

Feb. 28, 1967

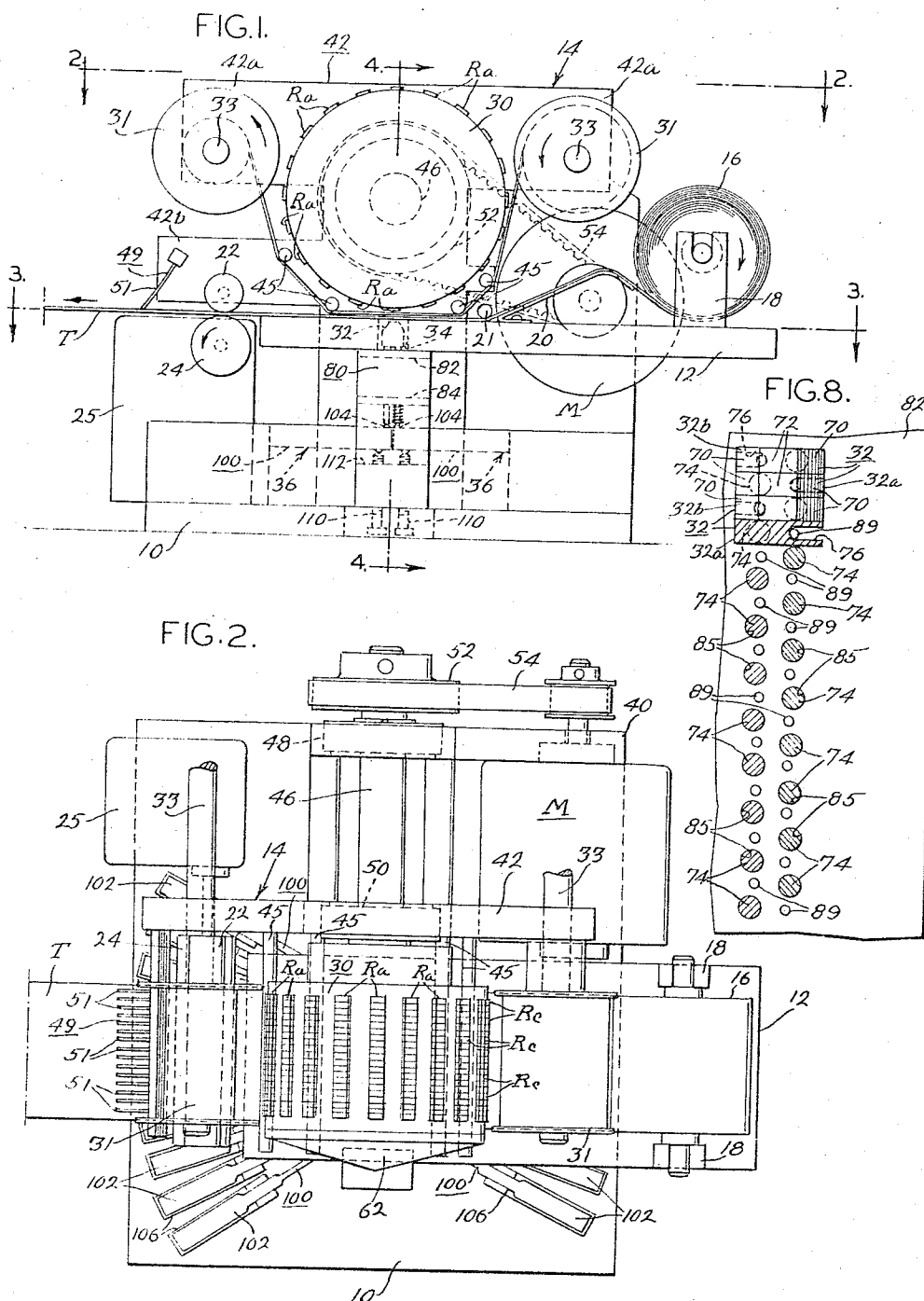
P. P. SHARPLES

3,306,191

HIGH SPEED PRINTER

Original Filed Dec. 18, 1962

3 Sheets-Sheet 1



Feb. 28, 1967

P. P. SHARPLES

3,306,191

HIGH SPEED PRINTER

Original Filed Dec. 18, 1962

3 Sheets-Sheet 2

FIG. 3.

