Nov. 20, 1956 H. J. KISTNER ET AL 2,771,025

PRINT IMPRESSION MECHANISM

Filed Nov. 2, 1953 2 Sheets-Sheet 1

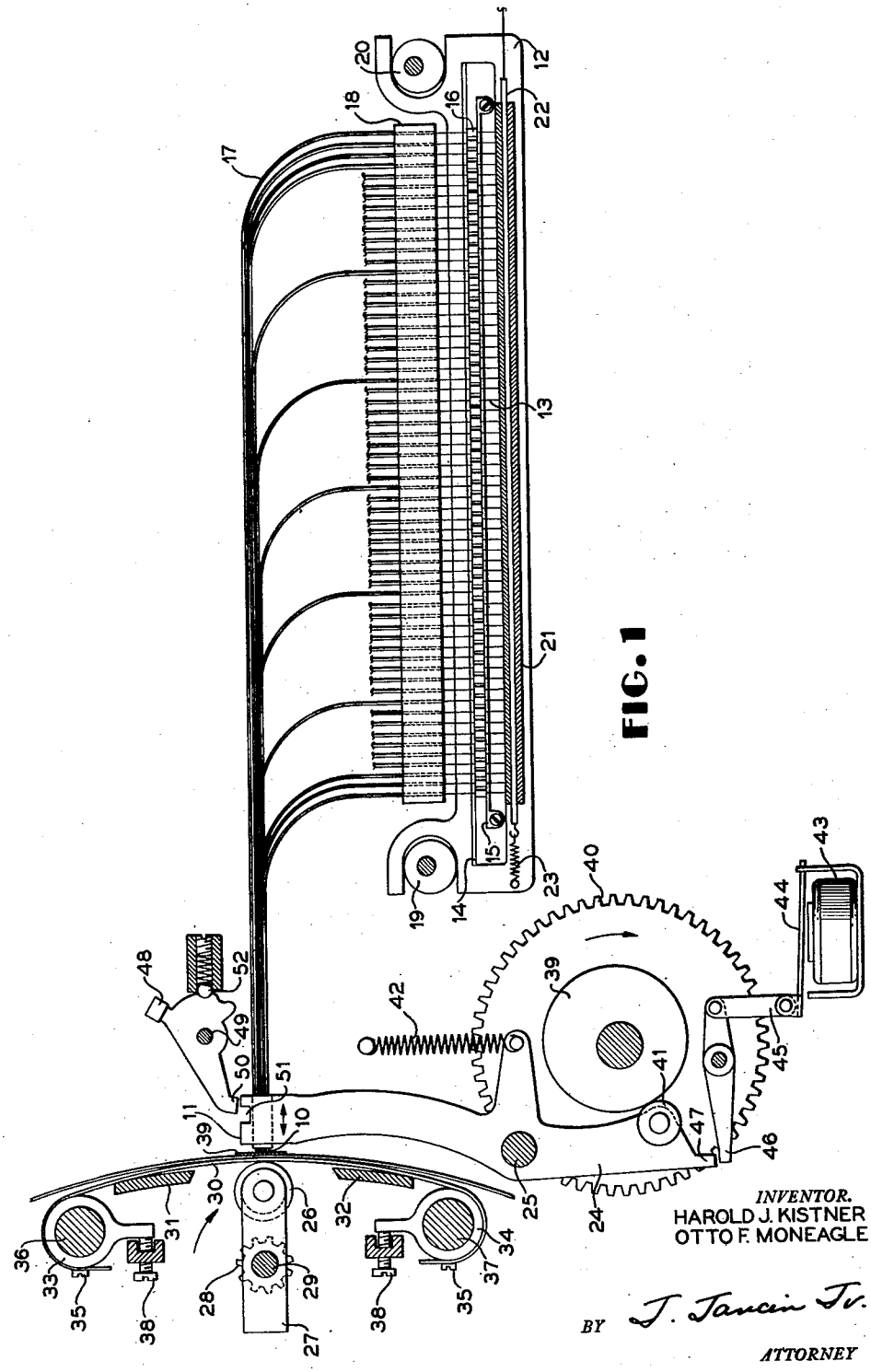

FIG. 1

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Filed Nov. 2, 1953. 2 Sheets-Sheet 2

