

- [54] **METHOD OF AND MACHINE FOR STORING DATA**
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[52] U.S. Cl.197/1 R, 197/17, 197/83, 197/172
[51] Int. Cl.**B41j 3/50**
[58] Field of Search.....197/1, 83, 1.1, 181, 17; 346/74; 340/174.1; 235/61.12, 61.111

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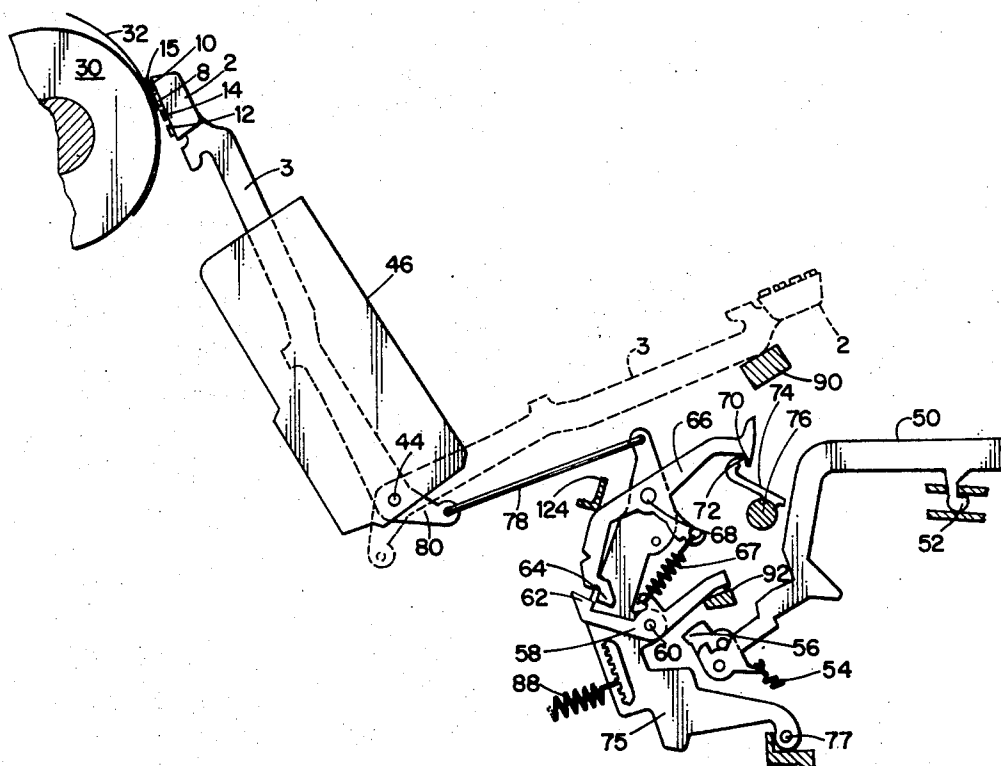
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[57] **ABSTRACT**

A method of and machine for storing data by placing in superimposed relation a substantially invisible machine readable coded symbol and a visible man readable character in the same area on a surface where the material may be subsequently man read or machine read.

6 Claims, 27 Drawing Figures



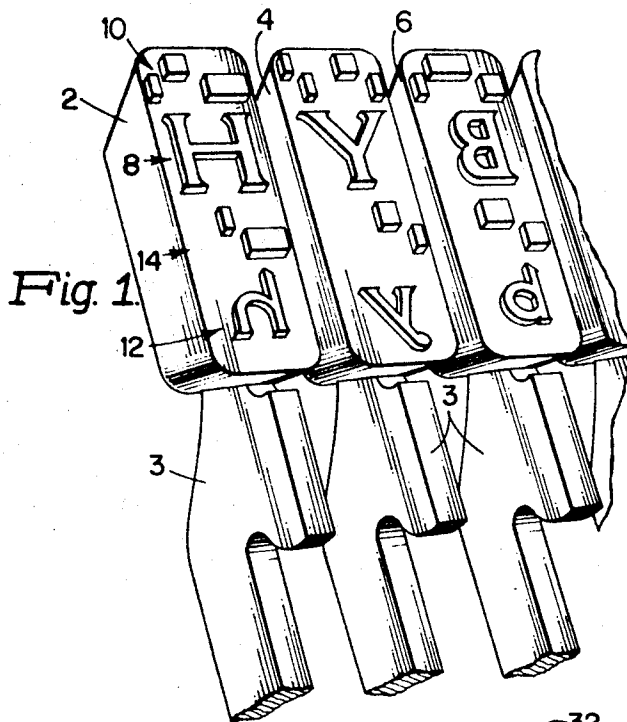


Fig. 1

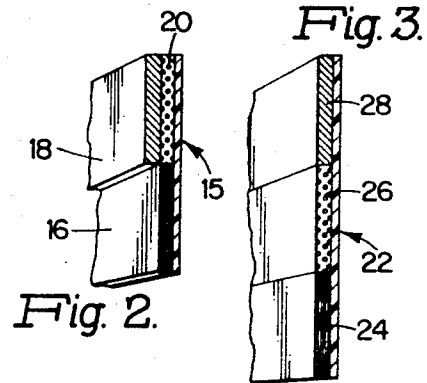


Fig. 2.

Fig. 3.

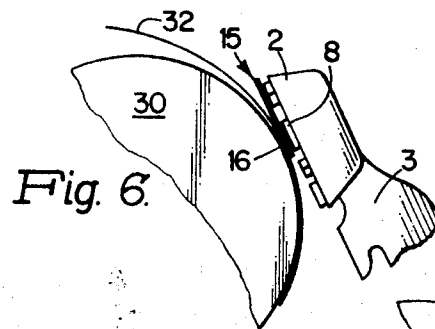


Fig. 6.

Fig. 5.

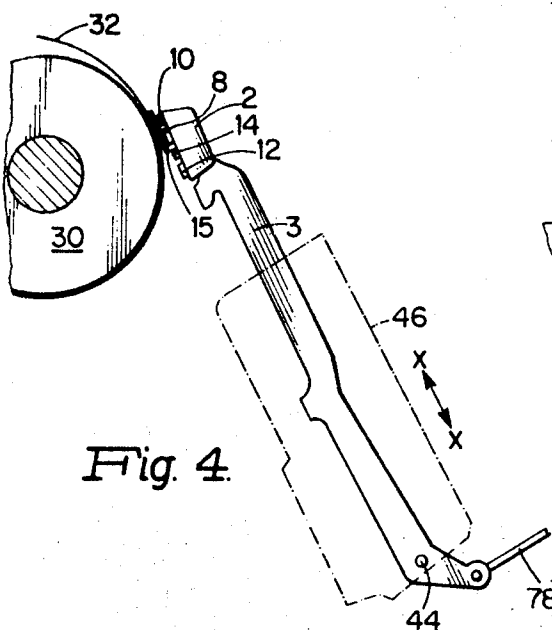


Fig. 4.

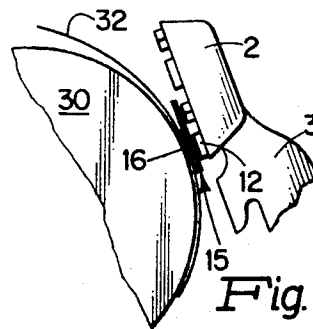


Fig. 8.

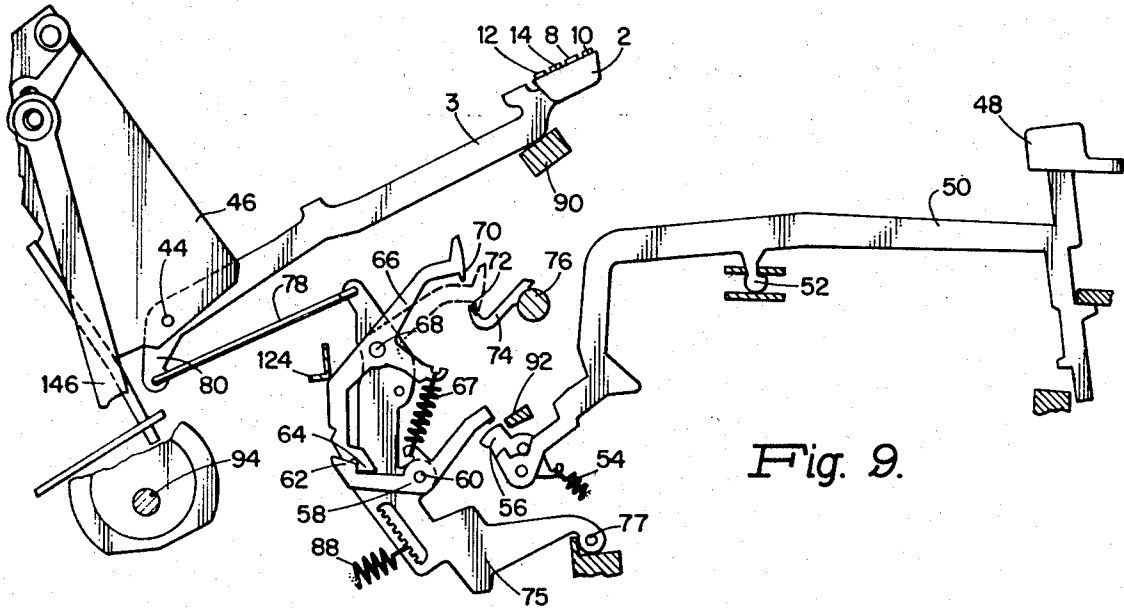
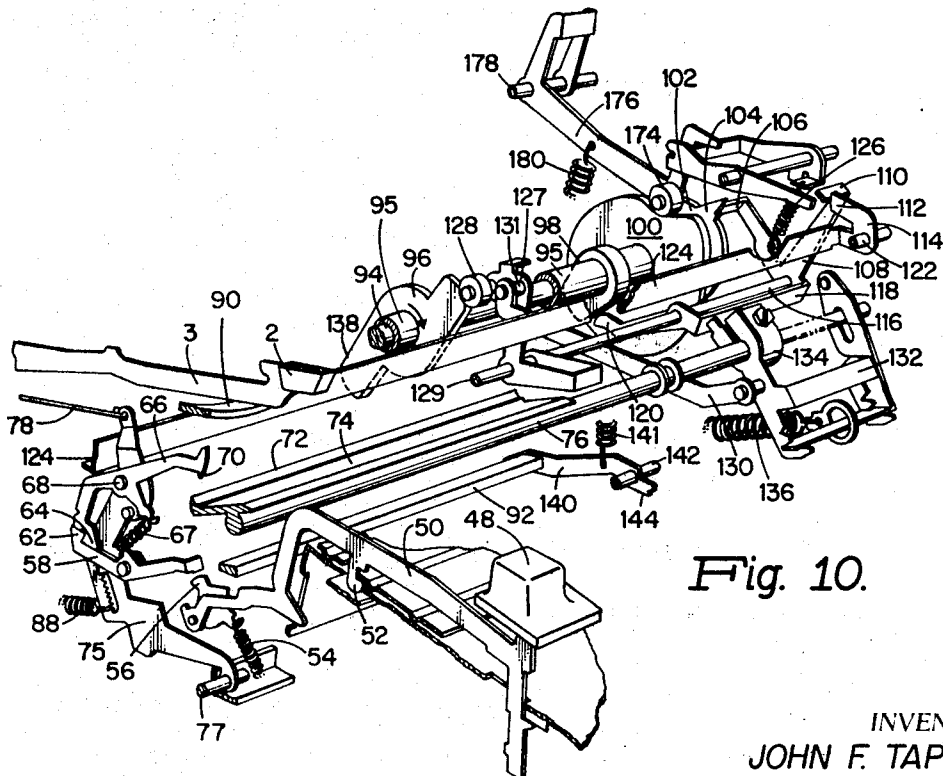
Fig. 7.

