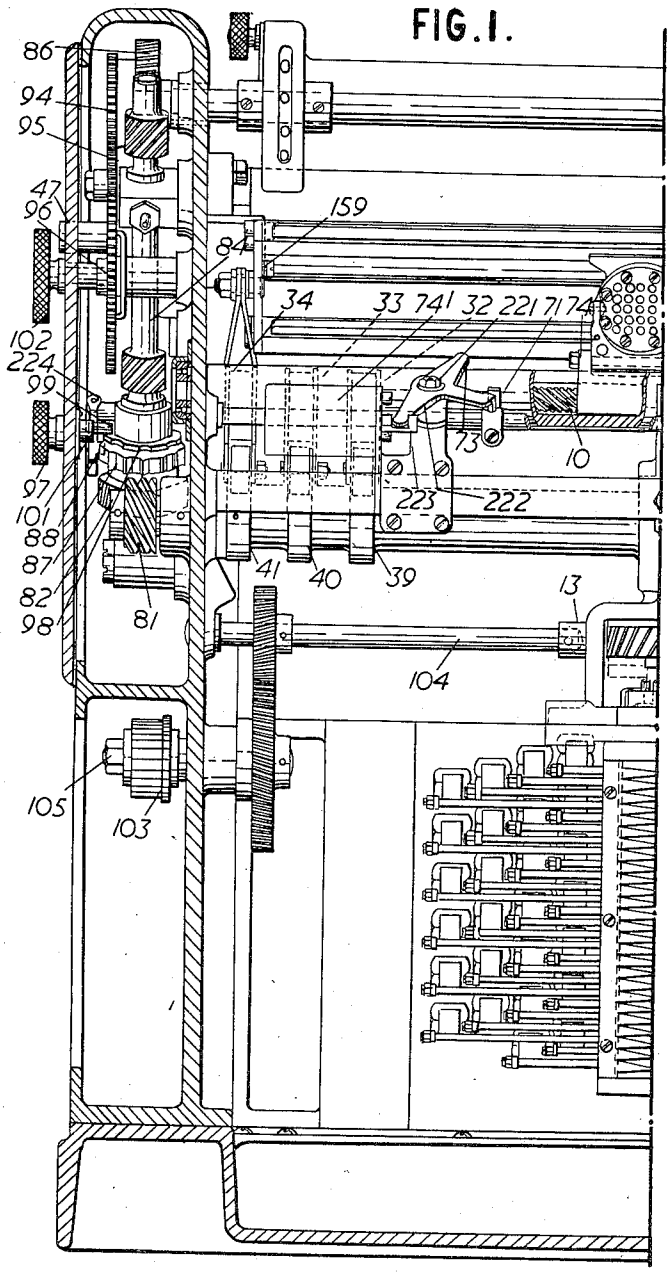
March 13, 1962 J. HANDLEY 3,025,348

HIGH-SPEED PRINTING MACHINES

Filed May 14, 1957 8 Sheets-Sheet 1

FIG. 1.



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HIGH-SPEED PRINTING MACHINES

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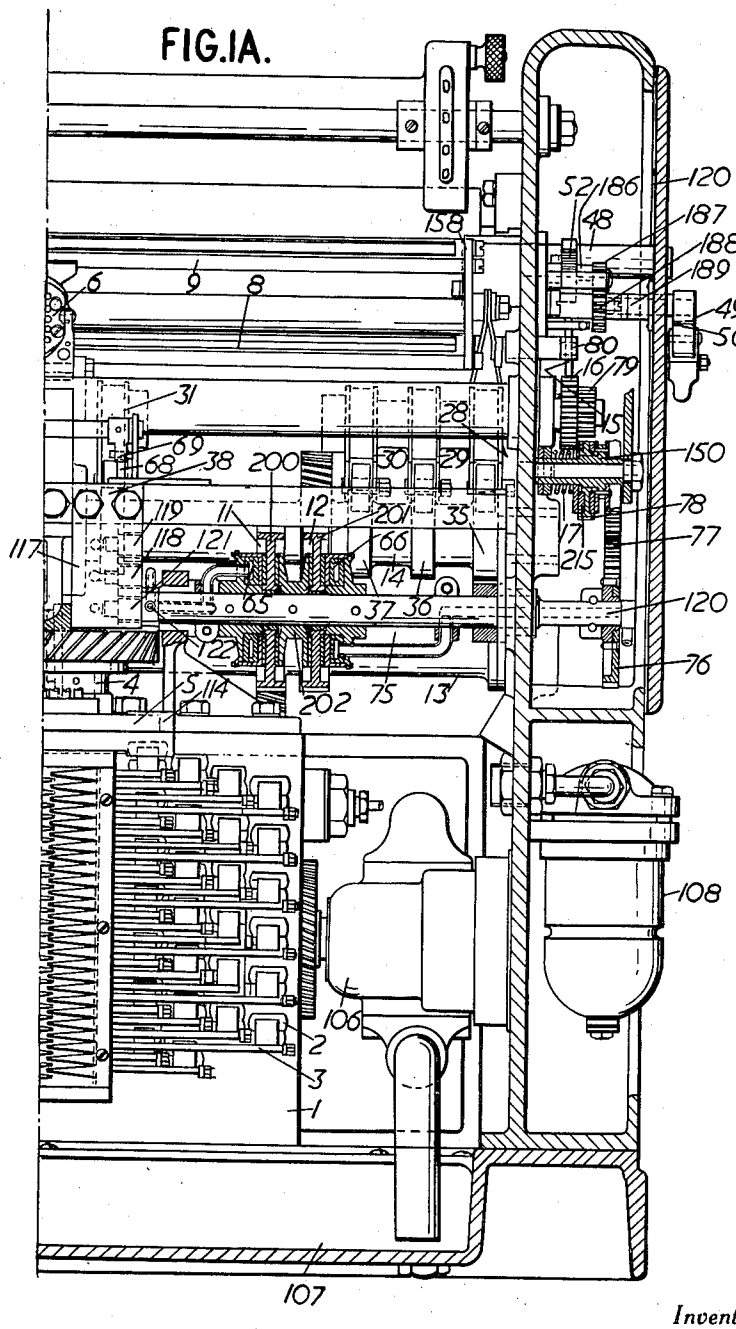
FIG.IA.



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HIGH-SPEED PRINTING MACHINES