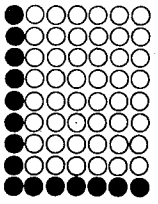

FIG. 3

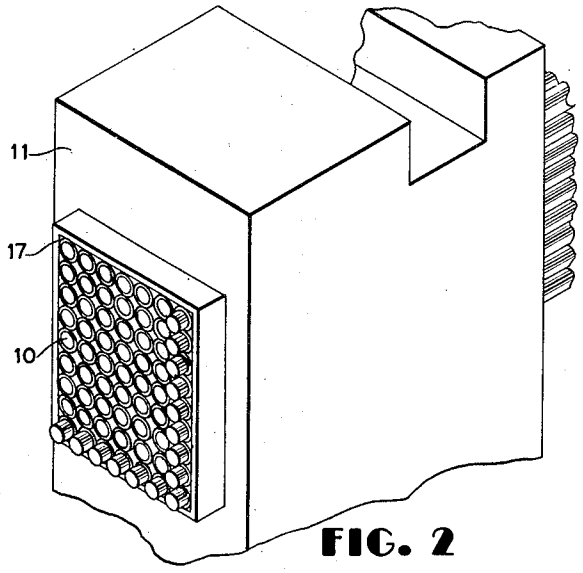

FIG. 2

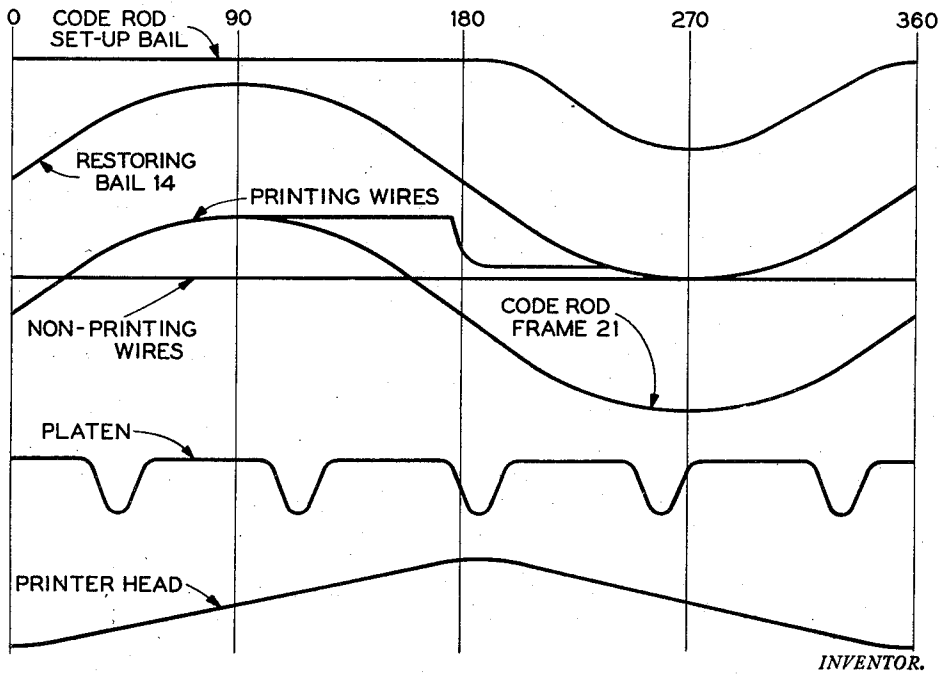

FIG. 4

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2,771,025

PRINT IMPRESSION MECHANISM

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Application November 2, 1953, Serial No. 389,621

4 Claims. (Cl. 101—93)

This invention relates to a printing machine in general and to a print impression mechanism therefor in particular.

