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Metz

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[54] **BELT PRINTER**

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[52] **U.S. Cl.** ..... **197/1 R;** 197/53; 197/144; 101/93.14; 101/228

[51] **Int. Cl.²** **B41J 3/44**

[58] **Field of Search** ..... 197/1, 144, 133, 53; 101/93 C, 111, 228, 226; 225/85; 118/235, 238

[56] **References Cited**

UNITED STATES PATENTS

765,532	7/1904	White	101/93 C X
1,191,697	7/1916	Himmer	101/228
2,152,031	3/1939	Currier	225/85
2,918,865	12/1959	Wooding	101/93 C
3,113,509	12/1963	Simpson	101/111
3,651,915	3/1972	Folkens	197/53
3,698,529	10/1972	Cattaned	101/93 C X

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[57] **ABSTRACT**

An impact mechanism prints directly on the outer coil of a web of paper using the web itself as a backing thereby obviating the use of a separate platen. In order to hold the outer coil in a printing plane, a pair of springs continuously urge the web against a pair of stops which are adjacent to the impact mechanism. The impact mechanism includes a plurality of tines which are positioned to strike character dies against the web upon being struck by pins. The pins are distributed in a single turn helix about a cylinder which is rotatably mounted on a pivoted bracket. The cylinder rotates to index the pins across the tines and reciprocates to strike the pins against the tines. In order to sever the web into sheets after information has been recorded thereon, a pair of rollers are positioned to grip the paper being advanced from the web so that the paper may be manually brought into contact with and severed by a fixed blade.