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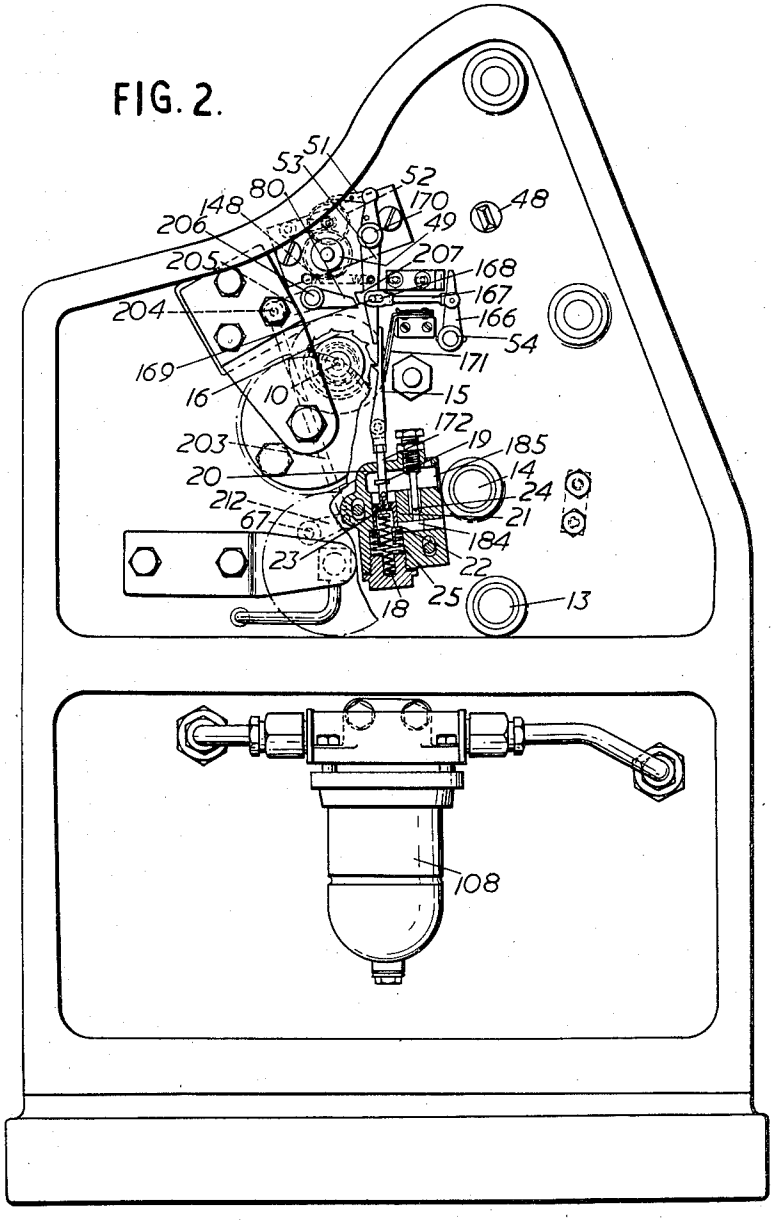
FIG. 2.



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HIGH-SPEED PRINTING MACHINES

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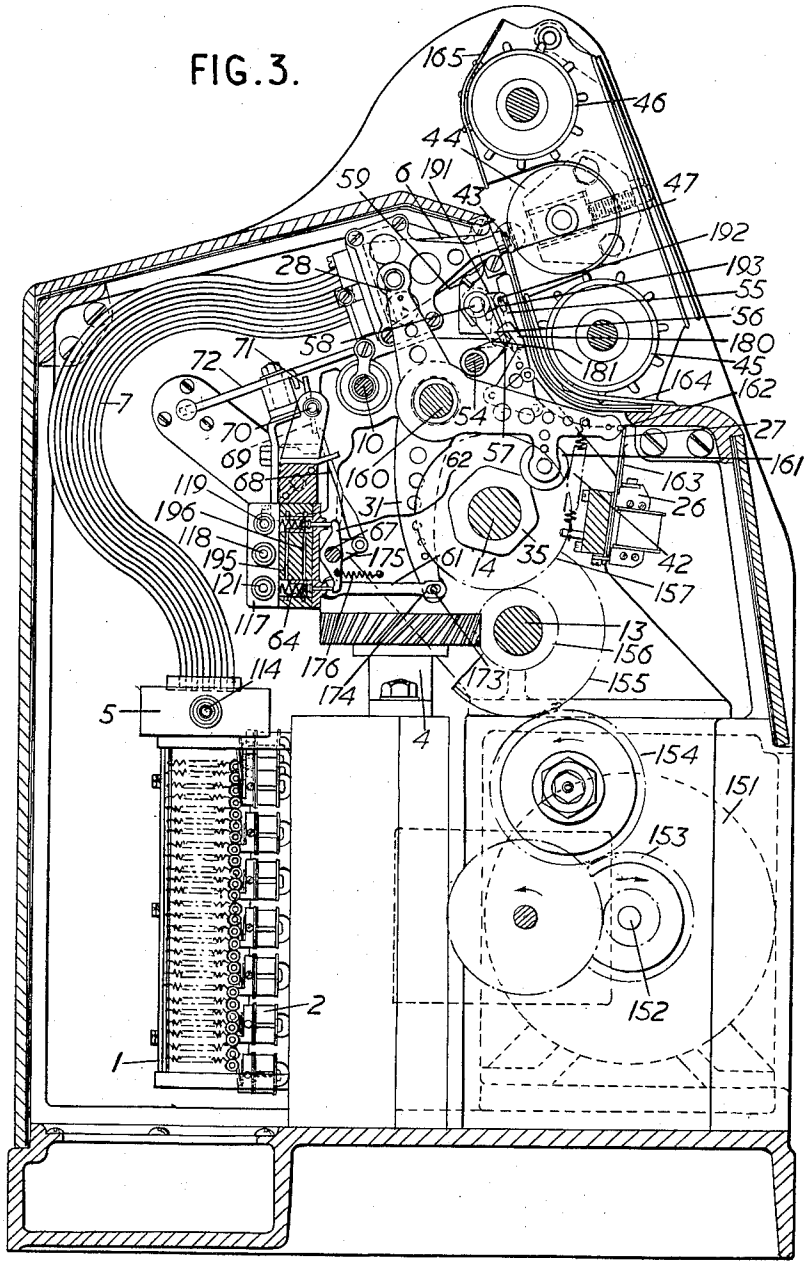
FIG. 3.



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HIGH-SPEED PRINTING MACHINES

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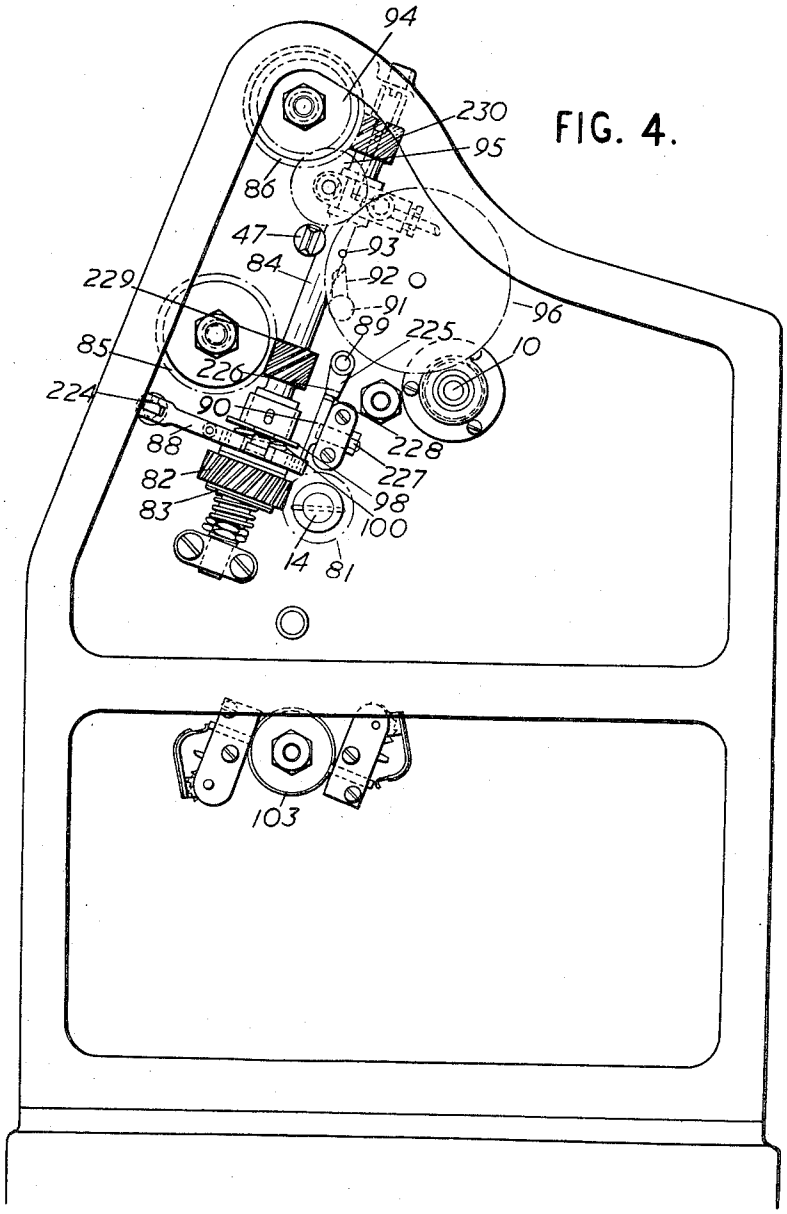

FIG. 4.