The print impression mechanism disclosed herein is described as applied for use in a wire printer, i. e., a printing machine in which selected wires of one or more clusters of such wires are differentially positioned in a longitudinal direction to form at the base of the cluster, or clusters, the desired character printing surface or character pattern. Printing by wire ends differentially positioned in a longitudinal direction to form character patterns has been suggested heretofore, e. g., in U. S. Patent 2,524,127 issued to Reynold B. Johnson. Most prior art printers of this class involve the use of print wire setting devices against which one end of the wires rests or with which the wires are otherwise positively engaged during the printing stroke. It is, therefore, a common characteristic of these printers that the print wires are held against longitudinal movement during the printing operation. This fact may afford poor quality printing because it presupposes that all of the print wires are exactly of the same effective length and that all of the wire ends thereof forming a character pattern are moved into the same printing plane by their individual setting devices. Although these conditions are theoretically possible, they are very difficult to achieve in practice. The invention disclosed in U. S. Patent No. 2,730,040, which issued on January 10, 1956, to Reynold B. Johnson, overcomes the aforesaid difficulties by providing for the controlled longitudinal movement of print wires under impact of the printing stroke so that the force of the printing stroke is itself effective to align the wire ends of the character pattern forming wires in a common printing plane.

In order to produce not only legible printing but good quality printing as well, particularly when multiple record sheets are produced simultaneously under impact of each printing stroke, a sufficient value of energy is required at the time of impact. If the value of impact energy is too low in a printer such as described in the aforementioned patent application, the wire ends forming the character pattern will be moved slowly in a longitudinal direction under impact of the printing stroke, whereupon a poor quality character imprint will result. On the other hand, if the value of impact energy is too high, the record sheet, or sheets, upon which the characters are printed will be damaged. As the value of impact energy is determined by the kinetic energy of the print impression mechanism, and since kinetic energy is equal to one-half the product of mass and velocity squared (K. E.=½mv.^{2}), it is apparent that the impact energy may be varied by changing either the mass of the character print wires or the velocity of the print wires during the printing stroke. It is usually advantageous to increase the velocity rather than the mass because utilization of low mass character forming print wires permits the use of a low force to set up the same since force is equal to the product of mass and acceleration ($F=ma$). In addition thereto, the use of a small mass and a low force permits the use of comparatively small machine parts which improves the noise factor of the printing machine considerably.

A principal object of this invention is to provide an improved print impression mechanism for printing machines.

In line with the foregoing, another object of this invention is to provide a print impression mechanism for wire printers for printing impressions, whether of a single character or a plurality of aligned simultaneously imprinted characters, of uniformly good quality.

A specific object of this invention is to provide a wire printer having a movable platen and a coacting movable printer head.

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 examples, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a somewhat diagrammatic sectional view of a wire printer that embodies the features of this invention. This view illustrates a print wire assembly and a print impression mechanism for a single character position.

Fig. 2 is a fragmentary view of a printer head showing the print wires of a cluster of wires displaced to form the letter L.

Fig. 3 is a diagram, on an enlarged scale, of the letter L, adapted to be formed by the character pattern print wires.

Fig. 4 is a timing diagram.

In view of the fact that the instant invention is an improvement over the invention described in the aforementioned Johnson patent, reference will be made thereto wherever possible in order to avoid undue prolixity.

WIRE PRINTING—GENERAL

The wire printing mechanism described herein forms characters from a closely spaced pattern of dots as shown in Fig. 3. Each dot is marked on a record sheet when the end of a print wire is pressed against an inking ribbon adjacent the record sheet. A generally rectangular cluster of sixty-three print wires, each having a very small diameter, e. g., 009 inch, is used at each printing station. Each cluster has its wires arranged in seven vertical rows of nine wires each. In forming a character pattern corresponding to the character to be printed, various print wire combinations are moved outwardly a short distance so that their ends protrude slightly beyond the base of the cluster. These protruding wires which form the character pattern cause the aforementioned dots to be imprinted on the record sheet so as to form the desired corresponding character.