12 Claims, 3 Drawing Figures

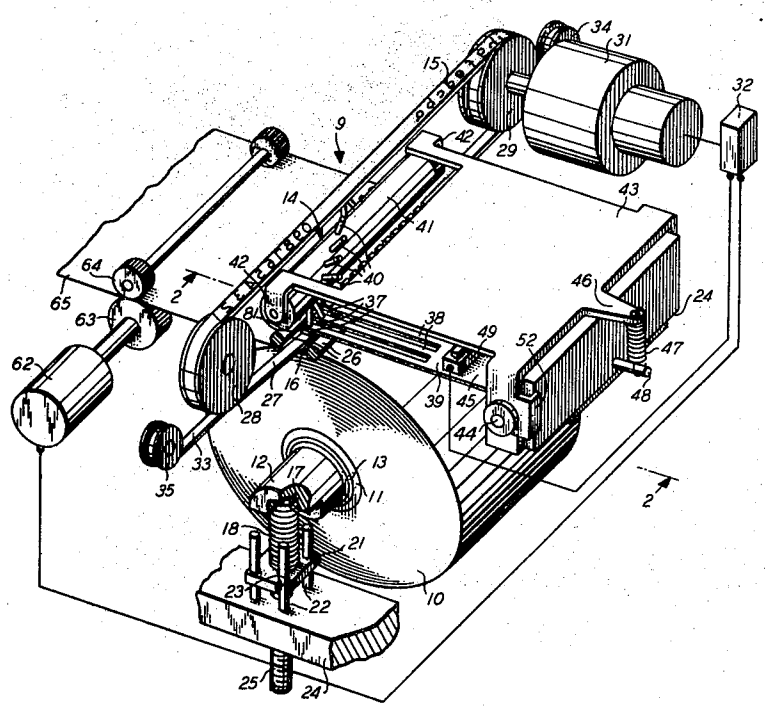


FIG-1

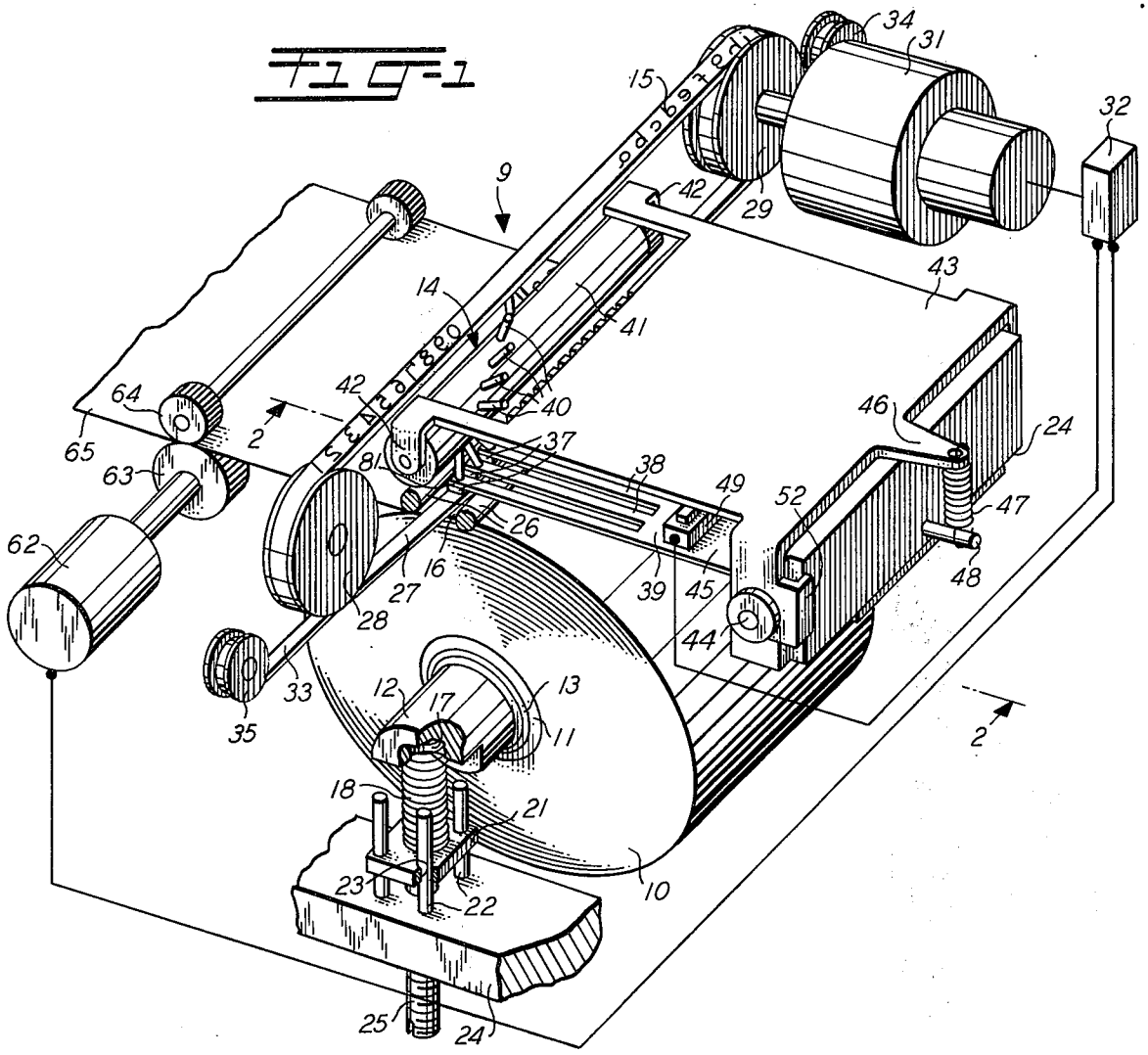
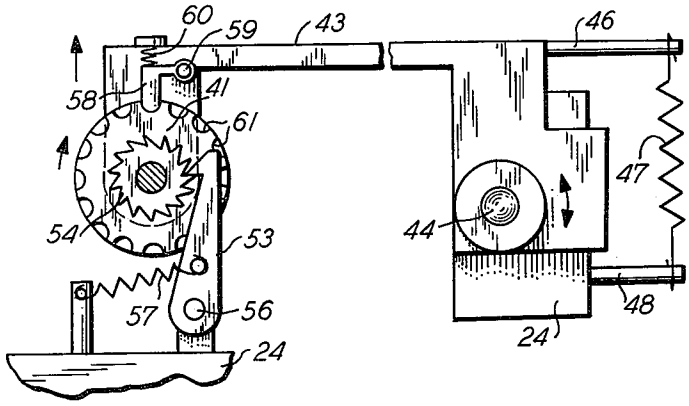