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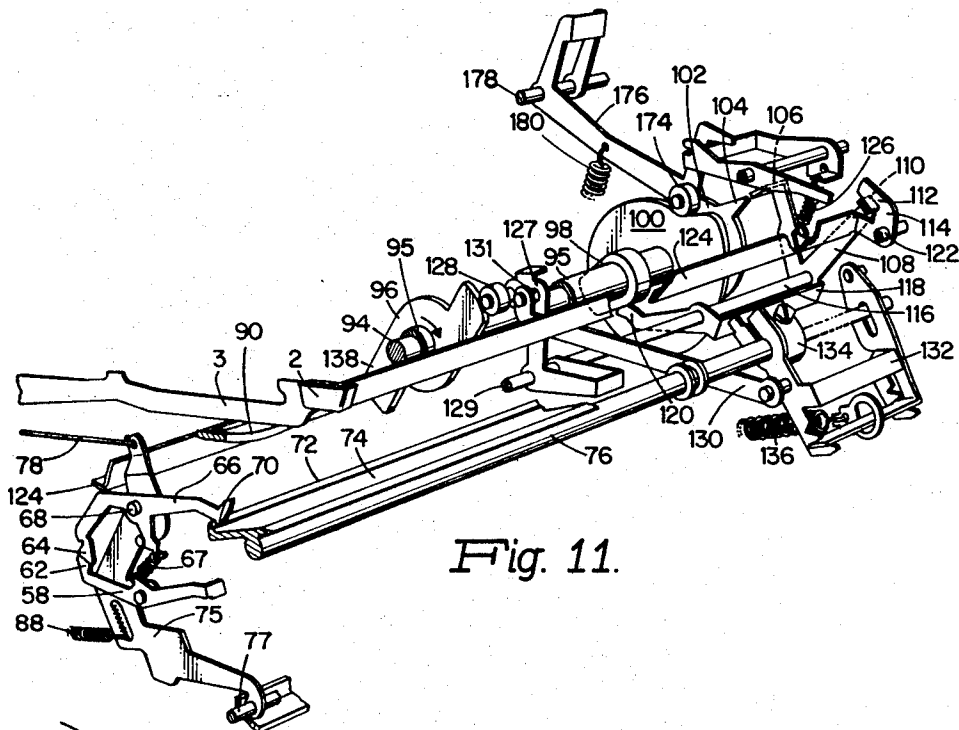


Fig. 11.

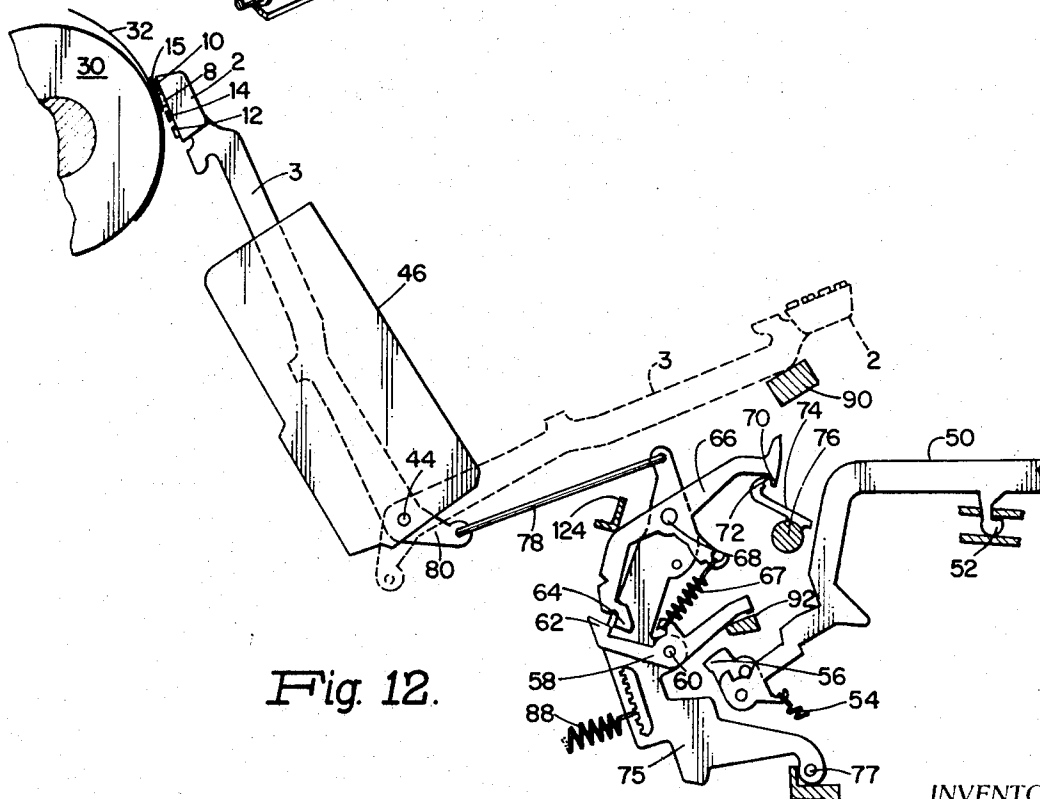


Fig. 12.

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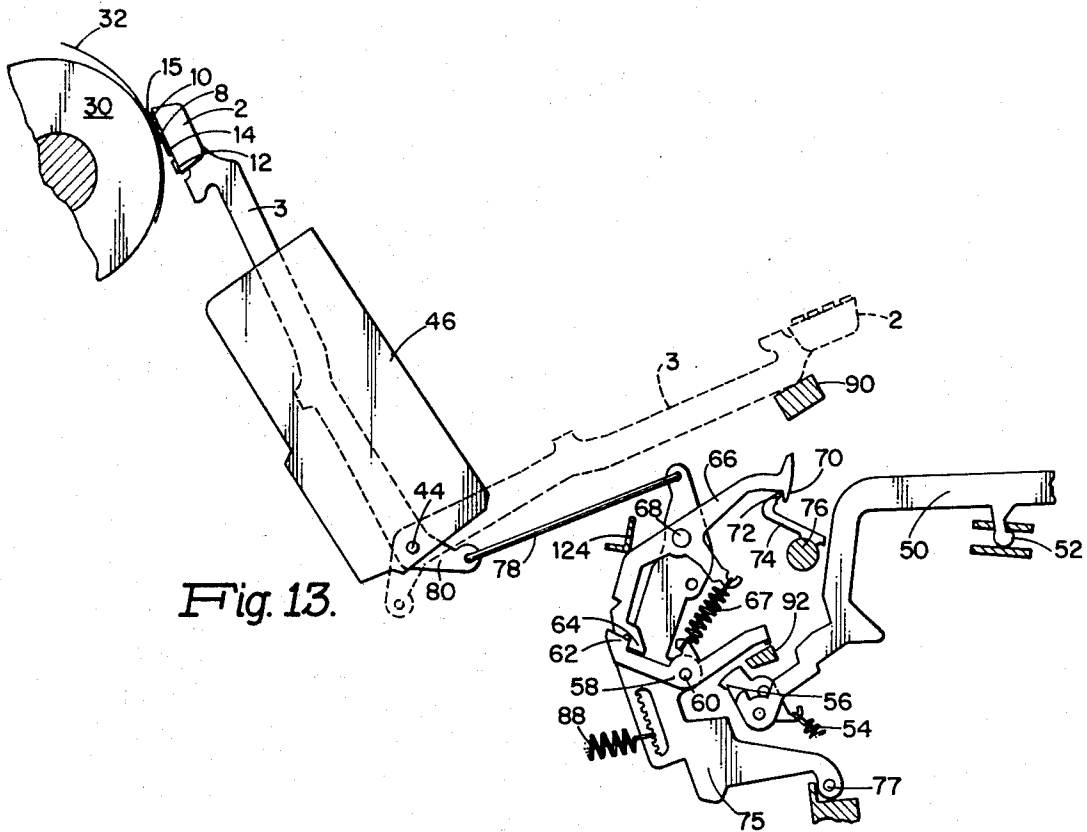


Fig. 13.

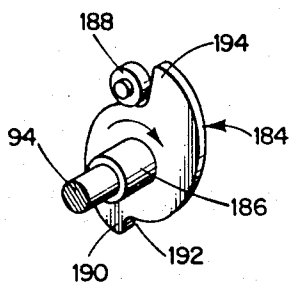


Fig. 20A.

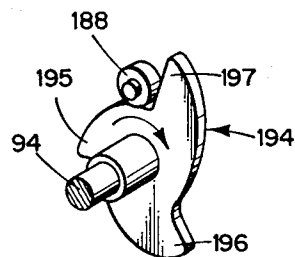
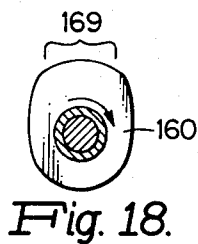
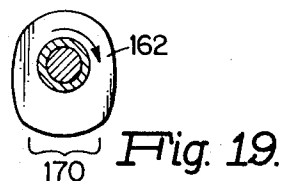
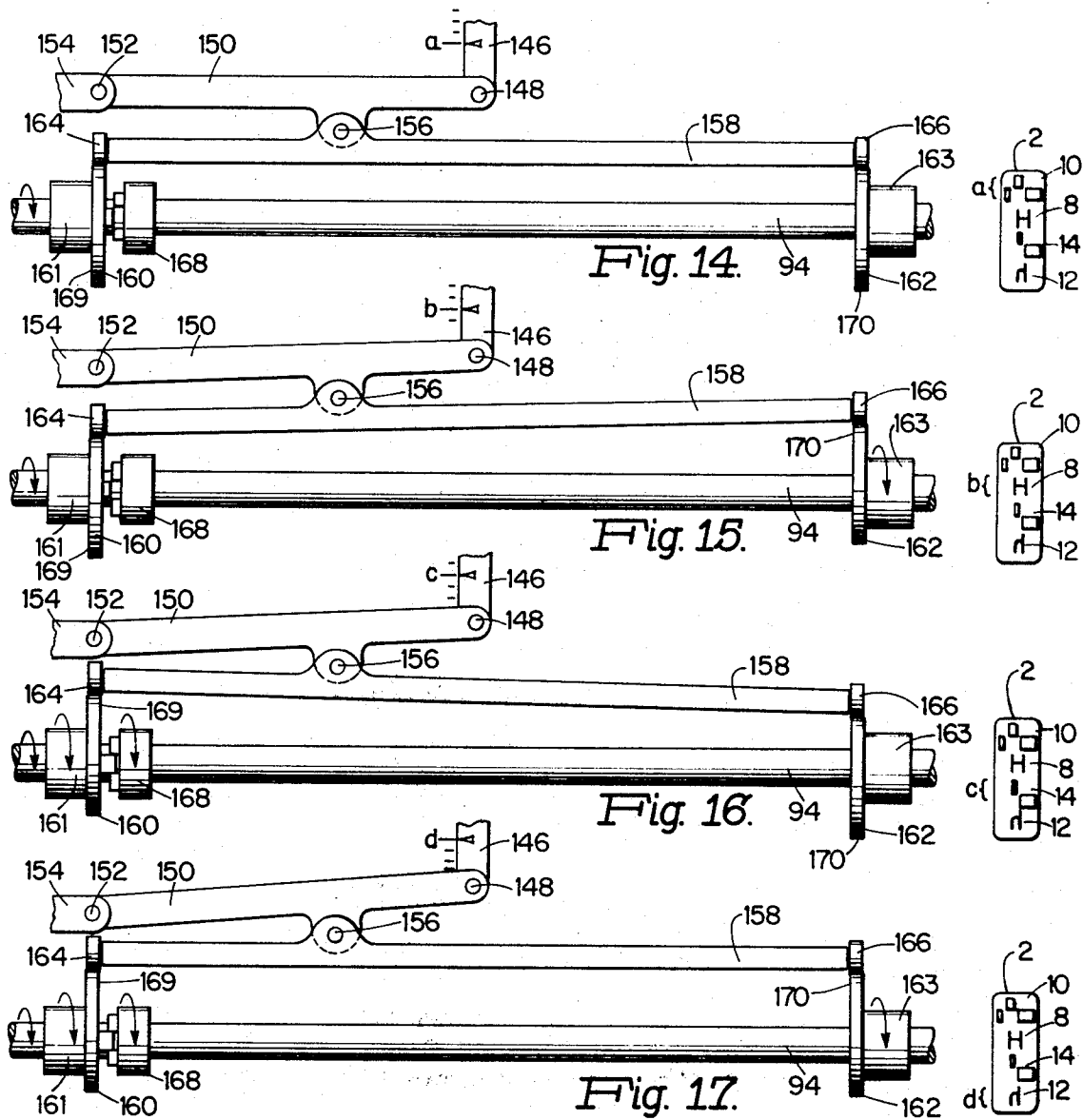


Fig. 20B.