Formation of the character pattern involves selection of the proper print wires to be projected to form the character pattern. As the means necessary to form the character pattern on the printer head is not a part of the instant invention, and since this means is described in detail in the aforementioned R. B. Johnson patent application, for clarity and brevity of description it will be described only briefly herein.

Referring to Fig. 1, the sixty-three print wires **10** form a rectangular cluster at printer head **11** (see Fig. 2), and from this cluster the print wires are fanned out in a series of guides in a print wire bail **12** to form a single line of wires at relatively large spacing at the other or control end **13**. Attached to the control end of each print wire **10**, and positioned between the restoring bail **14** of print wire bail **12** and a stop comb **15**, is a print

wire slug **16** having a weight, for example, of one gram. Furthermore, each of the print wires **10** is arranged within a tubular casing **17** having an internal diameter, for example, of .010 inch. One end of each tubular casing **17** is attached to printer head **11** in a close rectangular formation for movement therewith (see Fig. 2), and the other end of each tubular casing is fixed to a stationary tubular casing guide bar **18**.

Print wire bail **12** is reciprocated by cams **19** and **20**, whereupon slugs **16** are brought into alignment with non-movable stop comb **15** during the downward movement of bail **12**. Adjacent the control end **13** of each print wire **10**, and positioned within a code rod frame **21** attached to bail **12** is a code rod **22** which has a diameter, for example, of .093 inch. There is one such code rod for each printing position. As described fully in the aforementioned patent application, a pattern of notches is cut transversely across each of four sides of the code rod. Hence, by rotating the code rod in increments of 90°, four separate groups of notches can be presented to the control ends **13** of the print wires. The arrangement of each code rod **22** and associated control mechanism is such that as code rod **22** is moved by code rod frame **21** into contact with the control end **13** of print wires **10** by cams **19** and **20**, the code rod will have no effect on a given print wire **10** if the control end of the print wire enters a notch in the code rod. If, however, control end **13** of a print wire **10** strikes a high portion of code rod **22**, the print wire will be moved within its tubular casing **17**, and, accordingly, its wire end will protrude above the general level of the cluster of wires at the printer head.

If, for example, it is desired to arrange the print wire ends at printer head **11** to any one of forty-eight different character patterns, each character pattern corresponding to an alphabetic, numeric or special symbol character, it is necessary to present forty-eight different sections of code rod **22** to the control ends **13** of print wires **10**. As mentioned hereinbefore, code rod **22** may be rotated in increments of 90° to four different positions. It now follows that the aforementioned forty-eight different code rod sections may be obtained by shifting code rod **22** longitudinally to each of twelve index positions. Code rod **22** is biased to a normal position (to the left) by means of a spring **23**. This spring permits longitudinal movement of the code rod as well as the necessary rotary movement during adjustment into a given wire setting position whereupon a character pattern is formed.

The longitudinal movement of print wires **10** during set up and restoration thereof is limited and stabilized by print wire attached slugs **16**. Each slug, in effect, constitutes an inertia device which is overcome by impact of the printing stroke for normalizing at the printing zone the protruding print wire ends of a character pattern in a common printing plane during the printing stroke.

It was stated previously that print wires **10** are relatively free to move longitudinally under impact of the printing stroke. Reference to Figs. 1 and 4 will show why this is true. At 270°, cams **19** and **20** have rotated so as to carry code rod frame **21**, and consequently code rod **22**, out of contact with the control ends **13** of print wires **10**, and align slugs **16** along stop comb **15**. This so-called restored position is achieved by movement of restoring bail **14** under influence of cams **19** and **20**, during which movement restoring bail **14** engages the print wire attached slugs **15** and moves said slugs into proximity with the flange of stop comb **14**. This action also aligns the control ends **13** of the print wires.

At approximately 90° of the printing cycle, the parts will assume a so-called setting up position. At this time the cams **19** and **20** have carried restoring bail **14** upwardly and out of contact with slugs **16**. At the same time, code rod frame **21** is moved upwardly so that code rod **22** engages the control ends **13** of print wires **10**, thus setting the print wires in a selected character pattern printing position.

