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Montoya

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[54] **SUPERSONIC PRINTING METHOD AND SYSTEM THEREOF**

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[51] **Int. Cl.²** **B41J 3/20**

[58] **Field of Search** ....101/426,1 R, DIG. 5, DIG.13; 197/1 R; 332/2, 58, 68; 250/511–513; 181/0.5 ED, 0.5 R; 346/74 R, 74 M, 74 MP, 75, 76 R, 77 R, 77 E; 116/137 R; 178/30, 31, DIG. 7

[56] **References Cited**

UNITED STATES PATENTS

3,138,219	6/1964	Blizard	181/.5 ED
3,154,370	10/1964	Johnson	346/77 R
3,187,669	6/1965	Greenblott et al.	101/DIG. 5
3,193,408	7/1965	Triller	250/512
3,351,948	11/1967	Bonn	101/426 X
3,461,229	8/1969	Oppenheimer	101/DIG. 13
3,475,760	10/1969	Carlson	346/1 R
3,502,878	3/1970	Stewart et al.	250/512
3,532,181	10/1970	Demaria et al.	181/.5 R
3,573,847	4/1971	Sacerdoti	101/1
3,643,095	2/1972	Shuster	250/511

OTHER PUBLICATIONS

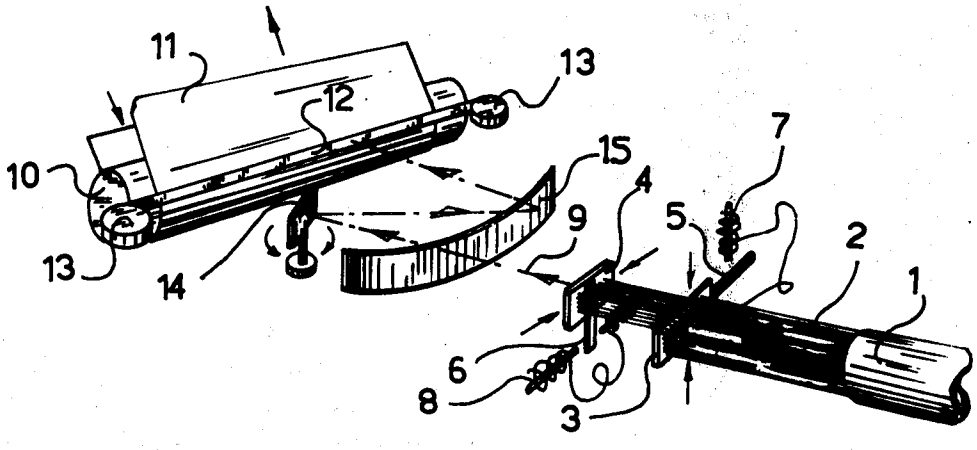
"Acoustic Holographic Printer", IBM Tech. Discl. Bulletin, Vol. 13, No. 6, Nov. 1970, pp. 1621–1622.

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[57] **ABSTRACT**

A printing method and system wherein the printing is produced by a supersonic beam impacting against a pressure responsive material, such that the pressure action of the supersonic beam causes printing or impression. The printing system comprises a source of supersonic beam, a modulating system arranged in the path of the supersonic beam to modulate the same, such as to reproduce predetermined characters, a focusing assembly to focus the modulated supersonic beam onto one face of the pressure responsive material and to cause sweeping thereof across the latter to produce impression of a predetermined image.