FIG-2



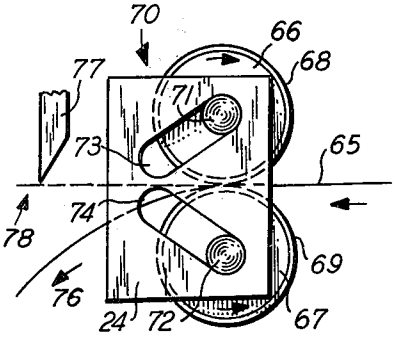


FIG-3

BELT PRINTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to printers and more particularly to impact printers which record information on material fed from a roll or web.

2. Technical Considerations and Prior Art

Printers tend to be very complicated mechanisms with many moving parts. Generally, the cost of purchase and maintenance of a printer is directly proportional to its complexity. Consequently, a reduction in complexity is a necessary step in producing printers for the low cost market.

One of the more complicated mechanisms necessary in a printer is some agency for selectively moving the characters to be printed across the page. In recent years, much attention has been directed to "belt" or "chain" printers exemplified by the teachings in U.S. Pat. No. 2,918,865, which issued to E. R. Wooding, in which the characters are distributed in the form of dies along an endless carrier. However, until recently, the high cost of logic circuits for positioning the characters across a page has curtailed utilization. Improvements in microminiature circuit technology have resulted in cost reductions that now render belt printers commercially feasible for the low cost market.

As a result of these improvements, there is now an opportunity to simplify belt printers by reducing the complexity of the other mechanisms such as impact mechanisms and paper cutters associated therewith. In prior art printers, a platen or other type of backstop is utilized as a backing for the paper to support the paper in a printing plane as an impact mechanism strikes characters onto the paper. In order to properly align and tension the paper as it advances from a supply to the platen, additional devices such as guides and feed rollers are necessary. One way to reduce the number of parts and thus simplify the printer is to dispense with the platen or backstop and print directly on a roll or web of paper, which is what is done in the instant invention.

If one is going to print directly on the web of paper, then a suitable impact mechanism must be utilized. The impact mechanisms of the prior art belt printers, such as that shown in the aforementioned U.S. Pat. No. 2,918,865 to E. R. Wooding, cannot be used with a printer which prints directly on a web of paper because such mechanisms have hammers and type members positioned on both sides of the printing plane with the type members serving essentially as platens which support the paper. Consequently, an impact mechanism which can operate from only one side of the paper must be used.

In the instant invention, an impact mechanism located entirely on one side of the printing plane is created by spacing a series of pins or the like about a cylinder to form a single-turn helix. The pins are serially moved to printing modes along the paper by rotatably indexing the cylinder. After each index, the cylinder is then reciprocated to impact the pins against resilient tines which, in turn, strike dies to print characters on the paper. There are disclosures in the prior art of modern printers with helically disposed ribs, pins and the like; however, these helical arrangements are used generally as backings against which other hammers print rather than as hammers themselves. Furthermore, the prior art does not disclose using resilient tines to transfer the impact from the helically disposed elements to the printing dies.

Since the paper is fed from a roll, it is necessary for the sake of convenience to sever the paper into sheets as each complete message is recorded. In the prior art, stationary blades are generally used but no mechanism for adequately gripping the paper is disclosed. Since the present invention prints directly on the web of paper, there are no intermediate devices such as guides or feed rolls to bind or retain the paper when it is manually engaged with the blade for cutting. Consequently, it is quite possible to unwind unnecessary amounts of paper from the web upon trying to sever the paper into sheets. In the present invention, rollers are provided to grip the paper upon applying a horizontal force to the paper so as to avoid transferring the pulling force back to the web.

SUMMARY OF THE INVENTION

In light of the aforementioned considerations, it is therefore an object of this invention to provide a new and improved printer which prints directly on a web of material utilizing the underlayers of the material and the filler roll of the web as a backing.

It is a further object of this invention to provide a new and improved impact mechanism which may be used with printers that print directly on a web of material.