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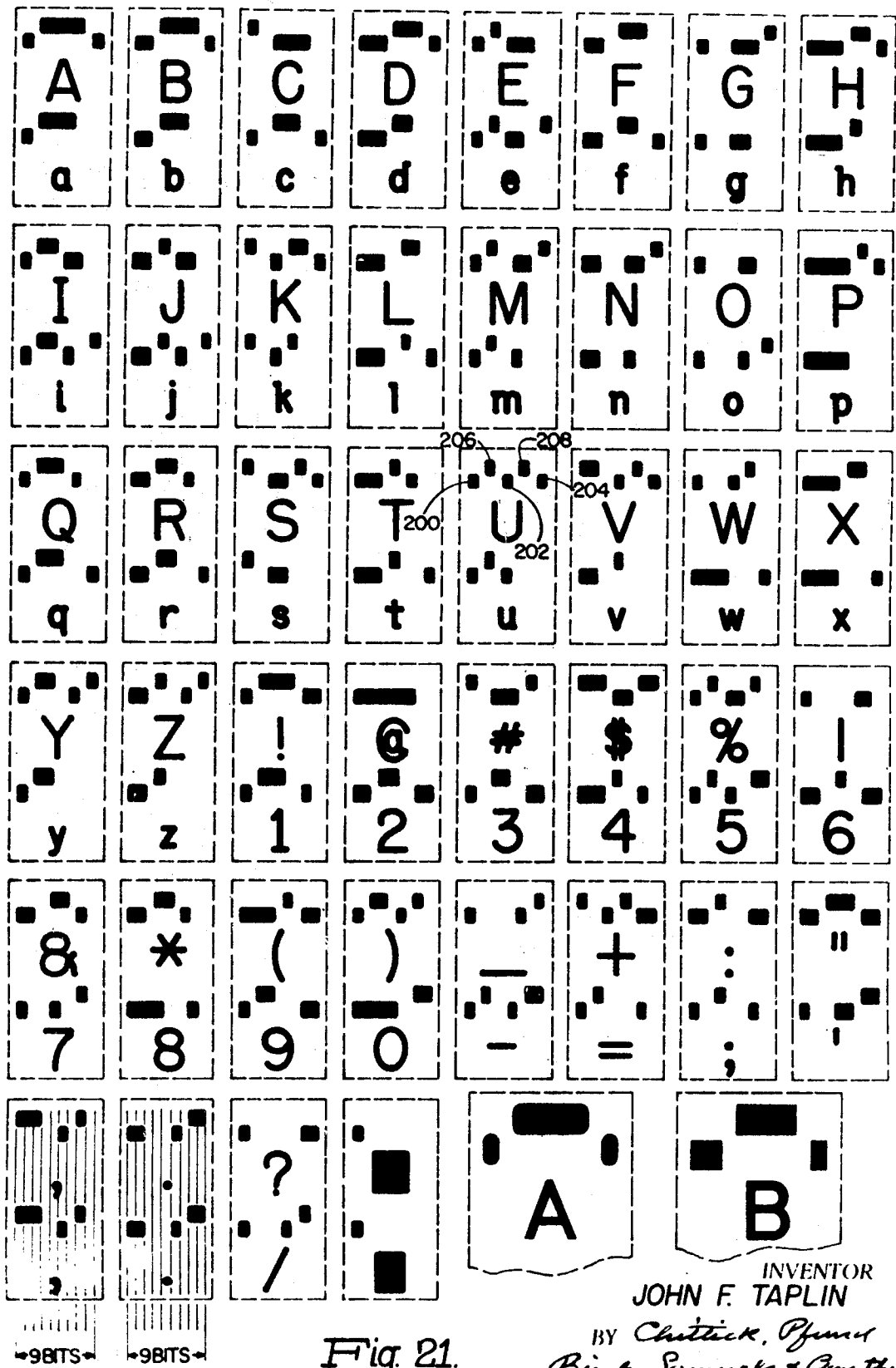
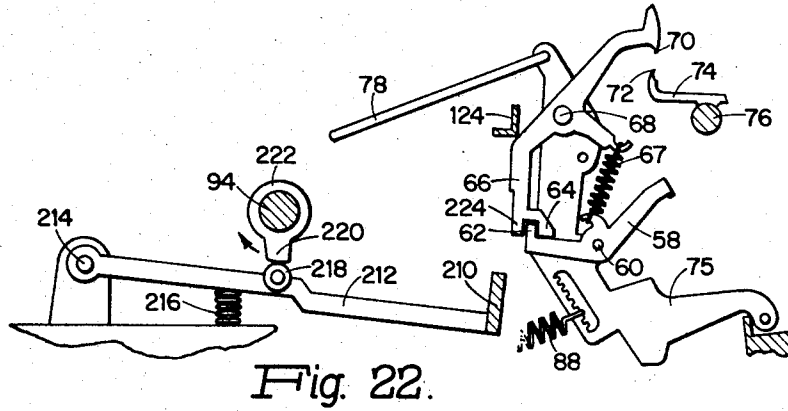
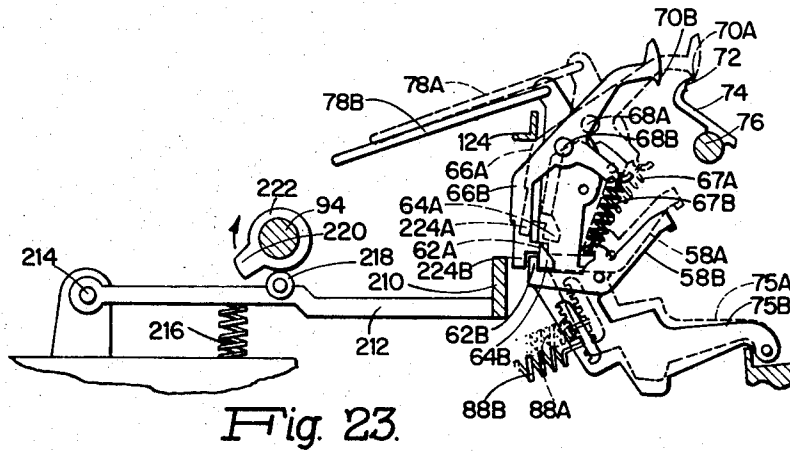
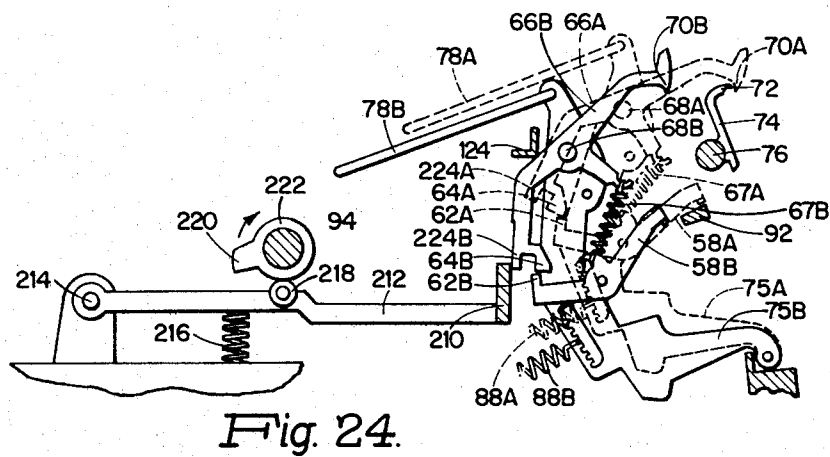


Fig. 21.

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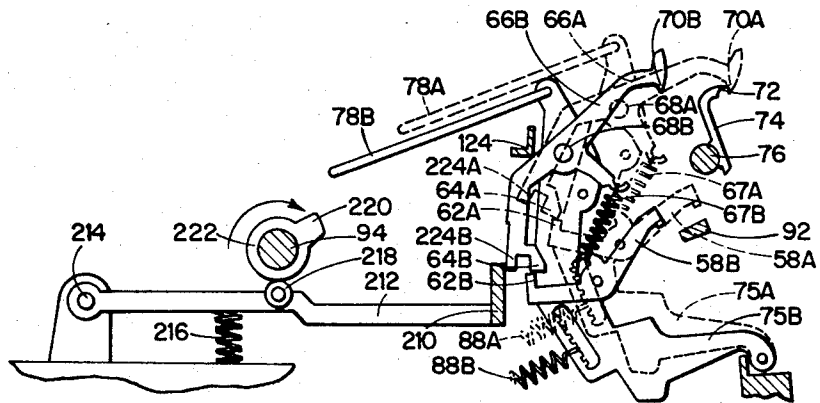


Fig. 25.

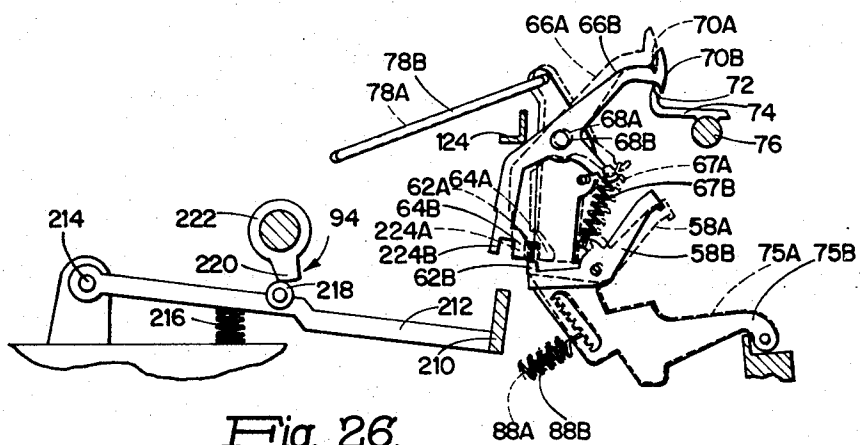


Fig. 26.

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METHOD OF AND MACHINE FOR STORING DATA

BACKGROUND OF THE INVENTION

This invention relates to the field of information recording and storage in which the record is both man and machine readable and particularly to arrangements for producing such records which provide characteristics not heretofore available.