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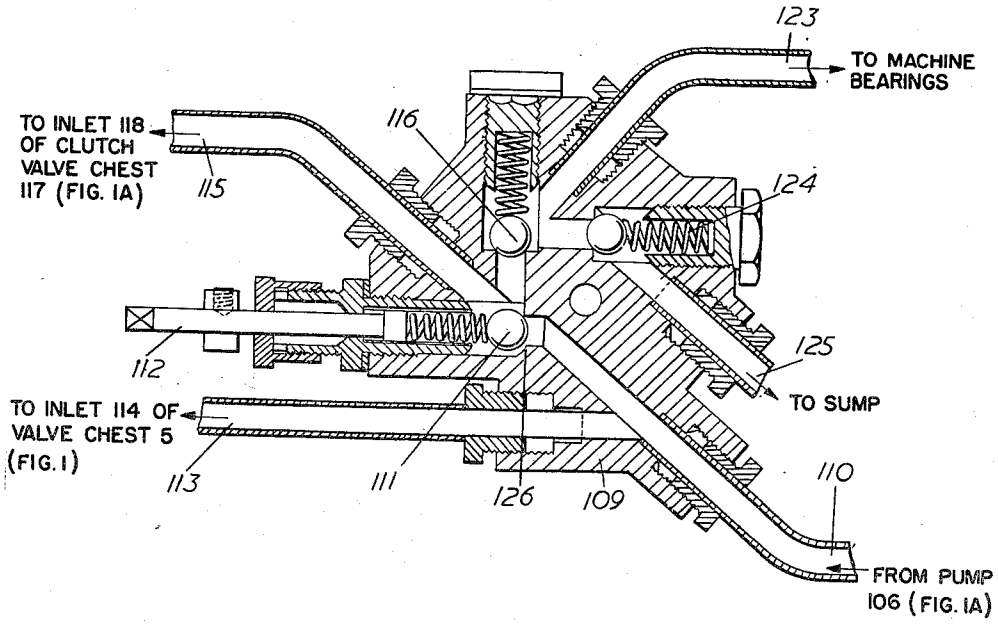
FIG. 5.



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HIGH-SPEED PRINTING MACHINES

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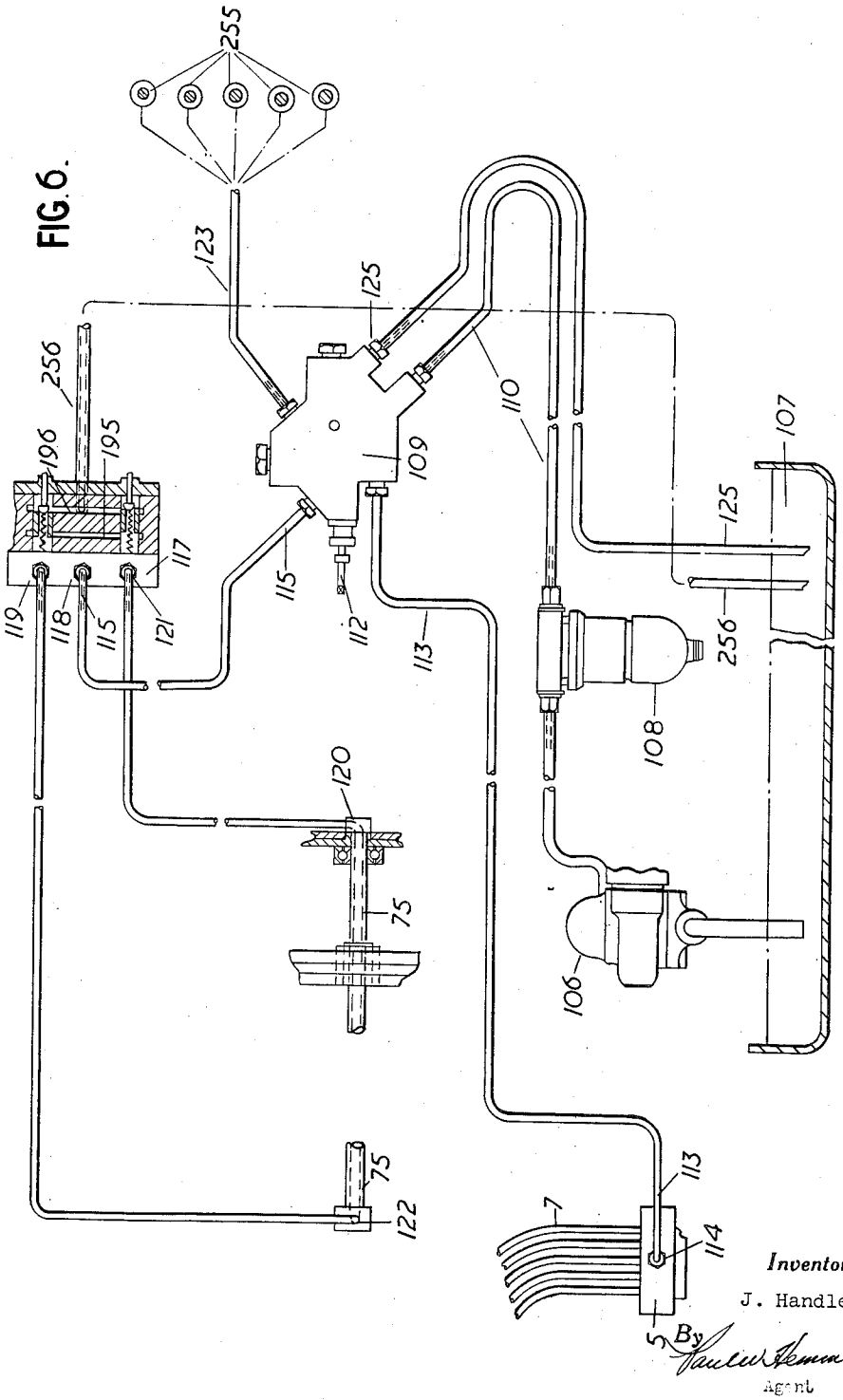
FIG. 6.