It is still a further object of this invention to provide a new cutting apparatus for severing material in sheets after it has been printed upon wherein the cutting apparatus is suitable for use with a printer that prints directly on a web of material.

In accordance with these and other objects, the invention contemplates mounting a web of paper so that it is continuously urged into a printing plane in which an impact mechanism serially distributes information across the outer coil of the web using the web itself as a backing. The impact mechanism includes a line of spaced projections helically distributed around a cylinder. The cylinder is rotatably mounted on a pivoted bracket and uses a ratchet mechanism to index the projections into a printing mode each time the bracket pivots.

As the bracket pivots, it causes the projections to strike serially the free ends of resilient tines which, in turn, strike character dies mounted on a selectively movable belt. The character dies print directly on the web of paper as they are struck. As each message is recorded, the paper from the web is severed into sheets by a fixed blade. In order to prevent advancement of the paper as it is severed, a pair of rollers are provided to grip the paper therebetween upon manually pulling the paper in the horizontal direction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a printer embodying the principles of the present invention wherein the printer prints directly on the outer coil of a web of paper and wherein the printer utilizes a rotatable cylinder with a helical arrangement of pins to strike tines of a resilient comb in order to impact type dies against the outer coil of the web;

FIG. 2 is an enlarged side view taken along line 2—2 of FIG. 1, showing a ratchet and detent mechanism for rotating and positioning the cylinder upon which the pins are helically distributed; and

FIG. 3 is a side view of a device used with the printer of FIG. 1 for severing the paper from the web into sheets wherein the paper is gripped by a pair of rollers and severed by a cutting blade.

DETAILED DESCRIPTION

Referring now to FIG. 1, there is partially illustrated a printer designated generally by the numeral 9, which supports a web of a carrier such as paper 10 shown coiled around a filler 11 and mounted for rotation on a nonrotatable spindle 12 by a bearing 13. The web 10 and filler 11 serve as a backing against which an impact mechanism, designated generally by the numeral 14, impacts as it prints characters with belt-supported dies 15 on the outer coil 16 of the web. The spindle 12 has a recess 17 formed in each end thereof, (only one of which is shown) in which is seated a spring 18 that biases the entire web 10 toward the impact mechanism 14.

Each spring 18 rests upon a platform 21 which is, in turn, positioned on a set of pins 22 that pass through bores 23 in its platform. The pins 22 in each set are rigidly secured to a frame 24 which supports the entire printer 9, including the impact mechanism 14. In order to adjust the compression and thus the force of each spring 18, an adjustment screw 25 (only one of which is shown) is threaded in the frame 24 and abuts the lower surface of the corresponding platform 21. It is to be understood that the structure supporting the hidden right end of the spindle 12 is identical to the structure supporting the visible left end of the spindle.

The springs 18 urge the web of paper 10 against a pair of spaced, parallel rollers 26 which are rotatably secured to the frame 24 and define the printing plane of the printer 9. The bias of the springs 18 slightly compresses the web of paper 10 to ensure a firm printing surface on which the impact mechanism 14 can record.

Positioned between the rollers 26 is a printing belt 27 which carries the character dies 15. The printing belt 27 is trained positively about and supported by an idler pulley 28 and a drive pulley 29. The drive pulley 29 is driven by a drive motor 31 that is controlled from a master controller 32 to position the character dies 15 in selected sequential locations across the web 10. The master controller 32 can be of the type disclosed in U.S. Pat. No. 2,918,865 which issued to E. R. Wooding. A conventional inked ribbon 33, supported by supply and take-up spools 34 and 35, is disposed between the printing belt 27 and the outer coil 16 of the web 10 to render impacts by the dies 15 visible.

Positioned above the belt 27 and between the rollers 26-26 are a plurality of pallets 37, each of which corresponds to a printing space in a line of print across the outer coil 16 of the web of paper 10. The pallets 37 are, in turn, each secured to the free end of a separate one of a plurality of tines 38. The tines 38 are formed in a sheet of spring steel, or the like, to form a comb 39, the butt 45 of which is rigidly secured to the frame 24 of the printer.