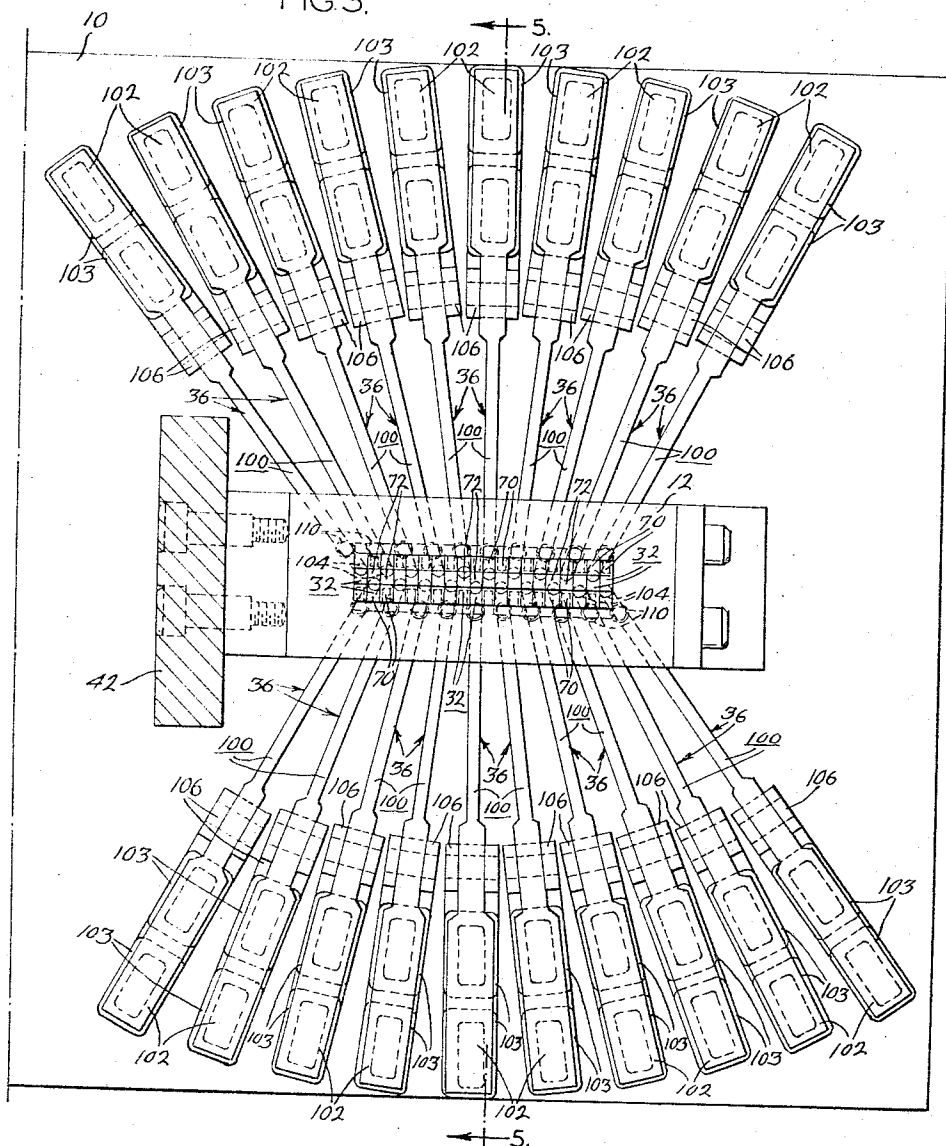
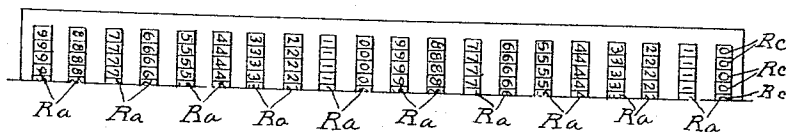


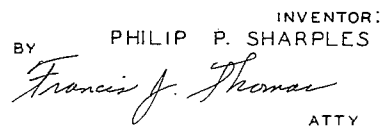
FIG. 7.



INVENTOR:
PHILIP P. SHARPLES
BY *Francis J. Thomas*
ATTY

3,306,191

3 Sheets-Sheet 3



1

3,306,191

HIGH SPEED PRINTER

Philip P. Sharples, Bryn Mawr, Pa., assignor, by mesne assignments, to Anelex Corporation, Boston Mass., a corporation of New Hampshire

Continuation of application Ser. No. 246,249, Dec. 18, 1962. This application Aug. 27, 1965, Ser. No. 483,103
6 Claims. (Cl. 101-93)

This invention relates to an improvement in high speed printers of the type employed to print information received from computers which is capable of printing 20,000 or more characters per minute. This application is a continuation of my copending and now abandoned United States application Serial No. 246,249, filed December 18, 1962, entitled "High Speed Printer."