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HIGH-SPEED PRINTING MACHINES

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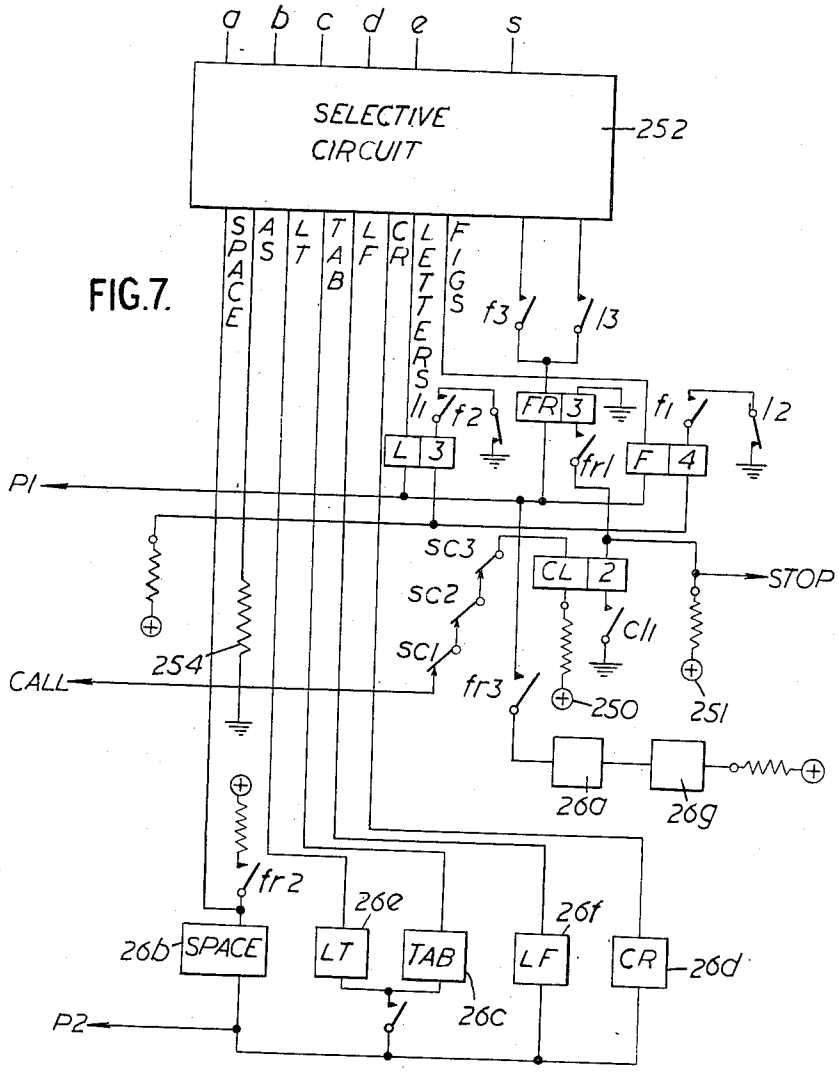
FIG.7.



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United States Patent Office 3,025,348 Patented Mar. 13, 1962

3,025,348

HIGH-SPEED PRINTING MACHINES

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Filed May 14, 1957, Ser. No. 659,069
Claims priority, application Great Britain May 18, 1956
12 Claims. (Cl. 178—25)

This invention relates to type printing telegraph apparatus.

It is an object of the present invention to reduce the time taken in apparatus of this kind to effect the letter feed operation.

According to the present invention there is provided type printing telegraph apparatus comprising a type head, a lead screw rotation of which causes said type head to be traversed across a platen, means for driving said lead screw through a friction clutch, a ratchet mounted on said lead screw, a pawl normally engaging said ratchet, and means for withdrawing said pawl from engagement with said ratchet to effect a letter feed operation.

In order to reduce the shock occurring when the pawl re-engages the ratchet, a further feature of the invention provides type printing telegraph apparatus comprising a shaft, means for driving said shaft through a friction clutch, a pawl normally engaging with a ratchet mounted on said shaft and preventing rotation thereof, means for withdrawing said pawl from engagement with said ratchet to permit rotation of said shaft, and spring means for advancing said pawl to meet a succeeding tooth of said ratchet.

Hydraulic deceleration of the ratchet and pawl by a plunger and dashpot may be provided. The rate of acceleration of the ratchet wheel may be controlled by increasing or decreasing the clutch pressure, and the rate of deceleration may be controlled by varying the opening of a leak valve in the dashpot. By this means approximately uniform acceleration and deceleration is obtained on the step by step movements of the type head for letter feed.

The invention will be described as applied to type printing telegraph apparatus of the type in which impression-forming sections are moved in the type head to set up the desired character.

One embodiment of the invention will now be described in detail with reference to the accompanying drawings, in which:

FIGS. 1 and 1A together form a composite figure constituting a front view of a machine according to the present invention with certain parts removed or shown in section in order that its working may be more easily understood,

FIG. 2 is a view of the machine of FIG. 1 and FIG. 1A from the right-hand side of that composite figure, again with certain parts sectioned for clarity,

FIG. 3 is another view of the machine of FIG. 1 and FIG. 1A taken from the right-hand side, with the side plates removed to show the function-controlling rockers and the valve chest shown in part-section,

FIG. 4 is a view of the machine of FIG. 1 and FIG. 1A from the left-hand side of that composite figure,

FIG. 5 shows in section a hydraulic pressure control unit for use in the machine of FIG. 1 and FIG. 1A,

FIG. 6 shows the arrangement of the hydraulic system as a whole, and

FIG. 7 shows a suitable circuit arrangement for operating the machine of FIG. 1.

Referring first to FIGS. 1, 1A and 3 of the drawings, a selecting box 1 contains fifty-two selector relays 2, there being a selector relay 2 for each character (i.e. letter, figure or symbol) that it may be desired to print. Operation of a particular selector relay 2 causes the armature 3

of that relay 2 to select the control plate (not shown) associated therewith for movement by a common striker (not shown). These operations are well known, having been described in my copending application Serial No. 554,009, filed December 19, 1955. A variation exists, however, in that the striker is operated in the present disclosure from cam shaft 4 while it was operated by four electromagnets in the aforementioned application. The desired combination of selector bars (not shown) therefore moves upwards (the direction being taken with reference to FIGS. 1 and 1A) and opens a corresponding combination of valves in valve chest 5. These valves may be of any suitable type but are preferably similar to valves 63 and 64 shown in FIG. 3. The opening of a combination of valves in valve chest 5 allows fluid under pressure to pass from the hydraulic system (FIG. 6) through the open valves into corresponding flexible tubes 7. The fluid under pressure then acts on pistons associated with the desired combination of punches 43 in punch head 6 to thrust these punches 43 forward to their printing positions against the action of their individual springs not shown. The punches 43 are arranged as shown in my aforementioned co-pending application. The selection and operation of the punches 43 form no part of the present invention.

The punch head 6 is arranged to traverse on guide rails 8 and 9, the traversing movement being effected by rotation of lead screw 10. Lead screw 10 has mounted thereon a ratchet wheel 16 (FIGS. 1, 1A and 2) and a gear 79. Ratchet wheel 16 is normally engaged by pawl 15 which prevents rotation of lead screw 10 in a clockwise direction even though a drive in this direction (as seen in FIG. 2) may be applied to the lead screw 10 through gear 79.

Referring to FIG. 3, a drive from motor 151 is supplied through its shaft 152, gears 153, 154 and 155. Gear 155 is mounted on intermediate shaft 13 which is therefore driven by motor 151. Also mounted on intermediate shaft 13 is gear 156 which engages with gear 157 mounted on cam shaft 14. Cam shaft 14 is therefore driven in the opposite direction to intermediate shaft 13 and the ratio of gears 156 and 157 is such that the speed of rotation of cam shaft 14 is half that of intermediate shaft 13.

Two hydraulically-operated friction clutches 11 and 12 are provided to drive a shaft 75 from either intermediate shaft 13 or cam shaft 14 respectively. The clutches 11 and 12 consist of respective moving parts 200 and 201 which are loosely mounted on shaft 75 and driven respectively from intermediate shaft 13 and cam shaft 14. Fixedly mounted on shaft 75 is unit 202. Enclosed within unit 202 are rubber capsules 65 and 66 which are expandible under pressure to cause either moving part 200 or moving part 201 to be forced into pressure engagement with unit 202, so that unit 202 and shaft 75 are driven either from intermediate shaft 13 or cam shaft 14. In the normal running condition, clutch 12 is engaged and shaft 75 driven therefrom. The control of clutches 11 and 12 and the supply thereto of oil under pressure will be described later.

