rod **188**.

After one of the slides has been positioned by the pawls **71** and **116** in response to the sensing of a card, either its bails **11**, **12** or **40**, **41** move the slide upwardly. Just before this movement takes place, the link **151** is moved downwardly by a bail **192** to engage the teeth at the lower end of the link with the teeth **150** on the slide for holding the latter against movement to the left by

the spring **51** or **52** when the notches **70** are moved out of engagement with the pawls. As the slide is moved upwardly, the link **151** and the bail **192** move with it until the link engages the stop plate **153**. The bail **192** is moved still higher to the position shown in Fig. 4 so that the link may be lifted by the spring **154** when disengaged from the stop plate by movement of the slide to the right. After printing operations have been completed, the bail **192** is moved downwardly to return the link **151** to a position where it is latched to the stop plate.

The bail **192** extends through vertical slots **194** in the plates **3** and is connected at each end, as shown in Fig. 3, to a link **195** which is pivotally attached to a lever **196** operatively engaging a cam **197** on the shaft **173**. A spring **198** holds the lever **196** in engagement with the cam and causes downward movement of the bail **192** when the low portion of the cam comes into position for engagement by the lever.

To effect a movement of each slide to the right in Fig. 4 after it has been moved to its upper horizontal position, there are provided bail members **200**, **201** extending through slots **202** in the plates **3** and connected together at each end by a member **203** (Fig. 3). Each of the members **203** is pivotally connected by a link **204** to an arm **205** which is attached to a shaft **206** rotatably supported by the side plates **1**. Another arm **208** is fixed to the shaft **206** and operatively engages a cam **209** on the shaft **138**.

As the cam **209** is driven to effect a movement of the bail members **200**, **201** to the right in Fig. 4, one or the other of the bail members engages a single lug **210** projecting from the upper edge of the slide. The bail member engaging the lug and the point in the cycle at which engagement takes place depends on the distance that the slide was permitted to move to the left during the sensing operation. The lugs **210** are formed on the slides at different points along their lengths for reasons that will be described shortly.

The printing elements **9** are mounted for longitudinal movement in U-shaped members **212**, and each element is slightly enlarged at its forward end so that the spring **184** can move it away from the platen only to the desired distance. Each member **212** is mounted upon a plate having projections **214** which receive pins **215** connecting the links of a continuous chain **216** cooperating with sprocket wheels **217** to effect movement of the printing elements past the ends of the hammers. At the ends of the pins **215** are rollers **219** which are movable within guide members **220** for supporting the printing elements in the same horizontal plane with the hammers. Referring to Fig. 5, it will be noted that each member **212** carries several printing elements **9**, and the members are so arranged on the chain **216** that a continuous row of printing elements are presented to the hammers.

In order to cause the chain **216** to circulate continuously, there is provided a bevel gear **222** on the shaft **173** meshing with a bevel gear **223** connected to a shaft **224** that is rotatably supported by plates **225** extending between the side plates **1**. Mounted upon the shaft **224** is a gear **226** meshing with an idler gear **227** which operates to drive a gear **228** on a shaft **229** carrying one of the sprocket wheels **217**. During operation of the machine, the chain **216** is circulated so as to move the printing elements past the hammers in the direction indicated in Fig. 5.

As mentioned above, the lugs **210** are formed on the upper edges of the slides at different points along their lengths. In Fig. 6 there is shown one slide of a pair at each printing position, and the lugs **210** are shown located upon the slides so that they are engaged by the bail members **200**, **201** for moving the slides to the right to effect operation of the hammers at the proper times. The other slide of each pair will have its lug **210** located at the same point on the slide, but they have not been shown in Fig. 6 because both slides are never in their latched positions at the same time and the slides of Fig. 6 are shown in such positions.