In order to impact the pallets 37 against the dies 15, a series of spaced pins 40 are arranged in a single turn helix about the outer surface of a cylinder 41. The cylinder 41 is mounted on its longitudinal axis to a pair of flanges 42 in a steel bracket 43 and can rotate to position sequentially each pin 40 in a printing mode over an associated pallet 37. Consequently, as the cylinder 41 rotates, the pins 40 are progressively located over the line of pallets 37 in position to print a line of type across the outer coil 16 of the paper web 10.

The bracket 43 is mounted by pivots 44 to the frame 24 of the printer 9. As the bracket 43 pivots, it moves the cylinder 41 normal to its longitudinal axis carrying the pins 40 toward and away from the pallets 37. The bracket 43 has a tab 46 projecting therefrom to which one end of a contractile spring 47 is attached. The other end of the spring 47 is attached to a projection 48 on the frame 24 so that the spring urges the bracket 43 in a clockwise direction about pivots 44 thereby moving the cylinder 41 and the pins 40 away from the pallets 37.

In order to cause the pins 40 to impact against the pallets 37, an electromagnet 49 is positioned beneath the bracket 43 to attract the bracket and rotate it counterclockwise, against the biasing action of the spring 47, upon receiving a print signal from the controller 32. As the bracket 43 is rotated counterclockwise, it causes a pin 40 vertically posed for printing to strike the associated pallet 37. Immediately following this impact, the electromagnet 49 is de-energized by the controller 32 and the spring 47 returns the bracket 43 to its initial position. A stop 52 engages the frame 24 to limit clockwise movement of the bracket 43.

Referring now to FIG. 2, ratchet and detent mechanisms are illustrated for rotatively positioning the cylinder 41. It is noted that these mechanisms were not illustrated in FIG. 1 for purposes of clarity. A ratchet pawl 53 engages a ratchet wheel 54 which is rigidly secured to the cylinder 41 for rotation therewith. The ratchet pawl 53 is mounted to the frame 24 for pivotal movement about a pin 56 and is urged into engagement with the ratchet wheel 54 by a spring 57. When the bracket 43 is moved in a clockwise direction about the pivots 44 under the urging of the spring 47, the cylinder 41 and the ratchet wheel 54 are raised. The interaction between the ratchet pawl 53 and the raising ratchet wheel 54 causes the wheel and the cylinder 41 to be rotated in a clockwise direction.

In order to properly position the cylinder 41, a detent 58 is pivoted on a pin 59 mounted on the bracket 43 and is urged into engagement with one of a plurality of indents 61 in the cylinder 41 by a compression spring 60. Each indent 61 corresponds in circumferential location to one of the pins 40 and thereby corresponds to one space in the line to be printed on the web 10. Consequently, as the cylinder 41 is rotated, the detent 58 is permitted to move out of the indent 61. This permits the cylinder 41 to be moved through a sequence of positions which locate the pins 40 in succession over their respective pallets 37 in succession for printing.

The ratchet and detent mechanism operates as follows. As the spring 47 urges the bracket 43 clockwise, the ratchet wheel 54 is raised and the pawl 53 engages a tooth of the ratchet wheel causing the cylinder 41 to rotate clockwise until the stop 52 engages the frame 24 to prevent further rotation. At this time, the detent 58 engages the next successive indent 61 preventing further rotation of the cylinder 41.

Upon energizing the electromagnet 49, the bracket 43 rotates in the counterclockwise direction about pivots 44 moving the cylinder 41 normal to the cylinder's longitudinal axis and toward the pallets 37. Since the detent 58 is engaged with one of the indents 61, the cylinder 41 will not rotate and the ratchet pawl 53 will be cammed out of engagement with the teeth of the

ratchet wheel 54. One of the pins 40 will be aligned with one of the pallets 37 and will strike that pallet as the bracket 43 rotates. After the pin 40 strikes the pallet 37, the electromagnet 49 is de-energized and the bracket 43 again rotates clockwise under the influence of the spring 47 causing the ratchet pawl 53 to rotate the ratchet wheel 54 and cylinder 41 as before.