At approximately 180° of the print cycle, just prior to print time, cams **19** and **20** have moved code rod frame **21** and consequently code rod **22** downwardly so that none of the print wire control ends **13** are in contact with the code rod, and none of the slugs **16** are in proximity to stop comb **15**. This permits freedom of movement in a longitudinal direction of the print wires under impact of the printing stroke.

Hence, movement of code rod **22** sets up print wires **10** so as to form a character pattern between 0° and 180° of the printing cycle. As is shown in Fig. 4, code rod **22** engages control ends **13** of print wires **10** at approximately 25° of the printing cycle. As described in the aforementioned copending U. S. patent application, and as is shown in Fig. 4, the code rod set-up bails (bails, not shown, for applying a rotary and a longitudinal movement to the code rod) are effective during the latter half of a printing cycle, i. e., from 180° to 360°, so as to set up the code rod for the following printing cycle.

PRINT IMPRESSION MECHANISM

The present invention is embodied in the improved structure of the print impression mechanism which will now be described.

Referring to Fig. 2, tubular casings **17** are secured one to the other, and to printer head **11**, so that as cam follower arm **24** (Fig. 1) is caused to oscillate about pivot **25**, printer head **11** including the tubular casings is caused to reciprocate accordingly in a longitudinal plane. Due to the frictional engagement between each print wire **10** and its respective tubular casing **17**, this reciprocating movement of printer head **11** does not of itself cause a relative movement between a print wire **10** and its respective tubular casing **17**. In other words, print wires displaced at the printer head to form a character pattern such as the letter L shown in Fig. 2, will remain so displaced and will not be affected by the movement of the printer head per se.

A striker roller **26** is rotatably connected to a stud attached to a striker roller arm **27** which, in turn, is fixed to striker assembly gear **28** through a stud shaft **29** for rotating the aforesaid integral unit. A somewhat resilient steel band platen **30** is supported between striker roller **26** and printer head **11** by a pair of platen guides **31** and **32**. Platen **30** is attached at each end to a corresponding platen support **33** and **34** by locking screws **35**. It is to be observed that since platen supports **33** and **34** are freely mounted on rods **36** and **37**, respectively, the tension of platen **30** may be changed by varying the position of adjusting screws **38**.

The record sheet, or record sheets, upon which the characters are imprinted, are positioned between platen **30** and inking ribbon **39** which, in turn, is positioned adjacent printer head **11**.

Cam **39** is attached to printer head gear **40** which is caused to rotate by any suitable driving means, as is gear **28**, so that printer head **11** is caused to reciprocate as cam follower roller **41** rides on cam **39**. Cam follower arm **24** is normally biased against cam **39** by spring **42**. The movement of printer head **11** is shown in the timing chart of Fig. 4.

Platen **30** (Fig. 1) has imparted thereto a comparatively sharp, percussive blow each time roller **26** strikes the platen. As is shown in Fig. 4, platen **30** is moved five times or about every 72° during each printing cycle by striker roller **26**. In other words, platen **30** is moved five times for every one complete stroke of printer head **11**. This action of platen **30** moves the record sheet accordingly in a direction towards printer head **11**. Hence, even though the printer head may be operated at a low or intermediate printing speed, the high velocity movement imparted to platen **30** as a result of engage-

ment with striker roller **26** affords character impressions of uniformly good quality.