As indicated in Fig. 6, there are forty-five different characters that may be printed, and the combinations of perforations that effect a positioning of the slides to print the characters are shown adjacent thereto. It will be noted that the numeric characters are spaced from each other by three other characters. This is due to the fact that the slide may be stopped by the pawl **71** without any rotation of the latter or with rotation to any one of three positions. Stopping without rotation results in the printing of a numeric character, while rotation to each of its three positions results in the printing of an alphabetic or special character. The spacing between the lugs **210** on the adjacent slides must be equal to one fourth the distance between adjacent notches **70** in a slide. It will be noted that the spacing between 0 (zero) and 1 is equal to five units of slide movement or one and one fourth times the distance between adjacent notches **70**. This is due to the fact that a perforation at the No. 1 index point alone results in a stopping of a slide with its No. 1 notch **70** engaging the pawl **71** and with no rotation of the pawl, while a perforation at the zero point results in an engagement of the pawl with the zero notch **70** and a later rotation of the pawl to engage the upper step **92** on the zoning bar.

It will be appreciated that a slide will move its greatest distance to the left when being adjusted for the sensing of a 0 (zero) punch, and will move the least distance when it is adjusted to print an @, this being the symbol for a punching at the 8–4 index points. The latter punching results in a positioning of a slide to engage the stop pawl **71** with the S1 notch **70**.

The location of the bail member **200** relative to the lugs **210** on the slides is such that a movement of a slide in any one of the printing positions to effect a printing of the character opposite it in Fig. 6 will bring the lug to a position where it is engaged immediately by the bail **200** when the latter starts moving to the right. Movement of the bail to the right is timed so that it starts just as the printing elements **9**, bearing characters as indicated in Fig. 6, move into position for engagement by the hammers which are controlled by the slides opposite the printing elements. The bail members **200**, **201** move to the right at such a speed that they travel the distance between two adjacent lugs **210** in Fig. 6 during the time that it takes to move the printing elements from one printing position to the next adjacent printing position. Bail member **201** is spaced from bail member **200** a distance equal to the difference between the minimum and the maximum travel of the slide during adjustment plus a distance equal to the normal spacing between two adjacent lugs **210**.

With the arrangement described above, the slide having its lug **210** nearest the bail member **200** in Fig. 6 will move to the left on the sensing of perforations at the 8 and 4 index points, to a position where its lug is engaged immediately by the bail **200** when the latter moves to the right. This causes immediate operation of its hammer to engage the printing element bearing the character @. As mentioned above, a slide moves its shortest distance to the left on the sensing of perforations at the 8 and 4 index points. If a 0 (zero) is sensed in the position corresponding to this slide, then it is moved to the left to a point where its lug **210** is engaged by the bail **201** after movement of the latter a distance equal to the normal spacing between adjacent lugs. This is necessary because the printing element for 0 (zero) is the next one to follow that printing @, and a shifting of the printing elements through only one printing position is necessary before the slide is actuated to release its hammer. The sensing of perforations representing any other character will result in a positioning of the slide at points between those mentioned, and a longer travel of the bail member **201** is required before the slide is actuated. This permits the movement of the proper printing elements into position for engagement by the hammer which is controlled by the slide.

It will be appreciated that the slide having its lug **210** nearest the bail **200** will be actuated by the latter in only one of the positions at which it may be adjusted, and that is the position obtained on the sensing of perforations at the 8 and 4 index points. The slide having its lug farthest from the bail member **200** will be actuated by this member in every position of adjustment. Upon the sensing of a 0 (zero) in the card column corresponding to the latter slide, it will be positioned to the left at a point where its lug **210** is engaged immediately by the bail **200** on movement to the right. Since the other combinations of perforations result in a smaller travel of the slide, its lug **210** will always be at the right of the bail member **200** when adjusted for effecting printing.

The slots 16 and 42 in the slides 6 and 7 are curved upwardly at each end as shown in Fig. 4. Movement of the slides to the right by the bail members 200, 201 is sufficient to bring the curved portion at the left hand end of each slot to a position where it received the stud 14 and permits the slide to drop so as to release its lug from the bail member and to permit a hooked portion 233 at its right hand end to engage a latch 234. A flexible member 235 is engageable with each slide to cam it downwardly out of engagement with the bail members. The slide is held by the latch 234 in its right hand position until the bail 54 or 55 is moved again into engagement with the left hand end of the slide and guides its movement to the left under the action of the spring 51 or 52. The latch 234 is lowered to release the slide for movement to the left at the beginning of each cycle, as shown in Fig. 7.