Referring again to FIG. 1, after each line is printed, a control signal is generated by the controller 32 to a paper advance motor 62, instructing the motor to rotate a resilient roller 63 in a counterclockwise direction. The section 65 of paper extending away from the outer coil 16 of the web 10 is urged by a second resilient roller 64 against the roller 63. This of course advances the extended section 65 of paper by pulling it from the web 10 and causing the web to uncoil and position fresh paper in the printing plane.

Selected lengths of the section 65 may be severed from the outer coil 16 by a paper cutting portion of the printer, designated generally by the numeral 70 and illustrated in FIG. 3. The paper cutter is located downstream of the resilient rollers 63 and 64, comprising the paper advance mechanism. In the paper cutter 70, the section 65 of the paper is advanced between a pair of light weight rollers 66 and 67 which have high friction surfaces 68 and 69, respectively, of rubber or the like, located thereon for engaging the paper. The rollers 66 and 67 are mounted by pins 71 and 72, respectively, in slots 73 and 74, respectively, formed in the frame 24. The slots 73 and 74 converge toward the downstream end of the section 65 of the paper so that ordinarily the upper roller 66 rests upon the section 65 lightly pressing the paper against the lower roller 67.

While the section 65 of the paper is being advanced, it is pushed by the paper advance motor 62 between the rollers 66 and 67, causing them to rotate in opposite directions due to friction between the surfaces 68 and 69 and the paper. As the paper emerges from between the rollers 66 and 67, it falls downwardly in the direction of arrow 76. When it is desired to sever the leading portion of the section 65 of the paper, the paper is manually gripped and pulled in the horizontal direction as indicated by the dotted line. This causes the pins 71 and 72 to move downstream in the slots 73 and 74, and thus move rollers 66 and 67 slightly toward one another thereby securely gripping the section 65 of the paper disposed therebetween. Upon lifting the leading portion of the section 65 slightly upward, it engages a fixed blade 77 extending across its width which neatly cuts the paper as the paper is pulled against the blade in the direction of arrow 78. After a sheet of the paper 10 is severed, the portion just upstream of the blade 77 falls away in the direction of arrow 76. Since there is no horizontal tension on the paper, the rollers 66 and 67 will cease to be urged tightly together and therefore will cease to grip the paper. The paper will then advance freely between the rollers 66 and 67 as the paper advance motor 62 (FIG. 1) pushes it.

To summarize the operation of the printer disclosed in the preferred embodiment, the controller 32 receives a print signal whereupon it positions a selected character die 15 beneath the first pallet 37 which is located at the left end of the comb 39. The controller 32 then energizes the electromagnet 49 and the first pin 40 strikes the first pallet 37 printing the first desired character into the first space on the prepositioned outer coil 16 of the paper. The controller 32 then de-energizes the electromagnet 49 and the bracket 43 rotates clockwise thereby rotating the cylinder 41 one space with the ratchet and detent arrangement shown in FIG. 2 to position the next successive pin 40 over the second pallet 37.

The controller 32 then signals the drive motor 31 to position the second desired character die 15 beneath the second pallet 37 and energizes the electromagnet 49. The electromagnet 49 is again energized to print the second character into the second space on the outer coil 16 of the paper. The process continues until an entire line of print is recorded. If a blank space is desired, blank areas are provided on the printing belt 27 so that nothing will be recorded when the pin 40, which is in position for recording, strikes its associated pallet 37.

After each line of print is recorded, the controller 32 signals the paper advance motor 62 to advance the paper one or more spaces. A new line is now ready for printing after the complete message is recorded.

I claim:

1. In an apparatus for recording characters selectively and sequentially across an outer coil of material as the material is uncoiled from a web of the material;
- an impact mechanism for striking character dies against the material;
- means for continuously urging the web and the impact mechanism relatively toward each other to permit the uncoiled portion of the web to serve as a backing for the outer coil of material against which the character dies strike when the characters are recorded; and
- means positioned between the web and the impact mechanism for engaging the outer coil of material of the web and for holding successive sections of the outer coil in a printing location relative to the impact mechanism and against the web as the web uncoils.