2 Claims, 2 Drawing Figures



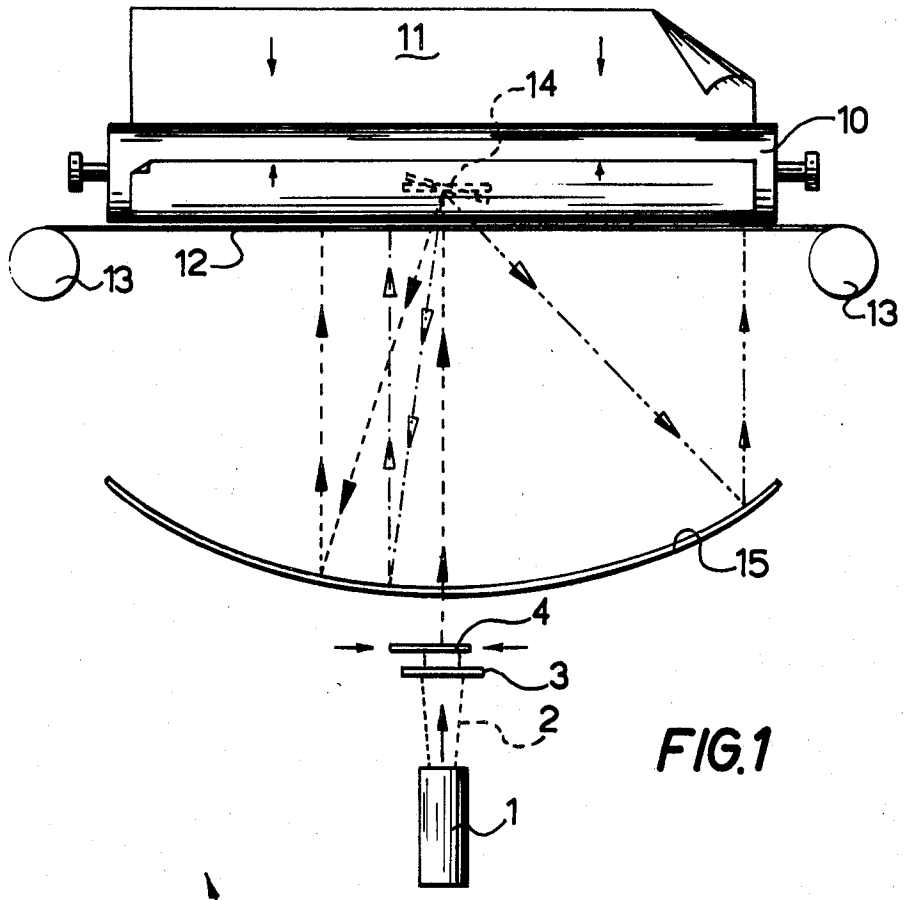


FIG.1

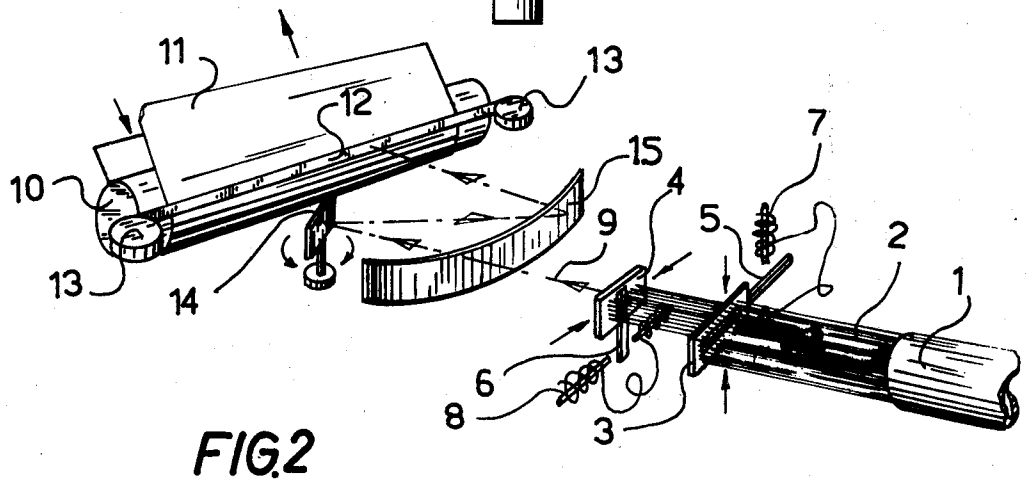


FIG.2

SUPERSONIC PRINTING METHOD AND SYSTEM THEREOF

This invention relates to the art of printing and, more particularly, to a new method and system of printing.

The use of supersonic energy has been developed in the last **50** years and has so far found many applicatons exclusive of printing.

It is known that a supersonic beam produces a pressure action as does an acoustic beam while being inaudible, as compared to the latter.

The applicant has noted that these particularities of the supersonic beam may be advantageously used to produce printing or impression in combination with a pressure responsive material.

It is therefore a general object of the invention to provide a printing method and system using the pressure action produced by a supersonic beam and a suitable pressure responsive material to perform the printing.

It is a more specific object of the invention to provide a printing method and system wherein a supersonic beam is modulated by transverse deflections to produce predetermined characters, is thereafter focused onto one face of a pressure responsive material and is caused to sweep along the one face to reproduce a predetermined image.

The above and other objects and advantages of the invention will be better understood in the light of the following detailed description of a preferred embodiment thereof, which is illustrated, by way of example only in the accompanying drawings, in which:

FIG. **1** is a schematic plan view of a printing system according to the present invention; and

FIG. **2** is a perspective view of the printing system of FIG. **1**.

The illustrated printing system includes a transducer **1** of any suitable type to produce a supersonic or ultrasonic beam, either mechanically or electrically, as is well known in the supersonic art, such as piezoelectric, magnetostrictive and electrostrictive transducers. Such transducers being connected in any suitable manner to an actuating oscillator circuit. By supersonic beam is meant a beam of wave energy of a frequency above the audible range, but below the frequency of electromagnetic radiation.