In the prior art, a large variety of methods, apparatus and record structures exist which provide both man and machine readability. Generally, a code representation of a character is presented adjacent the man readable character in a form which can be sensed by a magnetic, optical, electrical or other characteristic sensitive detector, the code impression being made to exhibit the suitable characteristic. Systems of this type which may be represented by the U. S. Pat. to Rand, No. 2,788,879, store information with a relatively low density since a separate space assignment for each man readable and machine readable character impression must be provided. In an effort to overcome this shortcoming and provide a high density storage medium, it has been proposed to type the man readable characters for a given line superposed on the magnetic code impressions for the previous line. Obviously, for this type of overlap of the man and machine readable characters, the machine readable character must be recorded in a manner which does not interfere with the visual recognition of the man readable character and for this purpose special ferro-magnetic record sheets have been proposed as shown in the U. S. Pats. to Hagelbarger No. 2,958,568 and to Brand No. 3,045,218. In these patents, since the record sheet is uniformly ferro-magnetic, it is necessary, in order to encode magnetically the information, that the code pattern appear as permanently magnetized portions of the uniformly magnetic surface. Systems which require specific magnetization of the record sheet, of course, are subject to obliteration by accidental exposure to magnetic fields or other phenomena which reduce the permanent magnetization of the code pattern.

The U.S. Pat. to Unk et al. No. 3,378,674 provides a similar arrangement with printing and machine readable magnetic code on opposite sides of a record carrier and further suggests electrical conductivity, dielectric constant, or fluorescence as the physical characteristic which forms the machine readable code and corresponding detector element. Where the machine readable code extends to overlap a portion of the man readable text, the advantages of sensing a non-magnetic characteristic such as dielectric constant or fluorescence is recognized since these materials can be readily obtained in transparent inks so as not to obliterate or otherwise alter the visual appearance of the man readable character.

Other forms of permanently magnetized code patterns have been suggested where the code pattern occupies the same space assignment as the man readable character. These arrangements generally involve a ferro-magnetic substrate or a magnetic ink with the code pattern magnetization of the magnetic medium taking place as the key strikes to produce the man readable character. The U.S. Pats. in this category include Jones No. 2,791,310, Linger No. 2,751,433 and Chaimowicz No. 2,784,392. These residually magnetized code patterns are subject to erasure and the

other disadvantages associated therewith as previously described.

In an attempt to combine the man and machine readable information in the space assignment of the individual character, various arrangements using stylized-type fonts either incorporating or in combination with additional coding marks have been employed. Examples of these arrangements include the U.S. Pats. to Feissel No. 3,004,696, Van Berket et al. No. 3,257,545, Perotto No. Re.26,744, Kosten et al. No. 2,963,220, Goldstern No. 2,944,735, German Pat. No. 714,685 to Maul, and Schlieben No. 3,227,861. These arrangements involve obvious disadvantages in terms of flexibility in the choice of type fonts and the readability of the characters due to the distortions required for accommodating the coded information.

The objective of providing an ordinary and unrestricted-type font which is readable by man with additional code markings which are substantially invisible and/or unobjectionable and which do not require the allocation of storage surface outside the individual character space assignment has eluded all of the foregoing prior art concepts. To the extent that these features are desired, the provision of a man and machine readable record which is unrestricted in terms of ordinary office procedures remains to be achieved. Further effort in the prior art directed to this end is represented by the British Pat. No. 924,738 where an ordinary character such as the numeral "2" is printed with magnetic ink and the portions of the printed character representing machine code are formed as slight mechanical depressions within the outline of the "2." The magnetic reading head is conditioned to sense the change between the flat portion of the record sheet and those portions of the man readable character which are depressed below the surface of the sheet to recognize the machine readable code. Another disclosure of this "code on character outline" concept which, however, gives no suggestion of how the result could be achieved is found in the U. S. Pat. to Seigel No. 3,486,006, column 3, lines 23-30, where again the digit "2" is suggested to be printed with a self-contained machine readable code located within the confines of the man readable character outline.

The present invention provides an information system which has not been achieved in the prior art in which a man readable document which is unrestricted as to type font or number of characters to be presented and which appears as an ordinary typewritten letter, is at the same time readily and accurately machine readable. This system provides for all the desired code characters each of which is substantially invisible and therefore unobtrusive to the human reader, each of which is confined within the character space assignment for each visible man readable character thereby making the application and the eradication (for correcting mistakes) of each character automatic both for the man and machine readable record thereof and thereby giving an efficient high density storage system which can be easily originated and readily man read or machine processed without any of the disadvantages inherent in the prior art. The invention further provides a code format which enhances the basic invention by being readily detectable and free from such disad-

vantages as small spacing between code elements and the possibility that the sensing mechanism will not be able to detect the correct code due to filling in of the space between the printed code elements. As contemplated, the code format will be readable asynchronously, i.e., with a starting bit for each character or synchronously, i.e., without a starting bit for each character, to produce an electrical signal sequence which is directly usable and compatible with existing machine data processors, particularly the USASCII code.

The foregoing advantages are achieved by a record medium which consist essentially of an ordinary substrate such as paper and a message in the form of ordinary visually recognizable characters formed thereon by any conventional means such as a typewriter and which has associated within the space assignment of each such character a code pattern representing that character which is substantially invisible. As disclosed herein, the code pattern is formed by an additional impression in the space assignment allocated for a given visible character with the code printed in a suitable medium for recognition by the detector used in the machine reading operation. For example, the preferred embodiment disclosed herein prints the code pattern as an array of marks printed in magnetic ink or magnetizable particles. Hereinafter, whenever the term magnetic ink, magnetic particles, or magnetic material is used, it will be understood to include deposits of paramagnetic particles which either are unmagnetized or have been previously magnetized or may thereafter be magnetized. The magnetic ink is substantially the same color as the substrate used as the record carrier or the magnetic ink has been overlayed either simultaneously or sequentially with an obliterating substance which substantially matches the color of the substrate. Over this code impression, the regular visible character is printed with an ordinary typewriter ribbon ink transfer process. The term ink as used herein refers not only to conventional ink which produces a visible character but also to any other material transferable from a ribbon to the substrate which will likewise produce the required visible character. Alternatively, the visible character can be printed in the conventional typewriter ribbon transfer process and the code pattern can be printed thereover in the same space assignment with an invisible or visible spectrum transparent ink which exhibits fluorescent or dielectric properties that permit the pattern to be sensed by an appropriate detector in the machine reading operation. In either case, the man readable character appears substantially unaltered relative to the same character prepared in an ordinary manner such as, for example, by a typewriter, but with the capability of being machine read by simple and inexpensive apparatus. Thus, the information contained in the visible man readable message can be retrieved as electrical signals for transmission, storage, record reproduction or other similar uses.

The deposit of magnetic material in code form on the paper or substrate followed by the deposit of the visible readable character thereover is preferably accomplished through the use of a specially devised typewriter and ribbon in which the type slugs operable by the keys on the typewriter contain (1) a type form for imprinting the coded invisible symbol, and (2) a

second type form vertically adjacent the coded type form for imprinting the visible readable character. The typewriter is so constructed that upon the striking of any key by the operator, the type bar will automatically make two successive very rapid strokes (hereinafter often called the double peck) against different areas of a novel ribbon or tape. The term ribbon as used herein will be understood to include tapes capable of making the required deposits on the substrate. This double peck occurs before operation of the escapement which when actuated advances the platen one space following the successive strokes at the same location. The segment that carries the type bars is raised or lowered, as the case may be, between the rapid successive type bar strokes so that on the second stroke of the type bar, the visible character will be applied directly over the invisible coded symbol made by the first stroke of the type bar. The special ribbon is appropriately moved vertically in timed relation with the type bars to present in the preferred sequences the magnetic material to the coded type for the first stroke and regular ink or equivalent for the second stroke. Thus, upon the depression of any key on the typewriter, a double peck of the type bar occurs, along with a corresponding shift of the segment and ribbon between pecks so that superimposed impressions are made in the same assignment space.

In the prior art relating to electrically operated typewriters, a so-called ribbon alternator is well known and in common use. This device operates to raise the ribbon to align the upper half of its width with the line of typing so that when a first selected key is depressed the ribbon is engaged by the corresponding type of that key at a position in the upper half of the ribbon. The ribbon then, at the end of that typing stroke, descends to its original position clear of the typed character. When the next key is depressed, the ribbon rises to a second higher position so that the type of the next key engages the ribbon at a position in the lower half of the ribbon. This action is repeated throughout the length of the ribbon as it advances step by step past the typing position during the typing operation. The result is that all of the ribbon is utilized with alternate typing strokes being made successively on the upper and lower halves of the ribbon.

This known ribbon alternator mechanism is used in the typewriter of the present invention to serve the purpose of moving to first and second positions a specially prepared ribbon which has on one half magnetic camouflaged particles or other equivalent material and on the other half conventional visible ink. The ribbon alternator functions in the present invention so that on the first peck of the type bar, the magnetic ink part of the ribbon will be in position to receive the blow of the coded symbol, and on the second peck of the type bar, the conventional ink part of the ribbon will be in position to receive at the same location on the surface the blow of the readable character of the type bar. Ribbons with two portions impregnated respectively with magnetic material and non-magnetic material are shown, for example, in the U.S. Pat. to Rand No. 2,788,879, while the U.S. Pats. to Wolowitz Nos. 3,114,447 and 3,141,539 show a two-part ribbon with regular ink and camouflage material.

It will be understood, of course, that the typewriter mechanism will also include manually controllable means for shifting from lower to upper case, and there will be coded symbols vertically adjacent for all upper and lower case letters as well as for all numbers and other conventional characters such as the period, comma, parenthesis, dollar sign, etc.

In summary, the invention contemplates in the preferred embodiment that upon the actuation of a key of the typewriter, there will be an immediate deposit in the assignment space of a coded substantially invisible symbol of magnetic material capable of being read by machine, followed instantly by the impressing of a visible man readable character directly thereover in the same assignment space. This result is achieved through the use of a novel typewriter mechanism which, following the actuation of any key, will cause the related type bar to strike twice in rapid succession and to shift vertically between strikes along with a corresponding vertical shift of the ribbon whereby the coded magnetic material and the visible readable character are successively deposited in the same assignment space on the paper.

It will also be understood that while reference herein is made to a typewriter as the means for accomplishing the steps explained above, the invention is not limited specifically to a typewriter per se, but contemplates any form of printing mechanism which is capable of applying successively in the same space a visible readable conventional character and an invisible coded symbol of detectable material.

It is further to be understood that when reference is made to a sheet of paper as being the material to which the readable and invisible characters are applied, any suitable symbol and character receiving substrate is contemplated as being within the scope of the invention.

Furthermore, it is to be understood that from the standpoint of rendering the magnetic or other material invisible, it might be preferred in some cases to utilize three successive strokes of the type bar in which the first stroke applies visible magnetic ink in code form. The second stroke of the type bar, without a segment shift but with a ribbon shift, would be against another part of the ribbon which would apply camouflaging material over the originally visible magnetic ink. The third stroke of the type bar, after the segment shift and ribbon shift, would apply the visible readable character directly over the now invisible coded symbol.

Any power driven typewriter that may be used to achieve the aforesaid overprinting may preferably include means for preventing mechanical interference between successively actuated type arms where the second type arm has been inadvertently placed in operation before sufficient completion of the typing action by the first type arm. This so-called "memory storage system" tends to overcome the machine stoppages that regularly occur with a typist who is prone to indulge in "burst" typing. "Burst" typing means that two or more keys are successively depressed within too short a time interval, resulting in mechanical interference between two or more type arms trying to print at substantially the same time within the same space.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows in enlarged scale portions of three adjacent type bars and type slugs with capitals and lower case letters and their related code symbols.

FIG. 2 is a schematic showing of a two-part ribbon.

FIG. 3 is a schematic showing of a three-part ribbon.

FIG. 4 illustrates the general arrangement of a platen, paper, ribbon and type slug striking thereagainst.