High speed printers of the type to which the present invention relates, include a rotatable printing drum having circumferentially spaced rows of characters on the outer peripheral surface thereof. A plurality of hammers are individually actuatable to engage a paper tape and drive it against an inked ribbon disposed between the drum and tape and into the characters on the drum to print the desired information line by line on the paper tape. The hammers are solenoid actuated and selective energization of the solenoids is synchronized with the drive mechanism for the printing drum in a conventional manner to effect printing of the desired character from information received from a computer.

It is an object of the present invention to provide a high speed printer having novel features of construction and arrangement providing for accurate and clear printing in line form 20,000 or more characters per minute wherein each line may include as many as 20 or more conventionally spaced characters.

It is another object of the present invention to provide a high speed printer including a series of small, lightweight hammers having little inertia to facilitate quick actuation and which are closely spaced in a row to permit printing of a comparatively large number of conventionally spaced characters in a row.

It is still another object of the present invention to provide a high speed printer including solenoids arranged in banks on opposite sides of the hammers and solenoid actuators having an enlarged solenoid end overlying its solenoid and a hammer end of reduced cross section adapted to engage and actuate the hammer upon energization of a solenoid.

It is a further object of the present invention to provide a high speed printer which is easily assembled for use and easily disassembled to facilitate, for example, replacement of parts.

It is still a further object of the present invention to provide a high speed printer including a novel cantilevered arrangement of some of the elements thereof such as the printing drum, the inked ribbon supply and take up means, the paper tape and ribbon guide means whereby the paper tape and inked ribbon may be easily threaded into the printer.

Briefly, the present invention contemplates a high speed printer including a series of small, lightweight, closely spaced hammers arranged in a row, each hammer having a depending stem or rod and biasing means normally urging the lower end of the rod against one end of an elongated actuator lever pivotally mounted intermediate the ends. The other end of the lever cooperates with a solenoid which upon energization attracts the lever to drive the hammer into engagement with the tape and ribbon against a selected character on the drum to thereby impress the character on the tape.

In the present instance the rods of alternate hammers are aligned and are offset or staggered relative to the

2

aligned rods of hammers intermediate the alternate ones and the arrangement of springs biasing the hammers is such that the hammers may be disposed in close side by side relation in a row. Free, independent, quick actuation of the hammers is assured by small size and light weight. Further, the lever actuators are disposed in two banks, the levers in each bank oriented in a fan-like array with their hammer ends closely spaced and the solenoid ends spaced farther apart along points of an arc. This arrangement of actuators permits the use of large enough solenoids to insure quick actuation of the hammers and also permits the close orientation of the comparatively small, lightweight hammers whereby 20 or more hammers may be arranged to print 20 or more characters in each line. The present invention further contemplates a cantilever mounting for some of the elements of the printer such as the printing drum, the inked ribbon supply and take up means, and the paper tape and ribbon guide rolls. This arrangement permits the paper tape and ribbon to be threaded into the printer easily and quickly and also facilitates easy assembly and disassembly of the printing drum.

In the drawings:

FIG. 1 is a side elevational view showing the general arrangement of a high speed printer in accordance with the present invention;

FIG. 2 is a plan view taken along line 2-2 of FIG. 1 showing the cantilever mounting of elements of the printer and also the arrangement of the solenoid actuators;

FIG. 3 is an enlarged sectional view taken on line 3-3 of FIG. 1 showing the solenoid actuators;

FIG. 4 is an enlarged sectional view taken on line 4-4 of FIG. 1 showing the hammer mounting arrangement;

FIG. 5 is an enlarged sectional view taken on line 5-5 of FIG. 3 showing the hammer and actuator assembly in detail;

FIG. 6 is a perspective view of one of the hammers;

FIG. 7 is a layout or projection of part of the type drum which illustrates the relative position of the rows of characters on the drum; and

FIG. 8 is a fragmentary sectional view taken on line 8-8 of FIG. 5.