2. The apparatus of claim 1 wherein the means for urging the web comprises a spindle upon which the web is mounted and a pair of springs engaging each end of the spindle to urge the spindle toward the impact mechanism.

3. The apparatus of claim 1 wherein the impact mechanism includes:
- a cylinder mounted for rotation about its longitudinal axis;
- means for reciprocating the cylinder selectively normal to the longitudinal axis;
- means for rotating the cylinder about said axis through a predetermined arc upon each reciprocation of the cylinder, and
- means for impacting the characters against the material to record the characters thereon upon each reciprocation of the cylinder, wherein said impacting means is distributed around said cylinder in a helical pattern to print the characters across the sheet of material as the cylinder reciprocates and rotates.

4. The apparatus of claim 3 wherein the characters are mounted on a movable carrier positioned between the material and the cylinder.

5. The apparatus of claim 3 further including a plurality of resilient tines aligned with preselected spaces on the material and having pallet portions thereon for printing the characters upon being struck by said impacting means.

6. The apparatus of claim 5 wherein the impacting means comprises a plurality of spaced pins arranged in a single turn helix about the cylinder and wherein the pins are sequentially aligned with individual tines as the cylinder rotates.

7. In an apparatus for printing individual sheets of information wherein the sheets are produced sequentially from the outermost coil of a web of material;

an impact mechanism for printing information on the outermost coil of the web;

means for continuously urging the web toward the impact mechanism so that the remainder of the web serves as a backing for the outer coil of the web against which the impact mechanism strikes when printing;

means independent of the impact mechanism for engaging and holding the outermost coil of the web in a printing plane relative to the impact mechanism and against the web as the outermost coil is printed on; and

means for severing sheets from the web.

8. The apparatus of claim 7 wherein said severing means includes:

a pair of rollers between which material from the web advances;

means for mounting the rollers to selectively prevent the advancement of the material; and

a blade positioned downstream of the rollers to sever a sheet from the material upon engaging the material.

9. The apparatus of claim 8 wherein the means for mounting the rollers includes pins projecting from each end of each roller wherein the pins engage slots which converge in a direction downstream of the web.

10. In an apparatus for recording characters selectively and sequentially across an outer coil of material as the material is uncoiled from a web;

means for continuously urging the web into a printing plane to position the outer coil for a printing operation;

dies for printing the characters on the web;

a carrier for moving the dies selectively across and adjacent to the printing plane;

a plurality of resilient tines aligned with preselected spaces in the printing plane but positioned on the opposite side of the dies wherein said tines have portions thereon for striking the dies;

a cylindrical helix juxtaposed with and axially extensive across said tines;

means for reciprocating said helix normal to its axis to impact said helix against said tines causing said tines to strike said dies and record the characters on the outer coil of the material;

means for rotating said helix to position said helix to engage said tines individually and sequentially as said helix is reciprocated; and

means for severing the material after the characters have been recorded thereon, wherein the severing means includes means for restraining advancement of the material upon applying a pulling force to the material downstream of the severing means to thereby prevent the force from being transmitted back to the coiled web.

11. In an impact printer wherein an impactor means comprises a plurality of equally spaced apart and outwardly projecting impacting elements disposed in a single turn helix on the surface of a cylinder rockably mounted for impacting selected ones of a linear array of characters for printing, the improvement comprising:

a carrier for the characters mounted for transverse movement relative to and along a line on a web on which printing is to be effected;

a plurality of resilient tines having an individual pallet attached to each tine, whereas the pallets are located between the carrier and the cylinder, so that each pallet corresponds to a printing space in a line of print across the web and is sequentially aligned with successive impacting elements as the cylinder rotates for printingly impacting the characters; and

magnetic means for rocking the cylinder into element impacting engagement with successive pallets for printing.

12. A combination according to claim 11 wherein the tines are disposed in parallel relationship, thereby forming a comb; and the magnetic means comprises:

a rockable bracket mounted above the comb, the cylinder rotatably mounted in the bracket; and

a magnet fixed relative to the comb for selectively attracting the bracket to draw the cylinder toward the pallet.

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