FIG. 5 is a fragmentary enlarged view similar to FIG. 4 showing the upper case code striking against the upper part of the ribbon.

FIG. 6 is similar to FIG. 5 showing the upper case letter striking against the lower part of the ribbon.

FIG. 7 is similar to FIGS. 5 and 6 but showing the lower case code striking against the upper part of the ribbon.

FIG. 8 is similar to FIGS. 5, 6 and 7 but showing the lower case letter striking against the lower part of the ribbon.

FIG. 9 is a vertical section of part of a typewriter capable of performing the method of the invention.

FIG. 10 is a perspective view showing some of the mechanism of FIG. 9 along with other elements that are placed in operation upon the striking of a key.

FIG. 11 is a view similar to FIG. 10 showing the position of the elements immediately after the striking of the key. The key, key lever and block bail have been omitted for simplification.

FIG. 12 is a vertical section similar to FIG. 9 showing the position of the parts during the first strike of the type bar. FIG. 13 is a view similar to FIG. 12 showing the relatching of the levers after the second strike of the type bar.

FIGS. 14, 15, 16 and 17 illustrate the cam mechanisms and associated levers that cause the automatic shifting of the type bar supporting segment from the code striking position to the visible letter striking position in both upper and lower case.

FIG. 18 is illustrative of the cam that shifts the type from the upper to the lower case upon operation of the shift key.

FIG. 19 is illustrative of the cam that automatically shifts the type segment from code to letter position between strikes of the type bar.

FIG. 20A illustrates a two lobe cam for actuating the ribbon alternator using a two-part ribbon as shown in FIG. 2.

FIG. 20B illustrates a three lobe cam for actuating the ribbon alternator using a three-part ribbon as shown in FIG. 3.

FIG. 21 illustrates a complete font of type in which each letter or character has associated therewith one symbol of a so-called nine bit code.

FIG. 22 shows a modified construction which achieves proper sequential operation of two separate type arms in which the key of the second type arm has been depressed before sufficient completion of the operation of the first type arm.

FIG. 23 shows in dotted line initial movement of the levers and linkages causing actuation of a first type arm whose key has been depressed. The pull link bail has moved to blocking position.

FIG. 24 shows in dotted line further movement of the levers and linkages actuating the first type arm and in

solid line the movement of the pull link of a second type arm released by premature actuation of a second key. This second pull link is blocked by the bail.

FIG. 25 shows in dotted line the position of the parts when the second strike of the first type arm is being completed and the bail is still blocking the released pull link of the second type arm.

FIG. 26 shows the bail in unblocking position after completion of the second strike of the first type arm. The pull link of the second type arm has been freed permitting it to engage the type action bail so that the second type arm related to the prematurely struck second key can now operate without interference with the first type arm.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The method of the invention may be carried out through the use of a conventional electric typewriter, such as, for example, an Olivetti-Underwood, Model Editor 2, Ser. No. E13-6058631 modified to operate in the following way. As shown in FIG. 1, each of the type slugs on the ends of the type bars 3 is constructed to include not only the upper and lower case letters and other conventional symbols, but also appropriately related code symbols. Illustrated in FIG. 1, for example, the type slugs 2, 4 and 6 carry the letters H, Y and B which are conventionally adjacent each other in a typewriter. The capital letter H referred to by the numeral 8 has above it the code symbol 10 for this letter, and the small letter h referred to by the numeral 12 has above it its code symbol 14. Similarly, the capital letters Y and B have their code symbols thereabove, and the lower case letters y and b have thereabove their code symbols. All of the rest of the letters and numerals and other conventional punctuation forms, such as comma, period, parenthesis, etc., carried by the other type bars have appropriate code symbols thereabove. The construction that will be explained is capable of shifting the type slug from upper to lower case in accord with the typist's requirements and other automatically actuated means is provided so that when any key is struck the code symbol will first be recorded on the paper to be followed by automatic shifting of the segment so that on the second strike the visible letter will be imprinted over the code symbol in the same space assignment.

FIG. 2 schematically illustrates a ribbon 15 which may be used to carry out the method. The lower part of the ribbon as at 16 is impregnated with conventional ink and when engaged by the type will leave a visible man readable impression on the paper. The upper part of the ribbon is shown in two layers. The outer layer 18 is comprised of magnetic particles and the intermediate part 20 is a camouflaging material. Thus, when the ribbon 15 is hit by a code symbol at the upper part thereof, the magnetic particles 18, camouflaged by a superimposed layer 20, will be placed on the paper. Alternatively, the ribbon shown in FIG. 2 could be simply half ordinary ink and half transparent fluorescent ink which is visible in ultraviolet light. Using such a ribbon, the visible characters would be impressed first and overlaid with its invisible code impression. Obviously, this sequence can also be used for any transparent or invisible ink that can be detected to sense the code pattern.

The method of the invention can also be carried out through the use of a ribbon 22, shown in FIG. 3, having a regular ink portion 24 at the bottom, a camouflage material portion 26 at the middle, and a magnetic particle area 28 at the top.

The ribbon alternator mechanism made according to conventional construction is capable of shifting the two or three-part ribbon up and down to present the required surface to the code symbol 10 or 14 or letter 8 or 12 as the case may be.

The general operation of the typewriter mechanism for carrying out the invention is shown in FIG. 4 in which there is a conventional platen 30, a sheet paper 32, a ribbon 15, such as illustrated in FIG. 2, and a typeslug 2 (such as shown in FIG. 1) having on its face the upper case letter 8, the upper case code 10, the lower case letter 12, and the lower case code 14. The type bar 3 which is pivoted at 44 on the segment 46 is shown in FIG. 4 in the position in which the upper case code 10 is imprinting invisible magnetic particles on the paper 32.

FIGS. 5, 6, 7 and 8 illustrate in more detail the manner in which the type slug 2 is shifted with respect to the platen 30 to imprint any one of the four elements 8, 10, 12 or 14 thereon and the ribbon 15 is shifted to present the proper part of the ribbon for the code symbol or letter being imprinted. Thus in FIG. 5 the upper case code symbol 10 is engaging the upper part 18 of ribbon 15 to impress the upper case code symbol on the paper 32. In FIG. 6, the type slug 2 has been shifted upward along with ribbon 15 so that the capital letter 8 will engage the lower part 16 of ribbon 15 to imprint a visible letter over the invisible symbol previously applied in FIG. 5.

In FIG. 7, the slug 2 has been shifted further upward so that the lower case code symbol 14 will engage against the upper part 18 of ribbon 15 to imprint on the paper 32 the lower case code symbol in camouflaged magnetic ink.

Finally, in FIG. 8, the type slug 2 has been shifted to a maximum upward position and at the same time the ribbon 15 has been shifted to its upper position so that the lower case letter 12 engages the lower part 16 of ribbon 15 to imprint on the paper a visible lower case letter over the invisible lower case code symbol.

Reference will now be made to FIGS. 9, 10, 11, 12 and 13 to explain the operation of the typewriter mechanism which upon depression of any key of the typewriter causes an automatic high speed double peck of the type bar along with an automatic shift of the segment in which all of the type bars 3 are pivoted so as to produce on the paper a visible symbol directly over a coded symbol of camouflaged magnetic particles in the same assignment space. Throughout the following explanation of the herein disclosed mechanism, the coded symbol of magnetic particles will always be deposited on the paper first and the visible letter or other character will be placed thereover. The invention, however, contemplates that the order of imprinting may be reversed if suitable detectable substances are used which can be laid over visible conventional letters without impairing the visibility of such letters. This may be accomplished readily with the same typewriter mechanism by merely interchanging the position of the code and character portions on the type slugs 2, 4, 6, etc., or by changing the shift sequence of the segment and ribbon.

FIG. 9 shows the mechanism related to one key and one type bar of the typewriter. FIG. 10 shows most of the mechanism of FIG. 9 in perspective, along with a clutch and cam operated means that cause the automatic double peck after the key has been pressed.

The key 48 is on the end of key lever 50 which is pivoted at 52. The key is held in UP position by a tension spring 54 at its other end. Depression of key 48 causes the end 56 to move clockwise to engage pull link latch lever 58 turning it counterclockwise through a small angle about pivot 60. This frees the upturned latch end 62 from engagement with a cooperating finger 64 on the lower end of pull link 66 which then under the force of the spring 67 pivots clockwise on pivot 68 so that the hook end 70 swings down to overlap and engage the upwardly turned hook edge 72 of the type action bail 74 carried by a shaft 76 (see the dotted line position in FIG. 9).

The two pivots 60 and 68 are mounted on a bell crank 75 one end of which is carried by a fixed pivot 77. As soon as the hook end 70 has entered into engagement with the hook 72 of bail 74, shaft 76 is caused to rotate by cam mechanism to be explained hereinafter through a substantial angle of about 70° to the position illustrated in FIG. 12. This movement of bail 74 and link 66 causes the bell crank 75 to be swung clockwise, pulling with it link 78 which is connected to a short lever arm 80 of type bar 3 which is pivoted at 44 on the segment 46. This motion results in the type bar 3 being swung counterclockwise from the dotted line position of FIG. 12 to the full line position at which the type slug 2 engages the appropriately located ribbon 15 to imprint the symbol or letter as the case may be on the paper 32 mounted on the platen 30.

As soon as the type slug 2 has made its engagement 12 the paper 32 through the intermediate ribbon 15, the shaft 76 rotates counterclockwise from the position of FIG. 13 back to that in FIG. 9. At the same time, bell crank 75 under the influence of tension spring 88 and the rebound action of slug 2 from the platen 30 cause the return of type finger 3 to its original inactive position resting on the type bar nest 90.

Since a second stroke of type bar 3 must be made immediately without a second depression of key 48, it is essential that the hook end 70 of pull link 66 remain in engagement with hook 72 of the bail 74 as shown in FIG. 11. Ordinarily, in a conventional single stroke typewriter, with link 66 in the position shown in FIG. 12, re-engagement of the finger 64 with latch end 62 would occur by virtue of the pull of tension spring 67 turning latch lever 58 clockwise. This relatching, however, is prevented after the first strike of the type bar 3 by the interposition of a relatch block bail 92 beneath the right hand end of latch lever 58. Thus, as bail 74 is rotated counterclockwise from its position in FIG. 12 to its original position in FIG. 9, spring 67 holds the hook end 70 in the path of the bail hook 72 as the bell crank 75 shifts under the pull of spring 88 from its typing position in FIG. 12 to its rest position in FIG. 9. This condition is illustrated in FIG. 11.

As the type bar 3 is returning from its first typing position against platen 30 as in FIG. 12, to its first rest position as in FIG. 11, the segment 46, through appropriate action of a then rotating cam is caused to move upwardly a sufficient distance so that the second time the type bar 3 is actuated (which takes place im-

mediately after its first return to the position of FIG. 11), the letter related to the code symbol imprinted on the first stroke will be imprinted directly over the code symbol. The second movement of type bar 3 occurs by virtue of a second turning of shaft 76 from the position of FIGS. 9 and 11 to that of FIGS. 12 and 13, which turning is accomplished through the further rotation of the cam mechanism previously alluded to. At the time of the second striking of the platen 30 by the type arm 3, which is illustrated in FIG. 13, the relatch block bail 92 will have been shifted downward to a position clear of the right end of latch lever 58. The result now is that the latch ends 62 and 64 of levers 58 and 66 automatically relatch themselves under the pull of spring 67 and as the bail 74 (see FIG. 10) turns downward from the position in FIG. 13 to its original position as in FIG. 9, the hook ends 70 and 72 separate as the bell crank 75 is pulled by spring 88 to the left to its original position. The maintenance of pull link 66 in its maximum counterclockwise position on pivot 68 when bell crank 75 is returned to the position of FIG. 9 by spring 88 results in disengagement of a clutch which stops any further oscillation of the shaft 76 and resets the mechanism to await the next actuation of any key 48.