Referring now to the drawings, the overall arrangement of a high speed printer in accordance with the present invention is best illustrated in FIGS. 1 and 2. With reference to the primary component elements of the printer and their respective functions, there is provided a base 10, a generally rectangular elongated paper tape supporting plate 12 overlying the base extending lengthwise thereof and a main frame structure 14 projecting upwardly from the base. A printing drum 30 is rotatably mounted on the support structure 14 above the platen 12 and has a plurality of axially extending circumferentially spaced rows of characters R_a on its outer periphery, the characters in the rows R_a also being aligned in circumferential columns R_c around the periphery of the drum.

A pair of ribbon spools 31 are rotatably mounted in the frame structure 14 on opposite sides of the printing drum 30 and by conventional means advance an inked ribbon between the printing drum 30 and the platen. A series of hammers 32 is mounted in a slot 34 extending transversely of the platen 12, each of the hammers being aligned with the characters in one of the circumferential columns R_c and each being actuatable individually by means of a solenoid responsive actuator 36 to engage a paper tape T and the inked ribbon against a selected one of the characters to impress the selected character on the paper tape T. In the present instance the characters are printed on character receiving means comprising an inked ribbon and tape. However, it is to be

understood that other forms of character receiving means such as self-inking paper may be employed.

In the operation of the printer, a paper tape T is advanced stepwise across the top surface of the platen from a supply roll 16 rotatably supported in a bracket 18 at one end of the platen 12 by means of a special paper feed mechanism at the opposite end of the platen 12 comprising an idler roller 22 and drive roller 24 driven intermittently by a Sigma Cyclanome pulse motor 25. In the course of travel, the tape T passes over a lost motion spring 20, under a paper guide roll 21 and through the nip of the rollers 22 and 24 to suitable collection means (not shown). In the present instance, there are 20 columns R_c of characters on the periphery of the drum, thus providing 20 identical characters in each axial row R_a and there are 20 axial rows R_a constituting two complete sets of characters, each set ranging from 0 to 9. As illustrated, there are 20 hammers arranged side by side in a compact row, each hammer aligned with one of the columns R_c . Suitable means are provided to synchronize with the positions of the rotating printing drum, the solenoid actuators and the paper feed mechanism to print the information in line form on the paper tape T. Accordingly with the printing drum rotating at a speed of 500 revolutions per minute, the feed mechanism pulses the paper to advance it one increment after each one-half revolution of the printing drum. During each one-half revolution of the printing drum, the solenoids are selectively energized to sequence the hammers to print a line of 20 selected characters in accordance with the signals from the computer. If the drum revolves at 500 revolutions per minute, it prints potentially 20,000 characters per minute.

Considering now more specifically some of the above-mentioned components of the printer, an important feature of the present invention is the provision of small, lightweight hammers having little inertia arranged in close side by side relation in a row of 20 or more characters facilitating printing in excess of 20,000 characters per minute. Each of the hammers comprises a hammer head and a rod depending from the hammer head. As illustrated in FIG. 6, each of the hammers 32 is a plate of comparatively narrow width having generally rectangular side faces which are chamfered at 70 to define a small rectangular striking surface 72 conforming generally in size to one of the character plates. A slot 76 is provided in one side face of the hammer which terminates in an arcuate rounded edge 78 below the chamfered side wall 70 thereof. A rod or stem 74 depends from the lower end face of the hammer and is offset toward the side of the hammer opposite the slot 76. The hammers are mounted in a row in close side by side relation in the transverse slot 34 in the platen 12 and are adapted for movement therein. To this end, a mounting box 80 including spaced upper and lower plates 82 and 84 respectively is provided below the transverse slot 34 in the platen, the plates 82 and 84 having a plurality of openings 85 therein aligned to receive the rods 74 of the hammers. The openings 85 in each of the plates are arranged in a staggered array as shown in FIG. 8, the top plate mounting a plurality of upwardly projecting locating pins 89 which are staggered and disposed to one side of the openings in the top plate. Accordingly when the hammers are mounted in the box, the stems 74 of alternate hammers 32a are aligned and spaced to the side of the aligned stems of the hammers 32b between the alternate ones (see FIG. 5). The hammers are normally urged downwardly by means of a coil spring 90 so that each of the rods 74 abuts its respective actuator.