Mounted on shaft 75 is a gear 76 which engages with a gear 77 (shown partly cut away in FIG. 1A) mounted on a shaft 150. Another gear 78 is arranged to be driven by shaft 150 through a friction clutch 215. The pressure of engagement of friction clutch 215 coupling gear 78 to shaft 150 may be adjusted by altering the force exerted through spring 17. Gear 78 engages with the gear 79 mounted on lead screw 10. When clutch 11 is engaged, lead screw 10 is driven anticlockwise (as seen in FIG. 2) and the punch head 6 is traversed from right to left (as seen in FIG. 1). When clutch 12 is engaged (the normal running condition of the apparatus), clock-

wise rotation of lead screw **10** is normally prevented by pawl **15** engaging ratchet wheel **16**, with the result that gears **79** and **78** are held still and the friction clutch **215**, which attempts to transmit the drive from the rotating shaft **150** to gear **78**, slips.

The guide rails **8** and **9** (FIGS. 1, 1A and 3) are mounted on brackets **158** and **159** which are carried by the upper arms of respective rockers **28** and **34**. These rockers **28** and **34** are two of a set of seven rockers **28** to **34** (see FIG. 1A) each of which is pivoted on a shaft **160** (see FIG. 3), each of which has a similarly-shaped horizontal arm and each of which carries a roller **161**. A series of springs **42** continually urges the rockers **28** to **34** in a clockwise direction (as seen in FIG. 3) about shaft **160**, thereby tending to bring the rollers **161** into contact with the surfaces of respective cams **35** to **41**. Three of these cams, namely cams **35–37**, are shown in FIG. 1A, and the remaining cams **38–41** are shown in FIG. 1. The rockers **28** to **34** carry projections **162** which are normally in contact with respective armatures **27** of seven similar relays **26**, there being one such relay **26** to control each of the rockers **28** to **34**. The relays **26** will be referred to individually as relays **26*a*** to **26*g***, the relay **26** shown in FIG. 3, being in fact relay **26*a*** which controls rocker **28**. The cams **35** to **41** are all similarly shaped to cam **35** shown in FIG. 3, although some are angularly displaced relative to cam **35**. All the cams **35** to **41** have a contour which gives a smaller acceleration in the vicinity of the humps than over the remainder of the cam surface. The purpose of this is to reduce the shock of the projections **162** engaging their respective relay armatures **27**.

When a character is about to be printed, the relays **26*a*** and **26*g*** (FIG. 7) associated respectively with rockers **28** and **34** are energised. This energisation is arranged to take place at a point in the rotation of cams **35** and **41** at which humps carried by these cams engage rollers **161** on rockers **28** and **34** to lift projections **162** on these rockers clear of the corresponding relay armatures **27**. Energisation of these two relays then moves the respective armatures **27** to the right (as seen in FIG. 3) against the action of their respective springs **163** so that they are clear of projections **162**. Rollers **161** on these rockers **28** and **34** are then free to move under the action of their respective springs **42** to follow the contours of cams **35** and **41** which are similarly shaped and which allow a clockwise movement of rockers **28** and **34** about the shaft **160**. This clockwise movement of rockers **28** and **34** brings the punch head **6** close to the platen **44** and the punch head **6** is maintained in this position during printing. The two relays **26*a*** and **26*g*** are de-energized and their respective armatures **27** are pressed by springs **163** against projections **162** on rockers **28** and **34** until cams **35** and **41** lift these rockers after printing to allow re-engagement of projections **162** with armatures **27**.

The paper (not shown) on which printing is to take place passes over sprocket wheel **45** between that wheel and guide **164**, between punch head **6** and platen **44**, and over sprocket wheel **46** between that wheel and guide **165**. There may be more than one layer of paper. A printing ribbon (not shown) passes through guides **47** (FIGS. 1, 3, 4) and **48** (FIGS. 1A, 2) and between rollers **49** and **50**, thus extending over the width of the paper on the platen **44**. If more than one sheet of paper is being used, a carbon ribbon is provided between each pair of adjacent layers of paper, this carbon ribbon being supported in a similar way to the printing ribbon. The manner in which the paper is fed and the ribbons are fed will be described later.

The operation of the apparatus to print information stored in a computer will now be described.

Commutator **103** (FIGS. 1 and 4) sends out, through brushes, a call signal of very short duration (e.g. the call signal can be of 0.5 millisecond duration and sent out at the rate of 100 per second). This call signal may, for example, be derived by completing a circuit from potential **250** (FIG. 7) through a call relay CL and contacts *sc*3, *sc*2 and *sc*1. In addition to sending the call signal to the computer, this conditions the printer for receiving the computer's signals by energising the call relay CL, which then locks up through its other winding as its contact *cl*1 completes a circuit from potential **251**. The other contact *cl*2 of the call relay CL is not shown, but acts to condition a selective circuit **252** for operation when signals are received over lines *a*, *b*, *c*, *d*, *e*, and *s*. The signals applied to these lines may be just positive potentials. The selective circuit **252** may be any suitable circuit for selecting a particular relay **2** for operation. For example, the tree circuit of FIG. 9 of my aforementioned co-pending application No. 554,009 filed December 9, 1955, could be used, or alternatively this could be replaced by a rectifier matrix or an electronic circuit. If there is a signal representing a character to be printed ready to come in, then it comes in since either relay F or relay L will be operated according to whether a figure shift signal or a letter shift signal was the last to be received and consequently either contact *f*3 or *l*3 is closed, when an earth is effected at P1 by a cam (not shown), and operates the particular selector relay **2** for that character and also a function relay FR (FIG. 7). The function relay FR, through its contacts *fr*3 operates the particular relay **26*a*** and **26*g*** which control rockers **28** and **34** to move the punch head **6** forward to the printing position. This movement of punch head **6** to and from the printing position for each printing operation is necessary because the movement of the actual punches **43** in the punch head **6** is so small as to allow too little clearance between the punch head **6** and the paper for the letter feed and paper feed operations.

The time taken to operate the punches **43** hydraulically after the energisation of a selector relay **2** is such that they are not thrust out to print until the forward movement of the punch head **6** to the printing position is completed. The function relay FR also operates the relay **26*b*** which controls the letter feed operation through rocker **29**, by causing the punch head **6** to be traversed. The relay **26*b*** controlling the punch head traverse is energised when P2 is grounded, the contact *Fr*2 being already closed at approximately the instant when printing takes place. The time taken for the punch head **6** to start to move as a consequence of this energisation is sufficient to allow the punches **43** to be withdrawn into the punch head **6** and the punch head **6** itself to be moved back to its normal rest position. The movement of the punch head **6** from its rest position is of the order of $\frac{1}{16}$ in. and the movement of the punches **43** of the order of $\frac{1}{32}$ in.

The letter feed or punch head traverse relay **26*b*** is energised at an instant when the rocker **29** is lifted clear of the armature **27** of that relay **26** by one of the humps on cam **36**. Cam **36** is shaped in a similar manner to cam **35**, but is angularly displaced relative to cam **35**. Rocker **29** is then free to follow the contour of cam **36**.

The rocker **29** has mounted thereon a hook-shaped member **180** which engages with a member **181** mounted on a shaft **54**. As rocker **29** makes a small downward movement (as seen in FIG. 3) under control of cam **36** and spring **42**, so shaft **54** is caused to make a clockwise movement by members **180** and **181**.