In summary, depression of key 48 puts in operation power driven means that causes the slug 2 on type bar 3 to strike two successive blows against the paper 32 on platen 30, but between blows the segment 46 is shifted upward so that the visible letter of the selected key is impressed on the second blow directly over the invisible magnetic particles previously deposited on the first blow.

Attention is now called to FIG. 10 which illustrates in more detail the mechanism that causes the automatic actuation of the parts heretofore discussed.

A power shaft 94 placed in continuous rotation when the typewriter is to be used extends transversely of the typewriter. This shaft 94 carries thereon a collar 95 which in rest position is non-rotating and to which is affixed a group of cams of which cam 96 will be referred to as the double peck cam, cam 98 the open clutch cam, and cam 100 the escapement cam. Shaft 94 also carries other cams not shown in FIG. 10 which will be mentioned later. All of cams 96, 98 and 100, as just mentioned, are mounted on a common collar within which the power shaft 94 is rotating. A conventional clutch 102 when actuated connects the power shaft 94 with the collar and the related cams. Thus, when the clutch 102 is engaged, all cams begin simultaneous rotation at the speed of the power shaft 94.

In conventional typewriter construction, the power shaft rotates at a speed in the order of 600 RPM, or 10 revolutions per second. Thus, when the cams are caused to rotate by engagement of clutch 102, 360° of rotation occurs in 1/10 of a second. Since cam 96 controls the striking of type bar 3, it can be seen that the double strike is made in 1/10 of a second. Alternatively, the speed of the power shaft can be reduced to minimize bearing wear, and the number of lobes of the various cams correspondingly increased so that the full cycle of operation is still completed in 1/10 second.

The mechanism about to be explained which causes clutch 102 to engage when any key is depressed, also includes automatically operated means for causing disengagement of the clutch at the end of each 360° of

rotation. In other words, while the power shaft 94 rotates continuously, each successive depression of the key 48 causes the cams 96, 98 and 100 to rotate through 360° in 1/10 of a second and then come to a stop. That is to say, successive actuation of the typewriter keys 48 will cause corresponding successive individual 360° rotation of the cam group.

The clutch 102 which as stated may be of any conventional construction currently used in electric typewriters has a projection 104 which is held against rotation by a stop 106 on one end of a bell crank 108 hereinafter referred as the start lever. The other end of this start lever has a finger 110 which is normally positioned against the end 112 of a pivoted lever 114. Start lever 108 is pivoted on a shaft 116 and is connected by a bar 118 to a cam actuated lever 120. Lever 114 is pivoted as at 122 and connected to a transversely extending bail 124 the left hand end of which is similarly pivoted on a pivot not shown.

Bail 124 normally rests against the upper side of each of the pull links 66 (see FIG. 9). When key 48 is depressed freeing the latch ends 62 and 64 of levers 58 and 66 so that spring 67 causes pull link 66 to rotate clockwise, putting hooks 70 and 72 into engagement, the bail 124 is moved upwardly by the left part of link 66 causing lever 114 as viewed in FIG. 10 to swing clockwise to a point (see FIG. 11) where end 112 clears the finger 110 of start lever 108. The tension spring 126 then instantly causes angular rotation of start lever 108 to the right so that stop 106 is moved away from projection 104 of clutch 102 (see FIG. 11). The instant projection 104 is freed, clutch 102 is actuated causing the cams 96, 98 and 100 to be engaged with the constantly rotating power shaft 94 to put them into their rotation of 360°.

DOUBLE PECK OPERATION OF THE TYPE BAR

As previously explained, the type action bail 74 makes two up and down motions in rapid succession to cause the type bar 3 to strike the platen 30 twice. This repeated motion of bail 74 is brought about by the following mechanism. Cam 96, when actuated by clutch 102, rotates clockwise as viewed in FIG. 10. Resting thereagainst is a follower 128 rotatably mounted on arm 127 which arm is pivoted at 129 and is also pivotally connected to link 130 at 131. Link 130 is pivotally connected to frame 132 clamped as at 134 on shaft 76. Frame 132 is constantly urged to turn clockwise by tension print spring 136.

When cam 96 commences rotation, follower 128 drops off the high part of the cam relieving the counterclockwise pressure of link 130 against frame 132. This enables the print spring 136 to turn frame 132 instantly clockwise to the extent permitted by the engagement of follower 128 with the low part of cam 96. This fast clockwise rotation of shaft 76 and attached bail 74 results in the first typing stroke of type bar 3. Follower 128 then climbs the rising face 138 of cam 96 as rotation advances toward 180°. This forces link 130 to the right and turns frame 132 counterclockwise to return bail 74 to its original position as in FIGS. 9 and 11. At the same time, spring 88, acting on bell crank 75, returns type bar 3 to its original position of rest against type bar nest 90 with hook end 70 remaining in the path of bail hook end 72, as in FIG. 11. As the second

180° rotation of cam 96 occurs, the up and down movement of bail 74 is repeated in the manner just explained. Thus, one rotation of cam 96 through 360° which occurs in 1/10 of a second, causes the type bar 3 to strike twice.

Means must be provided to cause disengagement of clutch 102 to stop cam 96 at the end of 360° rotation. This result is accomplished by cam 98 which commences its rotation along with cams 96 and 100 when clutch 102 is engaged. Toward the end of cam 98's and 360° rotation, it comes into engagement with lever arm 120 which is connected with start lever 108 by bar 118. This causes start lever 108 to turn counterclockwise moving it from its position in FIG. 11 back to its original position in FIG. 10 where the stop 106 will intercept projection 104 on the clutch 102 as 360° rotation of the clutch 102 is being completed.

The start lever 108 is held in this clutch engaging position by return of the bail 124 and the related lever 114 to a position where the end 112 of lever 114 is in engagement with the finger 110 of start lever 108 as shown in FIG. 10. Downward movement of bail 124 to its original position, as shown in FIG. 9, is permitted after the second peck of the type bar 3 because at that time the relatch block bail 92 has been shifted downward clearing the underside of latch lever 58. This permits relatching of the ends 62 and 64 of levers 58 and 66 as shown in FIG. 13. Such relatching, as shown in FIG. 13, locks lever 66 into a fixed position with respect to bell crank 75 so that when the second counterclockwise rotation of bail 74 occurs, the hook ends 70 and 72 will separate and bell crank 75 under the pull of spring 88 will return to the position of FIGS. 9 and 10. The left side of lever 66, as relatching occurs, moves downward allowing bail 124 to drop. Dropping of bail 124 causes lever 114 to turn on its pivot 122 counterclockwise to engage and hold finger 110 of start lever 108 in its original position of FIG. 10.

Thus, after the pressing of key 48, the power driven mechanism functions automatically to cause the related type bar 3 and type slug 2 on the end thereof to strike the platen twice in 1/10 of a second, and then to come to a halt awaiting the next depression of the same or another key 48 by the operator. This sequence of operation occurs faster than the typical typist can type, so there is no effect on the normal rate of typing.

ACTUATION OF THE RELATCH BLOCK BAIL

As can be seen in FIG. 12, the relatch block bail 92 is arranged to be located under the free ends of all of the latch levers 58 when bell crank 75 is away from its rest position. Bail 92 is supported by a pair of spaced arms 140 (only one of which is shown in FIG. 10) pivoted on shaft 142. Arm 140 is urged to UP position by spring 141. The extension 144 of arm 140 is actuated against spring 141 by a single lobe cam, not shown, that is grouped with cams 96, 98 and 100 carried by the collar 95 on shaft 94. This cam and spring 141 cause bail 92 to swing up into its raised position as shown in FIG. 12 immediately after key 48 has been depressed and cam rotation commenced by actuation of clutch 102. At the 180° point of cam rotation, when the second peck of type bar 3 is being started, bail 92 is moved down to its original non-engaging or non-blocking position with latch lever 58 as in FIG. 9 so that levers 58 and 66 can

relatch at 62 and 64 during the completion of the second peck stroke action of the type bar 3 as illustrated in FIG. 13.

It might be pointed out at this time that if it were desired to utilize the three-part ribbon shown in FIG. 3, which would require a triple peck by type bar 3, there would be no change in the mechanism except to change cam 96 from a two lobe cam in which the lobes are 180° apart to a three lobe cam with the lobes 120° apart and the ribbon alternator would be modified to give three positions instead of two. These changes would have the sole effect of causing the type bar 3 to strike three times during the 360° rotation of the clutch and associated cam group. The bail 92 would function in the same manner to prevent relatching of levers 58 and 66 during the first two pecks of type bar 3, but would permit relatching during the completion of the third peck prior to disengagement of clutch 102.

MECHANISM FOR SHIFTING THE TYPE BAR SEGMENT

BETWEEN THE FIRST AND SECOND PECKS

The segment 46 appearing in FIGS. 4, 9, 12 and 13 supports all of the pivots 44 of all of the type bars 3. This segment is mounted in guides permitting limited movement in the direction X—X as in FIG. 4. Such short movement considered in relation to the length of link 78 (see FIG. 9), in no substantial way changes the operating characteristics of bell crank 75, levers 58 and 66, and the oscillating bail 74. Movement of the segment 46 and related pivots 44 in the direction of line X—X in FIG. 4 will result in slug 2 imprinting sequentially on the paper 32 in position against platen 30, the code 10 and the letter 8 or the code 14 and the letter 12, illustrated in FIG. 1. The typist can select either lower case character 12 or upper case character 8.

In FIG. 9 adjacent segment 46 is shown a link 146 which is the same link 146 appearing in FIG. 14 to 17. This link in FIGS. 14 to 17 is pivoted at 148 to another link 150 having its other end pivoted at 152 to a fixed part of the typewriter 154. Link 150 is connected by a pivot 156 to a rocking beam 158. It will be noted that pivot 156 is located one-third of the distance from the left end of rocking beam 158 and two-thirds of the distance from the right hand end. The result of this construction is that if the left end of rocking beam 158 is raised a unit distance, the link 146 will be raised twice as far as it would be if the right hand end of rocking beam 158 were raised the same unit distance.

The up and down movement of rocking beam 158 is accomplished through the use of two cams 160 and 162 both of which are single lobe cams as shown in FIGS. 18 and 19. These cams 160 and 162 are mounted on collars 161 and 163, respectively, through which extends power shaft 94 previously referred to in connection with the descriptions of FIGS. 10 and 11. Cams 160 and 162 have cooperating followers 164 and 166 which are rotatably mounted on the ends of rocking beam 158. Cam 160 mounted on collar 161 on power shaft 94 is under the control of a conventional typist operated shift key. This shift key when actuated causes a clutch 168 to function to connect cam 160 with rotating shaft 94 to cause 180° rotation of cam 160 from its lobe up position shown in FIGS. 16 and 17 to lobe

down position, shown in FIGS. 14 and 15. Clutch 168 disengages after 180° rotation causing cam 160 to remain in the down position of FIGS. 14 and 15 until the shift key is released in a conventional manner by the typist after which clutch 168 re-engages causing cam 160 to rotate another 180° and to resume its up position shown in FIGS. 16 and 17.

The other cam 162 mounted on collar 163 may either be associated with the group of cams 96, 98, and 100 previously described by having collar 163 and collar 95 connected, or it may be put in operation by a separate clutch (not shown) similar to 102 or 168 controlled by another start lever similar to lever 108 also under the control of bail 124. In either case, whenever a key 48 is actuated, cam 162 goes through 360° of rotation simultaneously with the rotation of cams 96, 98 and 100.