The hammers 32 are assembled in the mounting box 80 through the slot from the top of the platen. The coil spring 90 for each of the alternate hammers 32a is positioned below the lower plate 84 aligned with the opening 85 therein and then the rod inserted down

through the aligned openings 85 in the upper and lower plates and the coil spring. A retaining ring 81 of the snap-on type is then pressed onto an annular recess in the lower end of the rod 74 to retain the coil spring between the bottom face of the lower plate and the ring. The coil spring 90 for each of the intermediate hammers 32b is positioned between the plates 82 and 84 in alignment with the opening 85 and then the rod of the hammer is placed through the openings 85 and spring. A snap ring 83 fits in an annular groove in the rod to compress the spring slightly and normally bias the hammer downwardly. By this arrangement, the hammers are mounted in close side by side relation in a compact manner without the coil springs of adjacent hammers interfering with one another thereby insuring independent, free movement of the hammers. When each of the hammers is actuated by its actuator 36, the pin 89 prevents the hammer from turning and also serves to prevent accumulation of foreign matter in the slot 76 in the hammer.

Another important feature of the present invention is the arrangement of the actuators 36 facilitating a compact orientation of the hammers. To this end, each of the hammer actuators 36, as shown in FIG. 3, comprises an elongated lever 100 having an enlarged solenoid end 102 overlying a solenoid 103 and a hammer 104 of reduced cross section engaging the rod 74 of a hammer. Each of the levers is pivotally mounted in a yoke 106 supported on the base of the printer, the lever being pinned to the yoke 106 at approximately the juncture of the solenoid and hammer ends thereof. As illustrated in FIG. 3, there are two banks of solenoids, the solenoids in each bank being located on an arc and there are two banks of levers 100 arranged in a fan-like array. As shown in FIG. 5, the hammer end 104 of each hammer is biased by a spring 109 against an adjusting screw 110 threadedly received in a block 112 underlying the mounting box 80. Each of the hammers 32 is normally biased downwardly so that upon energization of a selected one or group of solenoids 103, the solenoid end 102 is attracted to the energized solenoid thereby pivoting the lever and driving the hammer upwardly against the characters on the printing drum 30 to thereby print the desired character or characters on the tape. By this arrangement of actuators, the comparatively large solenoids sufficient in size to provide the necessary actuating power may be conveniently spaced as illustrated to operate the hammers which are arranged in a compact row.

A further feature of the printer of the present invention is the cantilever mounting of some of the elements of the printer to facilitate setting up the printer for operation and also for replacement purposes. To this end, as shown in FIG. 4, the frame structure includes a pair of spaced upstanding support brackets 40 and 42 projecting upwardly from the base to one side of the platen 12 and the printing drum 30 is mounted on an enlarged cylindrical hub 44 carried on the outer end of a shaft 46 journaled in bearings 48 and 50 fixed respectively in the spaced brackets 40 and 42. The inner end of the shaft mounts a pulley 52 engaged by a timing belt 54 driven by a motor M. As illustrated, the drum 30 is secured to the hub 44 for rotation therewith by a keyed connection as at 60 and is supported against axial movement on the hub 44 between the shoulder 61 and a retainer disc 62 received on the threaded stud 64 in the outer axial end face of the hub 44. This arrangement is comparatively simple structurally, and permits easy and quick removal of the printing drum 30, for example to install the hammers or to replace damaged type.

Other cantilever mounted elements include the ribbon spools 31, each of which is supported on a rotatable shaft 33 projecting forwardly from side arm portions 42a of the bracket 42 and a series of ribbon guide rolls 45 journaled at one end in lower side arm extensions 42b of bracket 42. The guide rolls 45 space the ribbon from the

5

rotating printing drum 30 to prevent damage thereto. This arrangement permits threading of the ribbon easily and quickly and easy rethreading thereof when necessary. Also journaled in one of the lower side arm extensions 42b are a paper guide roll 21 adjacent the lower end of the lost motion spring 20 and the idler roll 22. Downstream of the paper feed mechanism is a spring brake 49 comprising a plurality of fingers 51 carried by a spring biased shaft which projects forwardly from the side arm extensions 42b and which urges the bent tip portions of each of the fingers against the paper tape T.

From the foregoing it is apparent that the present invention provides a printer having novel features of construction and arrangement providing for accurate and clear printing of at least 20,000 characters per minute. The specific construction and arrangement of the hammers provides for a compact assembly facilitating operation of the printer at the very high speeds. Additionally, the cantilever mounting of some of the elements of the printer facilitates assembly of the parts of the printer, initial threading of the ribbon and paper tape in the printer and also rethreading when needed.

While a particular embodiment of the present invention has been illustrated and described herein, it is not intended to limit the invention and changes and modifications may be made therein within the scope of the following claims.