This clockwise pivotal movement of shaft **54** (as seen in FIG. 2) causes member **166** mounted thereon to draw link **167** to the right. Link **167** carries an aperture **168** in which a pin **169** mounted on rocker **53** engages. Rocker **53** is therefore turned anticlockwise (as seen in FIG. 2) about its pivot **170** and pushes pawl **15** out of engagement with ratchet wheel **16** against the action of spring member **171**.

The release of ratchet wheel **16** from pawl **15** allows gear **78** to be driven from shaft **150**, gear **79** being driven therefrom and lead screw **10** and ratchet wheel **16**

being driven in a clockwise direction (as seen in FIG. 2). The pivotal movement of shaft 54 for letter feed is only of very short duration under control of its cam 36, and spring member 171 is then free to return pawl 15 into the path of the succeeding tooth on ratchet wheel 16, spring 148 at the same time restoring rocker 53, link 167, member 166 and shaft 54 to their rest positions shown in FIG. 2.

Pawl 15 is mounted on a rod 172 which passes through the top of an oil dashpot 20 and is itself mounted on a plunger 21 which is continually urged upwards (as seen in FIG. 2) by spring 18. When pawl 15 is moved out of engagement with ratchet wheel 16 by rocker 53 as described above, spring 18 moves plunger 21, rod 172, and pawl 15 upwards (as seen in FIG. 2) until collar 19 on rod 172 strikes the top of the dashpot 20. The movement thus permitted to pawl 15 is equal to about half the distance between successive teeth on ratchet wheel 16. Thus the succeeding tooth on ratchet wheel 16 will meet pawl 15 on a letter feed operation when the punch head 6 has been traversed approximately half the distance necessary for the letter feed operation.

The impact of the next tooth of ratchet wheel 16 on pawl 15 thrusts pawl 15, rod 172, and plunger 21 downwards against the action of spring 18 until the plunger 21 rests on the collar 22.

In the top surface of plunger 21 is a plate valve 23 which is an ordinary non-return valve arranged to open when the plunger 21 is being moved upwards and to close when the plunger 21 is being moved downwards. The upward movement of plunger 21, rod 172 and pawl 15 under the action of spring 18 is therefore free, while the downward movement after the re-engagement of pawl 15 by the next tooth of ratchet wheel 16 is damped by the oil inside the plunger 21 being forced along passage 184 past leak valve 24 and back into the main oil chamber 185 of the dashpot 20.

In the time between the release of one tooth of ratchet wheel 16 from pawl 15 and the engagement of the next tooth on wheel 16 with pawl 15, the ratchet wheel 16 and lead screw 10 are accelerated up to only half the speed of rotation they would reach if driven unimpeded from cam shaft 14 by clutch 12. The leak valve 24 is adjusted so that, when the pawl 15 is re-engaged in ratchet wheel 16 at this speed, the plunger 21 is brought to rest as it reaches collar 22. The punch head 6 is thus brought to rest without jar.

The anticlockwise movement of rocker 53 (as seen in FIG. 2) about its pivot 170 also causes pawl 51 which is in engagement with a ratchet wheel 52 (FIGS. 1A and 2) mounted on shaft 186 to be turned anticlockwise (as seen in FIG. 2). Also mounted on shaft 186 is a gear wheel 187 (FIG. 1A) which engages with another gear wheel 188 mounted on a shaft 189. Shaft 189 is the shaft on which roller 49 is mounted. The rotation of ratchet wheel 51 therefore causes roller 49 to be rotated, and as roller 49 is in pressure contact with freely-mounted roller 50, this roller 50 is also rotated and the ribbon (not shown), which passes between rollers 49 and 50 is fed. When rocker 53 makes its clockwise movement about pivot 170 to return to its rest position, pawl 51 is drawn over the teeth of ratchet wheel 52.

The ribbon used is conveniently of an expendable type. It is then fed by an amount equal to a small fraction of the traverse of the punch head 6 for letter feed, so that the punch head 6 will pass over each portion of the ribbon a number of times (e.g. 10) before that portion is removed from the surface of the paper.

The relay 26*c* which controls rocker 30 is the tabulating relay. This relay, similarly to the others, is energised at an instant when the associated rocker 30 is lifted clear of the armature 27 of the relay 26 by cam 37, which is shaped similarly to the other cams. Rocker 30 is then free to follow the contour of cam 37.

Fastened to rocker 30 and also to a member 191 (FIG. 3), through a pin 192 on member 191, is a link 55. The pin 192 runs in a slot 193 in link 55. Member 191 is mounted on a shaft 58 on which there is also mounted a camming member 56. As link 55 is drawn downwards by rocker 30, member 191 is moved thereby and itself causes shaft 58 to turn slightly clockwise (as seen in FIG. 3). Camming member 56 is therefore moved to the left (as seen in FIG. 3) and acts upon a camming arm 57 with which it is in contact. Camming arm 57 is mounted on shaft 54, and the movement of camming member 56 just described causes camming arm 57 to move downwards and give a clockwise turn to shaft 54 (as seen in FIG. 3) similar to that imparted from rocker 29. Ratchet wheel 16 is therefore released, lead screw 10 is rotated and the punch head 6 is traversed.

Camming arm 57 is so shaped that it retains camming member 56 in its operated (i.e. downward) position, even though rocker 30 and link 55 are returned to the unoperated position by cam 37 and retained there by the armature 27 of tabulating relay 26*c* which is not then energised. Pin 192 runs to the lower end of slot 193 during these returning movements. Therefore shaft 54 remains in its turned position and pawl 15 is retained out of engagement with ratchet wheel 16.

Shaft 58 is slotted to receive fingers 59, one of which is seen in FIG. 3. These fingers 59 may be moved as required to establish tabulating stops, and they have slanting upper edges.

After the energisation of the tabulating relay 26, punch head 6 is traversed until it reaches a position in its traverse in which there is a finger 59. When it makes contact with a finger 59, punch head 6 impinges on the slanting upper edge of the finger 59 and causes the finger 59 to turn shaft 58 anticlockwise (as seen in FIG. 3), thereby moving the finger 59 out of the path of the punch head 6 and releasing camming member 56 from the position in which it was held by camming arm 57. Shaft 54 is then turned back anticlockwise by spring member 171 and pawl 15 again enters the path of the teeth on ratchet wheel 16.

During a tabulating operation such as that just described, the lead screw 10 and ratchet wheel 16 reach the normal running speed transmitted from cam shaft 14 through clutch 12. When a tooth of ratchet wheel 16 is engaged by pawl 15 at this speed, the ratchet wheel 16 is not brought to rest by the time the plunger 21 reaches collar 22 in the dashpot 20. However, collar 22 is supported by a heavy spring 25, and the collar 22 is therefore, in this case, moved downwards, compressing the spring 25 until the ratchet wheel 16 is brought to rest. The spring 25 then expands again, returning collar 22 and the other movable members of the dashpot 20 to their normal rest position shown in FIG. 2.

The relay 26*d* which controls rocker 31 is the punch head return relay. The energisation of punch head return relay 26*d* also occurs at a point in the rotation of cam 38 at which a hump carried by this cam 38 lifts the projection 162 on rocker 31 clear of the armature 27 of the punch head return relay 26*d*. Rocker 31 is then free to follow the contour of cam 38, which is similar to cam 35.