For actuating the latch 234, there is provided, as shown in Fig. 3, a link 237 connected between each end of the latch and a bellcrank 238 loosely mounted on the shaft 206 and having an arm 239 cooperating with a cam 240 on the shaft 138. A spring 241 is connected between studs on the link 237 and the plate 3 for holding the arm 239 in engagement with the cam 240.

If there are no perforations in a card column, then the slide corresponding to the column moves to the left in Fig. 4 until its left hand end engages the bail 54 or 55. At this time, the upwardly curved portions at the right hand ends of the slots 16 or 42 receive to studs 14 and permit the slide to drop relative to the bails 11, 12 or 40, 41 so that the upward movement of the latter at the end of sensing will be insufficient to engage the slide with the locking link 151. The lug 210 on a slide in this position will also be out of the path of the bail members 200, 201 so that the slide is not picked up during printing and moved to the right. After the bail members 200, 201 have completed their travel to the right, the bail 54 or 55 moves to the right for engaging the left hand ends of the slides and guiding their motion again to the left. Any slides moving all the way to the left during sensing are returned to the right with the bail. During the first part of the return movement, the slide is cammed upwardly by the curved portions at the right hand ends of its slots. This upward motion would be sufficient to engage the slide with its link 151 if it were not for the fact that the bails 11, 12 or 40, 41 are lowered to a mid-position so as to counteract any upward camming. With the slide in its mid-position, it may be moved to the right without interfering with the stop pawl or causing the firing of a hammer. Soon after all of the slides have been moved to their right hand positions, the bails 11, 12 or 40, 41 move to their low positions so that the slides may be controlled by the pawls 71 and 116 on movement to the left.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A mechanism operable in response to the sensing of data on cards for printing such data on a record sheet comprising, in combination, card sensing means, means for feeding cards past said sensing means, an elongated slide, means for moving said slide longitudinally from a home position in synchronism with the feeding of cards past said sensing means, means operable in response to the sensing of data for stopping said slide, a hammer, type elements, means for circulating said type elements past said hammer for engagement by the latter, means for yieldingly urging said hammer toward said type elements, an interposer engageable with said hammer for holding it against movement by said yielding means, means including a spring urged member for disengaging said interposer from said hammer, a stop adapted to hold said member in a retracted position, means for moving said slide transversely after card sensing has been completed into frictional engagement with said member, and a bail engageable with said slide at a time dependent upon its position and operable to move the slide longitudinally toward its home position, said slide operating upon such movement to release said member from said stop for effecting operation of said hammer to engage one of said type elements.

2. A cyclically operable mechanism for printing data on a record sheet in response to the sensing of such data on cards comprising, in combination, card sensing means, means for feeding cards past said sensing means, a pair of elongated slides, means for moving each slide longitudinally in a first plane from home position during alternate cycles, said slide being moved in synchronism with the feeding of a card past said sensing means, means operable in response to the sensing of data for stopping said slide in a controlling position, a hammer, type elements, means for circulating said type elements past said hammer for engagement by the latter, means including a member adapted to be actuated by either one of said slides for effecting operation of said hammer to engage one of said type elements, means for moving said slide transversely from its control position after sensing has been completed into a second plane, said slide operatively engaging said member when in said second plane and adapted to actuate said member when moved in said second plane toward its home position, and a bail engageable with said slide at a time varying with the control position of the latter for moving it toward its home position, said bail operating to return one of said slides toward its home position while the other slide is moving from its home position.