I claim:

1. In a high speed printer, a rotatably mounted printing drum having a plurality of characters on the outer periphery thereof arranged in circumferential columns around the periphery of the drum, a hammer mounting frame, a plurality of hammers mounted in said mounting frame, said hammers corresponding in number to the number of columns on the drum, each of said hammers comprising a hammer head and a rod depending from said head, said hammer heads arranged in a row in close side by side relation and hammer rods for alternate hammers arranged in a first row and the hammer rods for intermediate hammers between the alternate hammers also arranged in a second row spaced from said first row, hammer rod actuating means adjacent one end of said rod remote from the head for selectively actuating the hammers whereby the heads engage character receiving means against selected ones of the characters whereby characters are printed in a row on the character receiving means, resilient biasing means for each of the hammers, means on said rod and said mounting frame cooperating with said resilient biasing means to normally urge the hammers away from the characters and in close proximity to said actuating means, said resilient biasing means for alternate hammers disposed adjacent the said one end of said rod and said resilient biasing means for the hammers between the alternate ones disposed adjacent the end of said rod opposite said one end whereby the biasing means are so positioned on adjacent rods so as to be free and clear of one another thereby to provide for free independent actuation of the hammers and means for guiding the hammers during actuation to insure free independent movement.

2. A high speed printer as claimed in claim 1, wherein each of said hammer heads is a plate having a striking surface and means defining a slotted opening in one side edge thereof and wherein said guide means includes a stationary pin for each of the hammer heads engageable in said slotted opening to prevent turning of the hammer heads upon actuation thereof.

3. A high speed printer as claimed in claim 2, wherein the depending rod is offset to a side edge of said hammer head opposite said slotted opening and wherein said

6

mounting frame comprises a mounting box having a series of openings arranged in staggered array to receive the rods of the hammers whereby the rods of alternate hammers in said row are aligned and the rods of hammers between the alternate ones are also aligned and wherein each of said stationary guide pins is mounted to one side of one of said openings in said mounting box.

4. A high speed printer as claimed in claim 1, wherein said hammer actuating means includes a solenoid for each of the hammers and a pivotally mounted actuating lever for each of the hammers having a solenoid end overlying its respective solenoid and a hammer end of reduced cross section adapted to engage the free end of a hammer rod.

5. A high speed printer as claimed in claim 4, wherein the solenoids for alternate ones of said hammers in said row are located in a bank at one side of the row of hammers and the solenoids for the hammers intermediate the alternate ones are located in a bank on the opposite side of said row of hammers and wherein the levers are disposed in a fan-like array on opposite sides of the row of hammers, whereby comparatively large solenoids sufficient in size to provide the necessary actuating power may be conveniently positioned to operate the compactly arranged hammers.

6. In a high speed printer, a rotatably mounted printing drum having a plurality of characters on the outer periphery thereof arranged in circumferential columns around the periphery of the drum, a hammer mounting frame, a plurality of hammers mounted in said mounting frame, said hammers corresponding in number to the number of columns on the drum, each of said hammers comprising a hammer head and a rod depending from said head, said hammer heads arranged in a row in close side by side relation and hammer rods for alternate hammers arranged in a first row and the hammer rods for intermediate hammers between the alternate hammers also arranged in a second row spaced from said first row, hammer rod actuating means adjacent one end of said rod remote from the head for selectively actuating the hammers whereby the heads engage character receiving means against selected ones of the characters whereby characters are printed in a row on the character receiving means, spring biasing means for each of the hammers, means on said rod and frame cooperating with said spring biasing means to normally urge the hammers away from the characters and in close proximity to said actuating means, said spring biasing means for alternate hammers circumscribing the rod adjacent the said one end of said rod and said spring biasing means for the hammers between the alternate ones circumscribing the rod adjacent the end of said rod opposite said one end whereby the spring biasing means are so positioned on adjacent rods so as to be free and clear of one another thereby to provide for free independent actuation of the hammers and means for guiding the hammers during actuation to insure free independent movement.

References Cited by the Examiner

UNITED STATES PATENTS

2,659,652	11/1953	Thompson	101—93
2,787,210	4/1957	Shepard	101—93
2,874,634	2/1959	Hense	101—93
2,940,385	6/1960	House	101—93
3,062,134	11/1962	Deighton	101—93
3,077,830	2/1963	Paige	101—93
3,190,957	6/1965	Foley et al.	101—93

WILLIAM B. PENN, *Primary Examiner.*