In addition to the arm carrying the roller 161, rocker 31 has an arm extending downwards from shaft 160, as shown in FIG. 3. This arm carries a pin 173 which engages in a slot 174 on a link 61. Link 61 is connected to rocker 62 mounted on a shaft 67 which is free to turn about its axis. Therefore, as the rocker 31 turns clockwise (as seen in FIG. 3) about shaft 160 when it follows the contour of cam 38, so the link 61 is moved to the left (as seen in FIG. 3) and rocker 62 causes shaft 67 to be rocked in a clockwise direction against the action of spring 176. This movement of rocker 62 causes the piston of valve 64 to be moved to the left and that of valve 63 to be moved to the right. Oil under pressure is supplied from an hydraulic con-

trol system (which will be described later) to an hydraulic clutch valve chest 117 (FIGS. 1A and 3). The inlet to valve chest 117 is at 118 and the oil under pressure then passes to pipe 195 and either to outlet 119 or outlet 121 depending on the positions of the pistons of valves 63 and 64. In the normal running condition of the apparatus, valve 64 is open and valve 63 closed (as shown in FIG. 3). Oil under pressure is then supplied from outlet 121 of valve chest 117 to the end 120 of shaft 75 (FIG. 1A) to feed capsule 66 of clutch 12.

The movement of link 61 to the left, as described, causes valve 64 to close and valve 63 to open. Oil under pressure is then supplied through outlet 119 of valve chest 117 to the end 122 of shaft 75 to feed capsule 65 of clutch 11. Clutch 11 is therefore engaged and clutch 12 disengaged, the oil expelled from capsule 66 of clutch 12 being removed down discharge pipes 196 (FIG. 3) and 256 (FIG. 6) to a sump 107 (FIGS. 1A and 6). Clutch 11 drives shaft 75 at twice the speed reached by a drive from clutch 12, and lead screw 10 rotates anticlockwise (as seen in FIG. 2) to return the punch head 6 from right to left (as seen in FIG. 1 and FIG. 1A).

Also fixed to shaft 67 (FIG. 3) is an arm 175 having a link 68 pivoted at the end thereof. As shaft 67 is rocked in a clockwise direction (as seen in FIG. 3), arm 175 draws link 68 downwards until link 68 is just clear of the lower end of a rocker 69, which is mounted on shaft 70 and constantly urged to the right (as seen in FIG. 3) by a spring (not shown). Rocker 69 is then free to make this movement to the right against a stop (not shown) which holds it directly above the upper end of link 68. Thus link 68, rocker 67, valves 63 and 64, and link 61 are held in the positions to which they have been moved, even when rocker 31 is restored to its normal position by cam 38. Pin 173 is moved down to the right-hand end (as seen in FIG. 3) of the slot 174 in link 61, as rocker 31 is restored.

Shaft 67 also carries an arm 212 (FIG. 2), having a link 203 pivotally connected at 204 to an arm 205 mounted on a shaft 206. When shaft 67 is turned clockwise (as already described), arm 212, link 203 and arm 204 are moved downwards and shaft 206 is rocked in an anticlockwise direction. Shaft 206 carries an arm 80 which is moved upwards and which engages projection 207 on rocker 53 to move this rocker 53 anticlockwise about shaft 170, thus removing pawl 15 from the path of the teeth of ratchet wheel 16. Ratchet wheel 16 is thus able to rotate freely during the return of punch head 6.

When the punch head 6 returns to the beginning of the line, a screw 74 (FIG. 1) thereon strikes the end of one arm 73 of a three-armed rocker pivoted at 221. Arm 222 of this rocker is engaged by one end of a piston 223 running in a damping cylinder 74', and the third arm 72 is arranged to control a rocker 71 mounted on shaft 70 (FIG. 3).

The impact of screw 74 on arm 73 causes the three-armed rocker to turn about its pivot 221 so that arm 72 moves rocker 1 and shaft 70 (FIG. 3) in a clockwise direction. Rocker 69 is therefore moved to the left (as seen in FIG. 3) against the action of its spring (not shown) and link 68 is able to move upwards and shaft 67 to turn anticlockwise under the action of spring 176. Valves 63 and 64 are changed back to their original positions so that shaft 75 is driven from clutch 12 again and rocker 80 (FIG. 2) is moved downwards to allow pawl 15 to re-engage ratchet wheel 16.

The arm 222 (see FIG. 1) of the three-armed rocker moves piston 223 in damping cylinder 74' against the action of a spring (not shown) therein and brings the punch head 6 gently to rest.

The line feed is effected by rocker 33 which is controlled by relay 26*f* and by cam 40.

The drive for the line feed is taken from a gear 81 (FIGS. 1 and 4) mounted on the cam shaft 14. Gear 81 engages a gear 82 arranged to drive a shaft 84 through a friction clutch 83. Normally pawl 88 pivoted at 224 engages a ratchet wheel 87 on shaft 84 and prevents shaft 84 from rotating, so that friction clutch 83 slips. However, when line feed relay 26 is energised and rocker 33 is allowed to follow the contour of its cam 40, which is exactly similar in shape to the other cams 35, etc., shaft 89 (shown in FIG. 4, but not in FIG. 1) is turned in an anticlockwise direction (as seen in FIG. 4). This movement of shaft 89 is controlled from rocker 33 by a mechanism (not shown) exactly similar to that which controls the movement of shaft 54 from rocker 29.

Mounted on shaft 89 is an arm 225 having a slanting end portion 226. In a position to be engaged by end portion 226 of arm 225 is a slanting end portion 228 of pawl 90 pivotally mounted on a screw 227. A spring (not shown) normally holds pawl 90 with its lower end (as seen in FIG. 4) away from pawl 88, i.e. the spring tends to draw the end portion 228 of pawl 90 towards the observer of FIG. 4. When shaft 89 is rotated anticlockwise (as seen in FIG. 4), however, end portion 226 of arm 225 engages end portion 228 of pawl 90 and causes it to move about its pivot 227 against the action of the spring, so that the lower end of pawl 90 lifts pawl 88 out of engagement with ratchet wheel 87. Friction clutch 83 then engages and shaft 84 is driven.

Gear 229 on shaft 84 drives a gear 85 and another gear 230 on shaft 84 drives a gear 86. Gears 85 and 86 are mounted on the same shafts as sprocket wheels 45 and 46 respectively, so that, when shaft 84 is driven, these sprocket wheels 45 and 46 are rotated and the paper is fed. The pivotal movement of shaft 89 is only of short duration under control of cam 40, and pawl 90 is allowed to move under the action of its spring to be clear of pawl 88 which engages the succeeding tooth of ratchet wheel 87.

In case double spacing may be required, a collar 98 is provided on shaft 84. Collar 98 is spring-urged up shaft 84 (as seen in FIG. 4) by spring 100. A hand wheel 97 (FIG. 1) carries an eccentric pin 99 so placed that by turning hand wheel 97, pin 99 can move collar 98 downwards to engage the projection on pawl 88. Collar 98 then allows pawl 88 to engage only every other tooth on ratchet wheel 87.

A tabulating paper feed, which may be needed when filling in forms, is also provided. This function is operated from rocker 32 under control of tabulating paper feed relay 26*e* and cam 39. Rocker 32 causes shaft 91 (FIG. 4) to turn anticlockwise (as seen in FIG. 4) to the position shown there, in which rocker 92 is in the path of a pin 93 on a wheel 96. Wheel 96 is driven from the shaft on which the sprocket wheel 46 is mounted by a gear 94 mounted thereon and through an intermediate gear 95.