In FIG. 14, the link 146 is shown in its lowermost position *a* with both cams 160 and 162 having their lobes 169 and 170 in downward position. As a result, segment 46 is likewise in its lowermost position. Thus, when type bar 3 is swung against the platen 30, the code symbol 10, shown in FIG. 1, will make engagement to imprint the camouflaged magnetic particles on the paper. As soon as the first peck of type bar 3 has been completed with the parts as illustrated in FIG. 12, the continuing rotation of cam 162 raises follower 166 to the position shown in FIG. 15. This results in moving link 146 upward to a second position *b* which shifts segment 46 in the direction of the face of the platen 30 sufficiently so that on the second peck of type bar 3 the visible capital letter 8 of FIG. 1 will strike against the ink portion 16 of ribbon 15, the ribbon through the operation of the ribbon alternator having made its controlled shift in position upwardly from the magnetic particle face 18 to the conventional ink face 16.

When the second peck of type bar 3 has been completed and the type bar returned to rest position, as in FIG. 9, cam 162 will have returned almost to the position in FIG. 14 so that segment 46 will be close to the position to cause type bar 3 to imprint the upper case code 10 upon the next actuation of any key 48.

In actual practice, the timing of the cam surface 170 of cam 162 having the maximum radial lift is adjusted so that this occurs just prior to and during the time the type slug 2 contacts the ribbon. Also, the timing of this same cam 162 at the minimum lift cam surface is designed so that the minimum lift occurs just prior to and during the time the type slug again contacts the ribbon.

When the lower case code 14 and the lower case letter 12 are to be successively imprinted, the shift key is released by the typist and the cam 160 then rotates 180° to its normal up position, as illustrated in FIGS. 16 and 17. In this position, and with cam 162 in its normal down position, the link 146 is in position *c* which means that the segment 46 will have been shifted upwardly with respect to platen 30 a sufficient distance so that upon operation of type bar 3 the lower case code 14 will be imprinted on the paper when the key 48 is depressed. By the time the second peck is being made, the cam 162 put in operation at the same time the other group of cams 96, 98 and 100 went into operation, will have rotated to up position as in FIG. 17. This results in moving link 146 to its maximum up position, namely,

position *d* in which when the type bar 3 makes its second peck, the platen will be engaged by the lower case letter 12.

From the foregoing explanation of the novel double peck typewriter construction, it is believed apparent that a typist may type in completely normal manner. The automatic operation of the cam 162 shifts the segment 46 up after 180° rotation so that the visible typing is produced by the second peck of the type bar 3 while the invisible deposit of magnetic ink in the same space assignment will have been accomplished by the first peck. The simultaneous rotation of the cams 96, 98, 100 and 162 causes all of these successive steps to occur in approximately 1/10 of a second following the depression of key 48.

After the type bar 3 has returned to its rest position on the type bar nest 90, as shown in FIGS. 9 and 10, the cam 100 will have returned to the position shown in FIG. 10 in which a follower 174 mounted on bell crank 176 drops into the low position causing downward movement of bell crank 176 pivoted at 178 under the influence of spring 180. This movement of bell crank 176 causes actuation of the escapement which functions according to well understood principles to advance the platen one space where it is ready to receive a next code and visible impressions upon depressing of the next key 48.

Other features of operation of the typewriter, such as the manual spacer, the back spacer, the platen return, etc., are conventional and, therefore, no disclosure is made or needed for an understanding of these mechanisms by a person skilled in this field, as their functioning has nothing to do with the method of the present invention or the mechanisms for performing the method.

THE RIBBON ALTERNATOR

The ribbon alternator may be actuated by another cam 184, see FIG. 20A, carried by collar 186 mounted on power shaft 94. Collar 186 like collar 163 may be connected to collar 95 or may be controlled by a separate clutch like clutch 102. In either case, operation of a key 48 will cause 360° rotation of cam 184 along with cams 96, 98, 100 and 162. As a follower 188 is moved by the first lobe 190 of cam 184, lever mechanism (not shown) driven by the follower will be actuated to raise ribbon 15 to present part 18 to the platen to accept the first strike of type arm 3. Thereafter the follower 188, dropping into low position at 192 of cam 184, lowers the ribbon 15 while segment 46 is being shifted by cam 162 to the second strike position. The follower 188 is then moved by the larger lobe 194 of cam 184 to raise ribbon 15 to a higher position to present part 16 to the platen just before the second strike of type arm 3. When cam 184 stops after 360° rotation, it will be again in the position of FIG. 20A.

If the ribbon of FIG. 3 is used with a triple peck of the type arm 3, then a three lobe cam 194 shown in FIG. 20B would be substituted for cam 184. The lobes 195, 196 and 197 are of increasing radial dimensions to bring the ribbon parts 28, 26 and 24 successively into position opposite the platen.

THE CODED TYPE FONT

FIG. 21 illustrates an entire font of conventional readable letters, figures and other characters with which are associated coded symbols adapted to carry out the method of this invention. It will be understood that other code symbols might be used but the present herein disclosed code is preferred as it has been found to be particularly useful because of its novel physical arrangement in which there is relatively a large degree of spacing between the code bars which substantially prevents loading. This in turn makes possible accurate imprinting of the code within even small space assignments required by the use of, for example, elite type.

The code disclosed, although not limited thereto, is a nine bit code consisting of a start bit, seven information bits according to the USASCII code, and a parity bit. The novel physical construction of the code is found in the arrangement of the bars in two adjacent levels, making it possible to have a relatively large space of at least 2 and preferably 3 or more bits between bars in each level and at least a single bit space between successive bars in adjacent levels. For a better understanding of the principle involved, reference is made to the capital U which shows three bars 200, 202 and 204 in the lower level and two bars 206 and 208 in the upper level. There is a 3 bit space between bars 200 and 202 and a 3 bit space between bars 202 and 204 in the lower level. There is also a 3 bit space between bars 206 and 208 in the upper level. At the same time, there is a 1 bit space between the nearest corners of bars 200 and 206, 206 and 202, 202 and 208 and 208 and 204. Thus the chance of the space between the bars becoming loaded with paper or lint particles which would reduce the clarity of the magnetic ink impression transferred to the paper is greatly reduced. Inspection of all of the other characters and their related code symbols appearing in FIG. 21 will disclose this common anti-loading characteristic.

While the three bit space between bars in each level is preferred, the invention contemplates that the minimum spacing between bars shall be not less than 2 bits in one level. FIG. 21 has utilized the USASCII code in a way that presents no less than a 3 bit space between bars in each level. This code could still be used but the bar arrangement varied to have a minimum 2 bit space between bars in each level. For example, in lower case *c*, the 3 bit bar in the upper level could be placed in the lower level while still presenting the 2 bit spacing. Other illustrations are lower case *e* with the upper level parity bit dropped to the lower level; lower case *f* with the upper level 2 bit bar dropped to the lower level; upper case *F* with the upper level 3 bit bar dropped to the lower level; lower case *j* with the upper level parity bit dropped to the lower level; upper case *K* with the starting bit dropped to the lower level; lower case *k* with the starting bit dropped to the lower level; upper case *L* with the upper level 2 bit bar dropped to the lower level; lower case *l* with the upper level 1 bit bar dropped to the lower level; lower case *m* with the lower level last bit raised to the upper level; lower case *o* with the upper level 1 bit bar dropped to the lower level; upper case *S* with the starting bit dropped to the lower level; lower case *s* with the starting bit dropped to the lower level; lower case *v* with the upper level bit dropped to the lower level; numeral 2 with the second

lower level 2 bit bar raised to the upper level; numeral 3 with the upper level 2 bit bar dropped to the lower level; numeral 4 with the lower level 1 bit bar raised to 5 upper level; numeral 5 with the upper level 2 bit bar dropped to the lower level; numeral 6 with the upper level 1 bit bar dropped to lower levels, lower; numeral 7 with the upper level 1 bit bar dropped to the lower level; symbol 0 (zero) with the upper level 2 bit bar dropped to the lower level; symbol + (plus sign) with upper level starting bit dropped to the lower level; symbol ; (semicolon) with the upper level 1 bit bar dropped to the lower level.

It will also be understood that the code bars could be further distributed by placing them in three levels to reduce even more the possibility of loading. For example, in the code for capital K in FIG. 21, the 2 bit bar in the upper level might be moved upward to a third level. This would not change the machine readability of the code but would increase the diagonal distance between the 1 bit bars in the lower level and the 2 bit bar. Thus, if there should be under some conditions any tendency to load between bars in adjacent levels which are 1 bit apart, one of the bars could be raised or lowered to a third level thereby to increase the diagonal distance between such bars.

While the nine bit code has been shown and described as useful in practicing the present invention, it will be understood that 4, 5, 6, 7 or 8 bit codes could be used. All such codes will incorporate the constructional features heretofore referred to; namely, that there will always be at least a 2 bit space between bars in each level (preferably a 3 bit space as in FIG. 21) and at least a 1 bit space between bars in different levels. There is always a start bit for asynchronous read out.

Although a horizontal code is shown which is readily scanned horizontally for serial read-out, the invention is not limited with respect to the method of code reading used. Thus the fixed relation of any code used relative to the visible character space assignment permits either horizontal or vertical scanning of a serially read code or parallel read-out of the code bits character by character. Various forms of code readers are well known in the prior art and can be readily applied to read the record sheet produced by the present invention.

The selection of a 4, 5, 6, 7, 8 or 9 code turns, of course, on the number of alpha, numeric or special characters that are to be coded. For example, for synchronous reading, the number of total bits that would be used for the total span of numeric characters plus a few special symbols would be 4 bits (since two to the fourth power is 16). These 4 bits could be coded to represent zero through nine plus six special symbols.

On the other hand, in machines requiring alpha and numeric characters, plus punctuation and other standard symbols plus upper and lower case, there might be 80 to 90 total characters. The information bits to code out, say 90 characters is two to the seventh power which will cover 65 to 128 characters. This requires seven bits plus a parity bit if parity is used, plus a start bit if read asynchronously.

The various coding arrangements briefly referred to above are well understood by persons familiar with this art and need not be further discussed herein, except

that it be understood that whatever code is used, the spacing of the bits in one or more levels will be as disclosed and claimed.

Preferably, for ease in manufacture, the corners of the code bars are more or less rounded as shown in detail in the enlarged letter A at the lower right of FIG. 21. The two levels may, if desired, be separated more or less as shown in the enlarged letter B instead of having upper and lower edges, respectively, colinear. This minimizes contamination loading which tends to obliterate the distinct printing of the code combination.

The code symbols when imprinted on paper as magnetic particles may be readily scanned by a magnetic pickup head reading device. This unit will include an air gap which is bridged by the individual code bits and extends transversely to be wide enough to straddle the two or more levels of the code symbols. The identical height of the individual code bars insures that the reading of the code by the scanner will be more accurate than in the case where the total vertical height is not a fixed and uniform distance.

MEMORY STORAGE SYSTEM

As is well understood by typists, it is not uncommon to strike two keys in too close succession, causing the type arm actuated by the second struck key to interfere with the uncompleted movement of the type arm actuated by the first struck key. In order to prevent interference of the type arms when the second key has been struck prematurely, means have been provided herein to delay operation of the second type arm until completion of operation of the first type arm. This arrangement may be referred to as a memory storage system. It, in effect, saves the information imparted by the depression of the second key (if depressed prematurely) until the typing initiated by the depression of the first key has been completed. This mechanism is helpful in carrying out the orderly sequence of the basic operations of the invention, namely, the imprinting of the visible character over the code character in the same space assignment without the delay occasioned by type arm interference when the keys of two type arms are successively actuated with too short a time interval therebetween.