3. The mechanism of claim 2 in which separate bail members are slidably received within slots in said slides for supporting the latter for movement toward and from said home position, said bail members operating to shift said slides in alternate cycles from movement in one plane to the other, curved portions of said slots adapted to receive said bail members when no data is sensed, said slot portions being shaped to support a slide in a position midway between said first and second plane when said bail member supporting said slide is in a position for supporting it normally in said second plane, said slide in its mid position being out of the path of said first mentioned bail.

4. A cyclically operable mechanism for printing data on a record sheet in response to the sensing of such data on cards comprising, in combination, card sensing means, means for feeding cards one at a time past said sensing means, an elongated slide, means for yieldingly urging said slide endwise from a home position, a bail engageable with one end of said slide and operative to permit movement of the latter in synchronism with the feeding of a card past said sensing means, means operable in response to the sensing of data on said card for stopping said slide in a controlling position, a hammer, type elements, means for circulating said type elements past said hammer, means including a shiftable member adapted to be actuated by said slide for effecting engagement of said hammer with one of said type elements, means for moving said slide transversely from its controlling position into operative engagement with said member, and a bail engageable with said slide at a time dependent upon its control position for moving it toward home position to shift said member, whereby actuation of said member is effected.

5. The mechanism of claim 4 in which said means for stopping said slide comprises a stop pawl engageable with notches in said slide, a latch for holding said stop pawl normally in a retracted position, and means operative upon the sensing of data on a card for disengaging said latch from said stop pawl.

6. The mechanism of claim 4 in which said means for stopping said slide comprises a stop pawl engageable with notches in said slide and mounted for pivoted movement, a bail for holding said pawl normally against pivotal movement, a latch for holding said pawl out of engagement with said notches, a member having stepped portions engageable by said pawl for limiting its pivotal movement to different positions, means for moving said stepped member so as to present different ones of said stepped portions to said pawl in synchronism with the sensing of predetermined points on said card, and means operative upon the sensing of data at other points on said card for disengaging said latch from said stop pawl, said stop pawl bail operating after the sensing of a card has been completed for releasing said stop pawl for pivotal movement.

7. A mechanism for printing data on a record sheet in response to the sensing of such data on a card compris-

ing, in combination, card sensing means, means for feeding said card past said sensing means, a control member, means for moving said control member from a home position in synchronism with the feeding of said card past said sensing means, a stop pawl engageable with said member for arresting its movement from home position, means operative upon the sensing of data at predetermined points on said card for engaging said stop pawl with said member, a second pawl engageable with said member when the motion of the latter has been arrested by said stop pawl at predetermined points, means for moving said second pawl during the feeding of a portion of said card past said sensing means, in a direction opposite to the movement of said control member, means operative upon the sensing of data in said card portion for engaging said second pawl with said control member, said second pawl operating to shift said control member from the position in which it was arrested by said stop pawl, a hammer, type elements, means for circulating said type elements past said hammer, means including a shiftable element adapted to be actuated by said control member for effecting engagement of said hammer with one of said type elements, means for moving said control member from the position in which it was adjusted by said stop pawl and said second pawl into operative engagement with said element, and a bail engageable with said control member at a time dependent upon its adjusted position for moving it toward its home position to shift said element, whereby actuation of said element is effected.

8. The mechanism of claim 7 in which said second pawl is disengaged from said control member after the latter has been shifted so that it is held in its shifted position only by said stop pawl, and means operating in response to the sensing of data at other predetermined points on said card for effecting a shifting of said stop pawl and said member to the position at which said member is engaged by said bail.

9. A mechanism for printing data on a record sheet in response to the sensing of designations at index points on a card comprising, in combination, means cooperating with said index points in succession and adapted to sense a designation, a control member, means for moving said control member from a home position in synchronism with the cooperation of said sensing means with said index points, means operating in response to the sensing of a designation at any one of a predetermined group of said index points for arresting the motion of said control member, means operable in response to the sensing of a designation at certain ones of said predetermined group of index points for engaging said control member, if the latter has been arrested in one of predetermined positions by said arresting means, and shifting it to another position, means operating in response to the sensing of a designation at any one of a second group of index points for shifting said control member to still another position, a hammer, type elements, means for circulating said type elements past said hammer, means including a shiftable element adapted to be actuated by said control member for effecting engagement of said hammer with one of said type elements, means for moving said control member transversely after card sensing has been completed into operative engagement with said shiftable element, and means engageable with said control member at a time dependent upon its position after said sensing means has cooperated with all of said index points for moving said control member toward its home position to shift said element, whereby actuation of said element is effected.