After code rod **22** has been set up so as to cause print wires **10** associated therewith to be set up correspondingly in a manner described hereinbefore, the selected print wire ends at the printer head are caused to project a distance, e. g., .030 inch, to form a character pattern. Referring once again to Fig. 4, these wire ends are caused to so protrude during the time interval between 0° and 90° of the printing cycle while printer head **11** is just beginning to move toward platen **30**. During the period 0° to 180°, platen **30** receives two blows as a result of roller **26** striking the same. However, these platen movements are not effective to cause printing upon the record sheet, or record sheets, because the print wires forming the character pattern are still outside of the printing zone. The printing zone is defined as that area within which the platen engages the character pattern to effect printing. During print time, approximately 180°, the character pattern forming wires are moved within the printing zone by printer head **11** so that as striker roller arm **27** rotates to sweep striker roller **26** past platen **30**, a print impression is obtained. It is to be observed that the protruding character pattern forming print wire ends are struck a percussive blow by platen **30** which is sufficient to cause a longitudinal movement of these print wires **10** so as to align the ends of the character pattern forming wires in a common printing plane. As is shown in Fig. 4, these print wires **10** are actually caused to move beyond the common printing plane to some indefinite position. The print wires are thereafter restored to a home position within printer head **11**. This occurs during the period between print time and 270° by the aforedescribed action of restoring bail **14** (Fig. 1) upon slugs **16**. It will be recalled that restoring bail **14** at this time is moved downwardly by cams **19** and **20** so as to align the print wire attached slugs against stationary stop comb **15**.

Print suppression

Print suppression may be selectively controlled automatically or manually. Automatic print suppression may be had by energizing print suppression magnet coil **43** shown in Fig. 1, which thereupon attracts armature **44**. This action moves connecting link **45** downwardly and pivots print suppression lever **46** in a clockwise direction, whereupon lever **46** engages the cam follower arm extension **47** of cam follower arm **24**. Hence, cam follower roller **41** is prevented from riding on cam **39** and printer head **11** is kept without the printing zone. This positions the character pattern forming print wires away from moving platen **30** so as to preclude printing.

Manual print suppression may be had by moving lockout lever **48** in a counterclockwise direction about pivot **49** so that dog **50** enters notch **51** in printer head **11**. This engagement also keeps printer head **11** outside of the printing zone. Lockout lever **48** is maintained in a set position by the engagement of spring biased ball **52** and an associated detent in the said lever.

SUMMARY

With particular reference to Figs. 1 and 4, code rod **22** is set up during the period between 180° and 360° so as to be positioned to correspondingly set up selected print wires **10** during the immediately following 0° to 90° period. This print wire setting causes a character pattern to be formed at printer head **11**. This character pattern is depicted by print wires **10** protruding from their respective tubular casings **17** which are secured, at one end, to printer head **11** and, at the other end, to stationary tubular casing guide bar **18**. During the time interval between 0° to 180°, printer head **11** is moved toward platen **30** under control of cam follower roller **41** and cam **39**. Since striker roller **26** moves in a path concentric to shaft **29** and at an angular velocity five times that of cam **39**, at print time, i. e., approximately 180°, platen **30** is moved within the printing zone now occupied by printer head **11**. This action effects printing upon the record sheet positioned between printer head **11** and platen **30**. The print impressions obtained on the record sheet, or record sheets, are of uniformly good quality because of the longitudinal movement of print wires **10** to a common printing plane under impact of the printing stroke, and the correct value of impact energy accorded by the high velocity platen **30**. During the time interval between print time and 360°, printer head **11** is removed from within the printing zone and print wires **10** are restored to their normal position under control of restoring bail **14**. During this period, code rod **20** is set up for the next printing cycle. The impacts accorded platen **30** during this time by the moving striker roller **26** are of no effect because printer head **11** is without the printing zone.

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 print impression mechanism of the class described in a cyclically operable printer for printing characters on a record sheet comprising a movable printer head having a cluster of loosely held print elements arranged so that the ends thereof define a character pattern at a printing face, a movable platen, means for moving said printer head towards and away from said platen once each printer cycle at a rate of speed insufficient to provide value of printing stroke energy which is sufficient to effect good quality printing, and means for simultaneously therewith moving said platen towards and away from said printer head a plurality of times each printer cycle at a rate of speed insufficient to provide a value of printing stroke energy which is sufficient to effect good quality printing, said moving means effectively moving said printer head and said platen simultaneously into a common printing zone once each printer cycle to cause said loosely held print elements and said platen to simultaneously engage the record sheet positioned in the printing zone between the printing face of said printer head and said platen, whereby the ends of said loosely held print elements are aligned by the impact of the aforesaid engagement in a common printing plane at a value of printing stroke energy which is sufficient to effect a good quality print impression of said character pattern on the record sheet.