The movement of shaft 91 from rocker 32 is controlled by a mechanism (not shown) exactly similar to that already described for controlling shaft 58 from rocker 30. The movement of shaft 91 is used to turn shaft 89 through a pair of members exactly similar to camming members 56 and 57, already described. Thus, when rocker 32 is operated, pawl 90 moves pawl 88 out of engagement with ratchet wheel 89 and holds it out until the pin 93 on wheel 96 strikes rocker 92 and turns shaft 91 clockwise (as seen in FIG. 4), so that pawl 88 is allowed to engage ratchet wheel 87 again. A number of pins 93 may be provided on wheel 96 and may be adjustable in position on wheel 96.

When a signal comes in for tabulating, punch head return, paper feed, or tabulating paper feed, it is necessary to prevent commutator 103 sending out its call signals until the function desired has been carried out. For this purpose, short-circuiting contacts *sc*1, *sc*2 and *sc*3 (FIG. 7) are arranged to be operated by the described movements of shaft 58, shaft 67, and shaft 89 respectively, and to remain operated until the particular function has been completed.

When the printing of a character or the carrying out

of a function has taken place in accordance with a received signal combination, a stop pulse is applied at Stop (FIG. 7). This consists of an earth condition applied through cam-controlled contacts (not shown). The presence of this earth condition de-energises relays CL and FR, so that their contacts all open and they are ready to be operated again.

Referring to FIG. 7, it will be seen that the various function signals are passed direct from the selective circuit **252** to the appropriate function relay **26***b*, **26***c*, **26***d*, **26***e* or **26***f*. The signals for carriage (i.e. punch head) return, line feed and space are distinct signals, but the tabulating and line tabulating (bell and "who are you" are used for these) occur in the figures case and have corresponding characters to be printed in the letters case. A contact *f***4**, one of the contacts of a figures relay F, is therefore necessary to ensure that the two relays **26***c* and **26***e* for these two functions are operated only when the appropriate combinations are received in the figures case. A selected function relay is operated at the instant when P2 is earthed by a cam (not shown).

The line AS marked on FIG. 7 is for the "all-space" signal which serves no purpose in the code used and is therefore earthed through a resistor **254**.

It will be obvious to one skilled in the art that the printer may be used to print signals stored on perforated tape or magnetic tape, for example, by gearing the shaft of commutator **103** to a tape reader.

The oil to be supplied to the various hydraulic parts of the apparatus is pumped from a sump **107** by an hydraulic pump **106** (FIG. 1A and FIG. 6). The oil is delivered through a filter **108** and a pipe **110** (FIG. 5 and FIG. 6) to a pressure valve chest **109**. The supply of oil for the printing punch valve chest **5** (FIG. 1 and FIG. 6) is taken through pipe **113** and fed into valve chest **5** at **114**. The pressure of oil pumped into pressure valve chest **109** is in excess of the sum of the pressures required for the various hydraulic devices. The pressure of oil supplied to valve chest **5** is controlled by a valve **112**, the ball **111** of which fits into a seating **126** in pipe **110** beyond the junction with pipe **113**. Valve **112** is arranged to open at the pressure required in valve chest **5**, the excess pressure passing through to pipe **115**.

Pipe **115** supplies oil under pressure to the inlet **118** of the clutch valve chest **117**. The pressure of oil supplied to valve chest **117** is controlled by valve **116**, the excess being taken down pipe **123**.

Pipe **123** supplies oil at a low pressure to various bearings on the machine shown diagrammatically at **255** in FIG. 6. Again the pressure in pipe **123** is maintained by valve **124** which opens at the desired pressure and bypasses the remaining excess pressure through pipe **125**. Pipe **125** returns oil to the sump.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What I claim is:

1. Type printing telegraph apparatus comprising a platen, a lead screw, a type head, means for securing said type head on said lead screw in threaded relation therewith for longitudinal movement across said platen in a forward direction in response to rotation of said lead screw in a first direction and for longitudinal movement across said platen in a return direction in response to rotation of said lead screw in a second direction, driving means including a friction clutch for selectively exerting a rotational force in each of said directions on said lead screw, a ratchet associated with said lead screw, a pawl normally engaging said ratchet and preventing rotation of said ratchet and lead screw when said first-direction rotational force is exerted on said lead screw and permitting rotation of said ratchet and lead screw when said second-direction rotational force is exerted on said lead screw, and means for withdrawing said pawl from engagement with said ratchet when said first direction rotational force is exerted on said lead screw to permit rotation of said lead screw and longitudinal movement of said type head.

2. Type printing telegraph apparatus as claimed in claim 1, in which the said driving means comprises a shaft arranged to drive said friction clutch, a first hydraulically-operated friction clutch for driving said shaft in one direction, and a second hydraulically-operated friction clutch for driving said shaft in the other direction.

3. Type printing telegraph apparatus as claimed in claim 2, further comprising rocker means controlling said hydraulically operated friction clutches, said rocker means normally causing said first hydraulically operated friction clutch to be engaged, relay means arranged to be operated on receipt of a type head return signal, and a mechanical linkage under control of said relay means for operating said rocker means to disengage said first hydraulically operated friction clutch, to engage said second hydraulically operated friction clutch and to withdraw said pawl from engagement with said ratchet until said type head is fully returned.

4. Type printing telegraph apparatus as claimed in claim 1, in which the means for withdrawing the pawl from engagement with the ratchet to effect a letter feed operation comprises a relay energisation of which operates a mechanical linkage controlling said pawl.

5. Type printing telegraph apparatus as claimed in claim 1 further comprising spring means operative on withdrawal of said pawl from said ratchet for advancing said pawl from a rest position, whereby said pawl may re-engage said ratchet before said ratchet has been rotated, to the position at which it is to come to rest, and hydraulic means including a plunger and dashpot for decelerating said ratchet after re-engagement by said pawl.

6. Type printing telegraph apparatus as claimed in claim 1, further comprising sprocket wheels for feeding a continuous roll of paper, means for rotating said sprocket wheels from a shaft, means for driving said shaft through a further friction clutch, and means for preventing said shaft from being driven except on the receipt of a line feed signal.

7. Type printing telegraph apparatus as claimed in claim 1, in which said type head comprises a plurality of impression-forming sections, and in which means is provided for moving a combination of said sections to form a desired character.

8. Type printing telegraph apparatus as claimed in claim 7, further comprising positioning means for moving said type head towards said platen prior to the printing of a character and away from said platen subsequent to said printing, and relay means operative on receipt of a character for controlling said positioning means.

9. Type printing telegraph apparatus comprising a shaft, means for driving said shaft through a friction clutch, a pawl normally engaging with a ratchet mounted on said shaft and preventing rotation thereof, means for withdrawing said pawl from engagement with said ratchet to permit rotation of said shaft, and spring means for advancing said pawl tangentially of said ratchet to meet a succeeding tooth of said ratchet.

10. Type printing telegraph apparatus as claimed in claim 9, further comprising hydraulic means including a plunger and dashpot of which said pawl is mounted for decelerating said ratchet after re-engagement by said pawl.

11. Type printing telegraph apparatus as claimed in claim 10, comprising further spring means arranged to yield to allow said pawl to be moved by said ratchet past the normal rest position and to restore said pawl and ratchet to said rest position.

12. Type printing telegraph apparatus as claimed in

claim 9 in which said shaft is a lead screw rotation of which causes a type head to be traversed across a platen.

References Cited in the file of this patent

UNITED STATES PATENTS

683,051 Kleber ---------- Sept. 24, 1901
982,659 Dean ---------- Jan. 24, 1911
2,025,778 Roe et al. ---------- Dec. 31, 1935
2,172,060 Fitch ---------- Sept. 5, 1939
2,192,351 Kleinschmidt ---------- Mar. 5, 1940
2,505,729 Zenner ---------- Apr. 25, 1950