10. In a mechanism for printing data on a record sheet in response to the sensing of such data on a card comprising, in combination, card sensing means, a control member, means for moving said control member from a home position in synchronism with the feeding of said card past said sensing means, means for intercepting said control member to arrest its movement from home position, means operative upon sensing of data at predetermined points on said card for engaging said intercepting means with said control member, a retracting means cooperating with said control member, means operable for moving said retracting means into engagement with said control member in response to the sensing of data in said card at certain ones of said predetermined points, said retracting means operating before printing is effected to shift said control member from the position in which it was arrested by said intercepting means, type elements, means for moving said type elements to a printing position, and means under control of said control member for causing a selected type element to print on the record which has been read.

11. A cyclically operable mechanism for printing data on a record sheet, in response to the sensing of such data on cards comprising, in combination, card sensing means, means for feeding cards past said sensing means, a pair of elongated slides, means for moving each slide longitudinally in a first plane from home position during alternate cycles, said slide being moved in synchronism with the feeding of a card past said sensing means, means operable in response to the sensing of data for stopping said slide in a controlling position, a hammer, type elements, means for circulating said type elements past said hammer for engagement by the latter, means for yieldingly urging said hammer toward said type elements, an interposer engageable with said hammer for holding it against movement by said yielding means, means including a spring urged member for disengaging said interposer from said hammer, said member being adapted for actuation by either one of said slides, a stop adapted to hold said member in a retracted position, means for moving said slide transversely from its control position after sensing has been completed into a second plane, said slide operatively engaging said member when in said second plane, and a bail engageable with said slide at a time varying with the control position of the latter for moving it toward its home position, said slide operating upon such movement to release said member from said stop for effecting operation of said hammer to engage one of said type elements, said bail operating to return one of said slides toward its home position while the other slide is moving from its home position.

12. A mechanism for printing data on a record sheet in response to the sensing of designations at index points on a card comprising, in combination, means cooperating with said index points in succession and adapted to sense a designation, a control member, means for moving said control member from a home position in synchronism with the cooperation of said sensing means with said index points, means operating in response to the sensing of a designation at any one of a predetermined group of said index points for arresting the motion of said control member, means operable in response to the sensing of a designation at certain ones of said predetermined group of index points for engaging said control member, if the latter has been arrested in one of predetermined positions by said arresting means, and shifting it to another position, means operating in response to the sensing of a designation at any one of a second group of index points for shifting said control member to still another position, a hammer, type elements, means for circulating said type elements past said hammer for engagement by the latter, means for yieldingly urging said hammer toward said type elements, an interposer engageable with said hammer for holding it against movement by said yielding means, means including a spring urged member for disengaging said interposer from said hammer, a stop adapted to hold said spring urged member in a retracted position, means for moving said control member transversely after card sensing has been completed into frictional engagement with said spring urged member, and means engageable with said control member at a time dependent upon its position after said sensing means has cooperated with all of said index points for moving said control member toward its home position, said control member operating upon such movement to release said spring urged member from said stop for effecting operation of said hammer to engage one of said type elements.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,608,837	Bryce	Nov. 30, 1926
1,882,766	Bryce	Oct. 18, 1932
1,997,167	Bryce	Apr. 9, 1935
2,013,533	Buhler	Sept. 3, 1935
2,030,427	Buhler	Feb. 11, 1936
2,053,063	Bryce	Sept. 1, 1936
2,101,444	Miles	Dec. 11, 1937
2,291,970	Neumann-Lezius	Aug. 4, 1942
2,398,036	Paris	Apr. 9, 1946