2. In a cyclically operable wire printer, the combination of a print impression mechanism of the class described, print wires each having a print end and a control end, a movable printer head wherein the print ends of said print wires terminate in a common plane, a movable platen, means for differentially positioning the control ends of selected ones of said print wires to move the print ends thereof relative the common plane so as to define a character pattern at a printing face, means for loosely holding the ones of said print wires defining the character pattern at the printing face so that the print ends thereof are frictionally movable relative the common plane, means for moving said printer head towards and away from said platen once each printer cycle at a rate of speed insufficient to provide a value of printing stroke energy which is sufficient to effect good quality printing, and means for simultaneously therewith moving said platen towards and away from said printer head a plurality of times each printer cycle at a rate of speed insufficient to provide a value of printing stroke energy which is sufficient to effect good quality printing, whereby said moving means effectively moves said printer head and said platen simultaneously toward one another once each

printer cycle so that the print ends of said print wires at the printing face engage one side of a record sheet at the same time the other side thereof engages said moving platen, the impact of the printing stroke effecting a movement of the print ends of the ones of said print wires defining the character pattern so as to align the aforesaid print ends in a common printing plane at a value of printing stroke energy which is sufficient to effect good quality printing on the record sheet.

3. In a cyclically operable wire printing machine for printing characters on a record sheet, a print impression mechanism comprising a plurality of print wires each having a print end and a control end, a corresponding plurality of print wire casings within each of which respective print wires are frictionally engaged, a movable printer head to which said casings are secured so that the print ends of said print wires terminate in a common plane, means operable on the control ends of said print wires for actuating selective ones of said print wires to move the same within their respective casings so that the print ends thereof form a character pattern at a printing face, said actuated print wires being maintained in a character pattern position by the frictional engagement between each print wire and its respective print wire casing, a movable platen, means for moving said platen into a printing zone a plurality of times each machine cycle and at a rate of speed insufficient to provide a value of printing stroke energy which is sufficient to effect good quality printing, and means for moving said printer head into the printing zone once each machine cycle and at a rate of speed insufficient to provide a value of printing stroke energy which is sufficient to effect good quality printing, said printer head and said platen moving means causing said printer head and said platen to be moved simultaneously into the printing zone once each machine cycle, whereby the print ends of said print wires forming a character pattern and said platen engage during the simultaneous movement thereof to provide a value of printing stroke energy which is sufficient to effect good quality printing on the record sheet of the character pattern at the printing face.

4. In a wire printing machine for printing characters on a record sheet, a print impression mechanism comprising a plurality of print wires; a corresponding plurality of print wire casings within each of which respective print wires are frictionally engaged; a movable printer head to which said casings are secured so that said print wires terminate at one end in a common plane to constitute a printing face; a movable platen including a resilient band, a rotatable arm, and a striker roller attached to one end of said arm for imparting a percussive stroke to said band once for each rotation of said arm so as to move said band into a printing zone; means for rotating said arm; means for actuating selected ones of said print wires to move the same within their respective casings relative to the common plane in order to form a character pattern at the printing face; and means operative in a timed relation to said arm rotating means for moving said printer head into the printing zone so that said band and the ends of said print wires forming the character pattern effect a print impression of the character pattern on the record sheet.

References Cited in the file of this patent

UNITED STATES PATENTS

1,489,015	Sherman	Apr. 1, 1924
1,562,893	Kruse	Nov. 24, 1925
1,572,062	Ahlburg	Feb. 9, 1926
1,695,271	Caplinger	Dec. 18, 1928
1,759,476	Allen	May 20, 1930
1,838,584	Smith	Dec. 29, 1931
1,902,060	Dechene	Mar. 21, 1933
2,184,510	Adams	Dec. 26, 1939
2,524,127	Johnson	Oct. 3, 1950
2,566,944	Last	Sept. 4, 1951
2,632,386	Hyland	Mar. 24, 1953
2,653,534	Wockenfuss	Sept. 29, 1953