This modification will be more clearly understood by reference to the following description of FIGS. 22 to 26 inclusive. In these figures, the numbering of the parts is in the main the same as the numbering of the same parts heretofore described with particular reference to FIGS. 9, 12 and 13. The changes involve a modification of the pull link 66 at its lower end which engages latch lever 58, the introduction of an additional cam on power shaft 94 which cam functions simultaneously with the group of cams 96, 98 and 100, and a pull link blocking bail which functions to delay the action of the pull link of the prematurely struck second key until the operation of the type arm controlled by the first key has been substantially completed. At that time, the cam depresses the pull link blocking bail from its blocking position to allow the second pull link to move into engagement with the type action bail which as will be explained continues in operation to cause the second type arm to them move through its typing cycle just as would have occurred had the second key been depressed in proper timed relation to the previously depressed first key.

Referring to FIG. 22, it will be noted that there is a bail 210 actuated by a bail arm 212 mounted on fixed pivot 214. The bail is additionally supported at its ends in conventional manner by two spaced pivoted arms (not shown). A spring 216 constantly urges bail arm 212 upward. Bail arm 212 carries a roller 218 which acts as a follower to cam 220. Cam 220 is affixed to a collar 222 which is connected to or integral with collar 95 on which cams 96, 98 and 100 are mounted. Thus, whenever clutch 102 is actuated in the manner heretofore explained through the depression of any key, cam 220 will commence rotation along with cams 96, 98 and 100 under the driving force of power shaft 94. When the machine is at rest, cam 220 will be in the position shown in FIG. 22 and bail 210 will be in down position.

It will also be noted in FIG. 22 that the upturned latch end 62 of latch lever 58 cooperates with the finger 64 on the lower end of pull link 66 to hold the latter against clockwise rotation on bell crank 75 in the same manner as heretofore described. However, in this modification, pull link 66 has an additional downward extension 224 outside of latch end 62. This extension in no way affects the cooperation of latch end 62 and finger 64, but does provide sufficient length to be intercepted by bail 210 when the latter is in UP position.

The sequence of operations will now be explained by reference to FIGS. 23 to 26 inclusive. For convenience in explanation, the parts put into actuation by the first key depressed (key A) will have the letter A added to the part number. Those parts actuated by depression of the second key (key B) will have the letter B added to the part number.

In FIG. 23, the first key A has been depressed, and as a result, cam 220 along with cams 96, 98, 100, 162 and 184 (see FIGS. 10, 11, 14 and 20) has been placed in rotation. As soon as the follower 218 is released by cam 220, spring 216 forces bail 210 to upper position. However, before bail 210 has reached this position, the pull link 66A, released by actuation of the key A and latch lever 58A, has moved into the path of type action bail 74 which likewise went into operation under the control of print cam 96. Thus, even through bail 210 promptly rises to the position of FIG. 23 after the striking of the first key A, the timing is such that the bail 210 cannot block the clockwise rotation of the pull link 66A released by the depressing of the first key A. Accordingly, the movement of all parts put in operation by key A, namely, bell crank 75A, pull link 66A, type action bail 74 and link 78A and associated type arm proceeds in the normal heretofore described manner. If no second key B is prematurely depressed, the type arm controlled by link 78A goes through its normal double peck typing operation and at the completion of that cycle with cam 220 returned to the position of FIG. 22, the bail 210 will have been moved again to its downward position without carrying out any intercepting function.

If, however, a second key B is depressed prematurely while bail 210 is still in its upper position as in FIG. 23, then the situation illustrated in FIG. 24 develops. Latch lever 58B is rotated counterclockwise by key B so that end 62B clears the bottom of finger 64B permitting pull link 66B to commence clockwise rotation under the pull of spring 67B. This clockwise rotation, however, is instantly interrupted by engagement of extension 224B

with bail 210. Thus, the hook end 70B is held out of the path of the oscillating hook edge 72 of type action bail 74. The result is that during the continued 360° rotation of print cam 96 and cam 220, only the type arm whose action was initiated by depression of key A is continued.

The typing action of the type arm controlled by reciprocation of bell crank 75A and link 78A under the oscillating movement of bail 74 continues through the first and second strikes as the delay cam 220 rotates from the position of FIG. 24 to that of FIG. 25. At the completion of the first strike, the parts are approximately as shown in FIG. 24. Relatching of latch lever 58A and pull link 66A cannot occur because of the presence of relatch block bail 92 under the right end of latch lever 58A. However, by the time delay cam 220 has reached the position shown in FIG. 25, type action bail 74 will have made its second clockwise movement and the second strike of the type arm A under the movement of link 78A will have been completed. As type action bail 74 moves counterclockwise, it allows pull link 66A and bell crank 75A to move counterclockwise which results in re-engagement of ends 62A and 64A so that there is not further operation of type arm A under control of key A.

At this point, had the key B not been prematurely depressed, clutch control bail 124 would descend to disengage clutch 102. This, however, does not occur because further rotation of delay cam 220, moving from the position of FIG. 25 to that of FIG. 26, starts downward movement of bail 210 to free pull link 66B just as the pull link 66A is returning to its home position. Pull link 66B, now clear of bail 210, is then instantly rotated clockwise under the pull of its spring 67B throwing the hook end 70B into the path of bail 74. This clockwise rotation of pull link 66B holds bail 124 in its UP position so that clutch 102 is not disengaged and continues in operation. Thus, cams 96, 98, 100, 162, 184 and 220 instead of coming to a halt at the end of 360° rotation, continue rotation for another 360° and the type arm B now under the control of key B, pull link 66B, bell crank 75B and link 78B is put into operation without interference with the now stationary type arm A controlled by key A even through key B had been depressed prematurely. When the double peck of type arm B has been completed, latch lever 58B and pull link 66B re-engage and the parts come to rest awaiting the actuation of the next key.

Once the extension 224B of pull link 66B has been freed by downward movement of bail 210, as in FIG. 26, a third key C, for example, might be prematurely depressed without detrimental results, because by that time the cam 220 would have reached the position shown in FIG. 23 and bail 210 would be in UP position to intercept the pull link released by actuation of the key C.

It can be seen from the foregoing that the actuation of a type arm related to a key prematurely depressed can be delayed until the operation of the type arm set in motion by the previously depressed key has been completed.

The configuration and positioning of delay cam 220 with respect to cams 96, 98, 100, 162 and 184 is such that the blocking bail 210 is in blocking position over about 315° of rotation of cam 220 and is in down un-

blocking position over about 45° rotation. Thus, under the usual speed of rotation of power shaft 94 of 600 RPM, it follows that temporary blocking will occur of any type arm whose key is depressed between about 1/100 and 1/12 of a second after depression of the previous key. These figures are approximate as the configuration of the cam 220 and the speed of rotation of the power shaft are the controlling factors. However, they do illustrate that the mechanism is capable of delaying and saving the actuation of the type arm controlled by the second key B whenever premature depressing of the second key occurs over any part of a wide angular range of movement of cam 220.

SUMMARY

The method of the invention contemplates depositing in the same space assignment on a substrate ordinarily in the form of a piece of paper or equivalent material, an invisible coded symbol, preferably in the form of ink with magnetic or magnetizable particles camouflaged so that it cannot be seen. The type bar actuated to record this symbol is then shifted with respect to the platen so that upon the second stroke of the same type bar accompanied by an appropriate shift in position of the two-part ribbon or tape, a man readable character will be imprinted on the paper directly over the invisible coded symbol in the same assignment space. As soon as this double stroke action has occurred, the platen is advanced one space in conventional manner ready to receive the same double action of the next key that the typist may put in operation. This method is carried out by the power driven mechanism which has heretofore been described. The speed capability of the double peck operation is sufficiently fast so there will be no diminution in the typist's normal output. This output is subject to retrieval by the use of known scanning equipment designed to scan magnetic or magnetizable particles placed on substrates.

It should also be mentioned that through the use of the double peck system, it is possible to reverse the order of deposit of the visible and coded material, namely, that the visible, readable character may be deposited on the paper first to be followed by an invisible, overlying layer of the coded symbol. Such overlying material might be, for example, in the form of a transparent substance invisible to the human eye, but readable by optical scanning equipment using, for example, ultraviolet illumination of a fluorescent transparent ink.

It will also be understood that the arrangement of the upper and lower case letters and their related code symbols may be inverted on the slug 2 without changing the method of operating. That is, the letters might be above the code symbols or the lower and upper case letters might be placed in reversed position. The described arrangement, however, is preferred.

The code symbols disclosed comprise a preferred construction but the use of other code forms is to be considered as within the invention.

For further reference, attention is called to the publication of Olivette-Underwood Corporation, 1 Park Avenue, New York, New York, entitled "EDITOR 2 TECHNICAL MANUAL TA-EE-1," printed March, 1968, currently available to the public at \$11.22 per

copy. Ribbon alternators are shown and explained in detail on pages 388 to 395. Clutches are shown and described on pages 24 to 27.

Modifications and further applications of the invention will now be apparent to those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. The method of storing data on a surface comprising the steps of superimposing one on the other of a visible man readable conventional type character and instrumentality substantially invisible but machine readable code symbol, the superimposing steps being accomplished by immediately successive strokes of a single instrumentality carrying said character and symbol against different areas of an interposed ribbon, the position of said instrumentality and said surface being shifted between strokes sufficiently to achieve said superimposing of character and symbol.

2. The method as set forth in claim 1 in which the code symbol is first placed on the surface and the readable character is then placed over said symbol.

3. The method as set forth in claim 1 in which the readable character is first placed on said surface and the code symbol is then placed over said character.

4. A typewriter including a platen, a constantly rotating power shaft, a plurality of cams on said shaft, at least one clutch on said shaft for simultaneously starting rotation of said cams and stopping said cams after 360° of rotation, a plurality of type arms and related type slugs thereon pivotally mounted on a shiftable segment, manually operable keys for causing actuation of said clutch and cams and any selected type arm, a type arm actuating bail, a first cam of said plurality of cams shaped to cause duplicated movement of a follower connected to said bail during 360° rotation of said first cam whereby said bail will be oscillated twice and said selected type arm will be caused to strike said platen twice in the period of said 360° rotation, a second cam on said power shaft controlled by a clutch simultaneously with said first cam, said second cam arranged to shift said segment between strikes of said type arm whereby on said second strike a different part of said type slug will engage said platen and whereby after said second strike said second cam will return said segment to its original position, and a third cam on said power shaft controlled by a clutch simultaneously with said first and second cams arranged to actuate an escapement after said second strike to advance said platen one space.

5. In an electric typewriter which includes a platen and an escapement mechanism, means for causing a selected type arm having a type slug with at least two characters thereon one above the other to strike the platen twice before operation of the escapement, means for shifting the type arm crosswise of said platen between strikes whereby the position of engagement of one character with said platen on the first strike will be the position of engagement of the other character with said platen on the second strike said means for causing the double strike of said type arm comprising a spring driven type action bail, a two lobe cam, and a cam follower connected to said bail to cause two oscillations of said bail for each 360° rotation of said cam.

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6. In a power driven typewriter having a plurality of keys and for each key a bell crank carrying thereon a key operated latch lever and a pull link normally restrained by said latch lever, a type action bail engage-
able by each pull link, a type arm connected with each bell crank, a power shaft having thereon a clutch con-
nected print cam for actuating said type action bail, pull link, bell crank and type arm; said power shaft also carrying a delay cam, means actuated by any key for placing said cams in rotation for 360°, a bail controlled
by said delay cam for blocking movement of any key released pull link into engaging position with said type

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action bail while a previously released pull link is in en-
gagement with said type action bail, said delay cam shaped to remove said bail from blocking position shortly before completion of 360° rotation of said print cam, whereby said unblocked pull link may then en-
gage said type action bail to initiate typing action of its type arm, and means controlled by the released pull link for maintaining continued engagement of said clutch and rotation of said print and delay cams for another 360°.

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