The supersonic beam **2** produced by the transducer **1** is of relatively large diameter and is projected along a path which is intersected by a modulating system including a pair of masking plates **3** and **4**, each having a slit extending orthogonally relative to the slit of the other. The plates **3, 4** are provided each with an extension **5** and **6** respectively having a magnetized portion and extending in the same direction as the corresponding slit. An electromagnet **7** is positioned adjacent and on opposite sides of the extension **5**, is connected to an actuating circuit and is arranged to cause up-and-down displacement of the masking plate **3**, whereby to allow at anyone time only a selected horizontal slice of the supersonic beam to pass therethrough towards the next masking plate **4**. The latter is similarly actuated by an electromagnet **8** and displaced laterally to allow only a small diameter supersonic beam to pass through the intersection of the two slits at any particular time. In order to form a predetermined character, both electromagnets **7** and **8** are fed with a suitably varying flow of current to cause a corresponding displacement in space

of the small diameter supersonic beam **9**. Each predetermined character may preferably be recorded onto any suitable type of memory, or records, from which it may be read to actuate the two electromagnets **7** and **8**.

A roller or drum **10**, such as an ordinary typewriter roller, holds a sheet **11** of paper or of any other appropriate print or impression receiving material. An ink carrier strip or ribbon **12** extends transversely in front of the sheet **11** and is held at opposite ends by reels **13**. The target strip or ribbon **12** is of a type adapted to respond to pressure against the front face thereof and having its rear face in contact with the sheet **11** and adapted to produce an impression on the latter in response to the pressure on the front face similarly as an ordinary carbon. Interdependent movement of the two masking plates **3** and **4** causes the beam **9** to sweep the target strip **12** along a trace forming the character desired to be printed on sheet **11**.

A focusing system is interposed between the modulating system and the pressure responsive ribbon or strip **12** and includes a pivotable mirror **14** arranged in the path of the modulated supersonic beam. The focusing system also includes a parabolic mirror **15** having the mirror **14** at the focus thereof.

The mirror or reflector **14** is arranged to be rotated step by step, such as by gears, to deflect the modulated supersonic beam more and more along the strip **12** after completion of each character so as to print successive characters along a printline. This synchronized progress or sweeping may be achieved by a synchronizing circuit, as is known in television to reconstitute the image, line by line. The parabolic mirror **15** directs the small diameter beam **9** always at right angles on the target ribbon **12** along the print line and, thus, prevents character deformation.

It will be understood by any person skilled in the art of telecommunication and printing that the above-described printing system may be combined into a telescriptor, electrocomposer, teletype, copier, calculator and programmer.

The principle of the invention may also be applied to a system for relief printing wherein the sheet of paper **11** and the pressure responsive strip **12** are replaced by a relatively soft and possibly hardenable material, which is suitably pressure responsive to receive and hold the impression thereon to form relief printing.

It must also be noted that the method and system of the invention are applicable as well to the impression of characters, drawings, diagrams and images.

Possible diffraction of the ultra-sonic beam, when passing through the intersecting slits of masking plates **3** and **4**, will have a minimum effect on the printed character, since ribbon **12** can be selected with a low printing sensibility to thus respond only to the central maximum power intensity zone of the diffracted beam. In fact, it can be calculated that the printed dot can have a diameter smaller than the wave length of the ultra-sonic beam when a ribbon **12** is selected with the proper printing sensibility. This, in turn, allows to choose a beam frequency of maximum propagation through ambient air.

I claim:

1. A printing system comprising a stationarily mounted transducer capable of emitting in ambient air a large diameter supersonic non-electro-magnetic beam, a target ink transfer sheet material in the path of

said beam, said target sheet material deformable under pressure exerted by said beam impinging thereon, to transfer ink to an impression receiving sheet disposed contiguous to said target sheet, and a modulating assembly to modulate said beam to print a character on said recording sheet, said modulating assembly including a pair of superposed masking plates, each having a narrow slit, the slits perpendicular to each other and in the path of said beam to allow the emergence of only a small diameter beam through the intersection of said slits, and interdependently controlled electromechanical means to move each plate back and forth to cause

said small diameter beam to sweep said target sheet along a trace forming the character desired to be printed on the impression receiving sheet.

2. A printing system as claimed in claim **1,** further including means to displace said narrow beam step by step along a print line of said target sheet, comprising a beam reflecting stepwise rotatable mirror in the path of said narrow beam, and a parabolic reflector having its focus at said mirror and located to receive said narrow beam from said mirror and reflect it onto said target sheet perpendicular thereto along said print line.

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