

[54] **METHODS OF SQUARING ELEMENTS WITH A SURFACE IN WHICH THEY ARE MOUNTED**

[75] Inventor: **Bela Bunkoczy**, Shelton, Conn.

[73] Assignee: **Bunker Ramo Corporation**, Oak Brook, Ill.

[22] Filed: **July 16, 1973**

[21] Appl. No.: **379,646**

[52] U.S. Cl. **51/281 R**

[51] Int. Cl. **B24b 1/00**

[58] Field of Search 51/281 R, 283, 289 R, 290, 51/323, 327, 277, 216 CP, 216 A, 227 R, 227 H, 229, 240 GB

[56] References Cited

UNITED STATES PATENTS

1,654,936	1/1928	Jones	51/323 X
2,424,835	7/1947	Luckey	51/323
3,158,968	12/1964	Ness	51/281 R X
3,763,611	10/1973	Düring	51/323

Primary Examiner—Donald G. Kelly
Attorney, Agent, or Firm—Norton Lesser; F. M. Arbuckle

[57] ABSTRACT

A method of squaring one or more elements, such as the print wires of a wire matrix print head, with a surface of a member in which the elements are mounted. The elements are of a material having a predetermined hardness which is less than the hardness of the material of the surface in which they are mounted. The first step of the method is to adjust the position of all of the elements relative to the surface so that they extend slightly from the surface. The extending portions of the elements are then ground with an element having an abrasive surface, the material of the abrasive surface having a hardness which is greater than the predetermined hardness but less than the hardness of the material for the surface in which the elements are mounted. The grinding step is terminated when the material of the abrasive surface starts being worn away by the harder material of the surface in which the elements are mounted.

4 Claims, 3 Drawing Figures

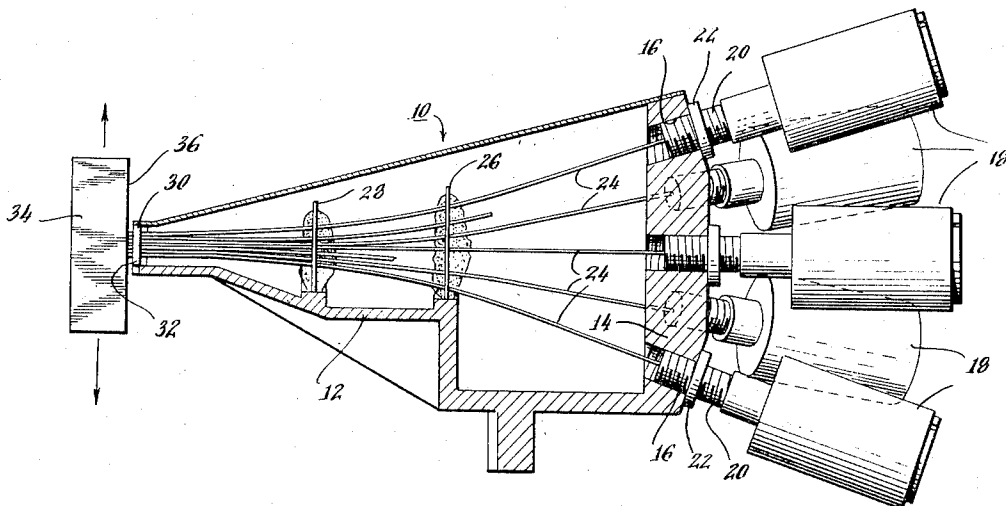


Fig. 1.

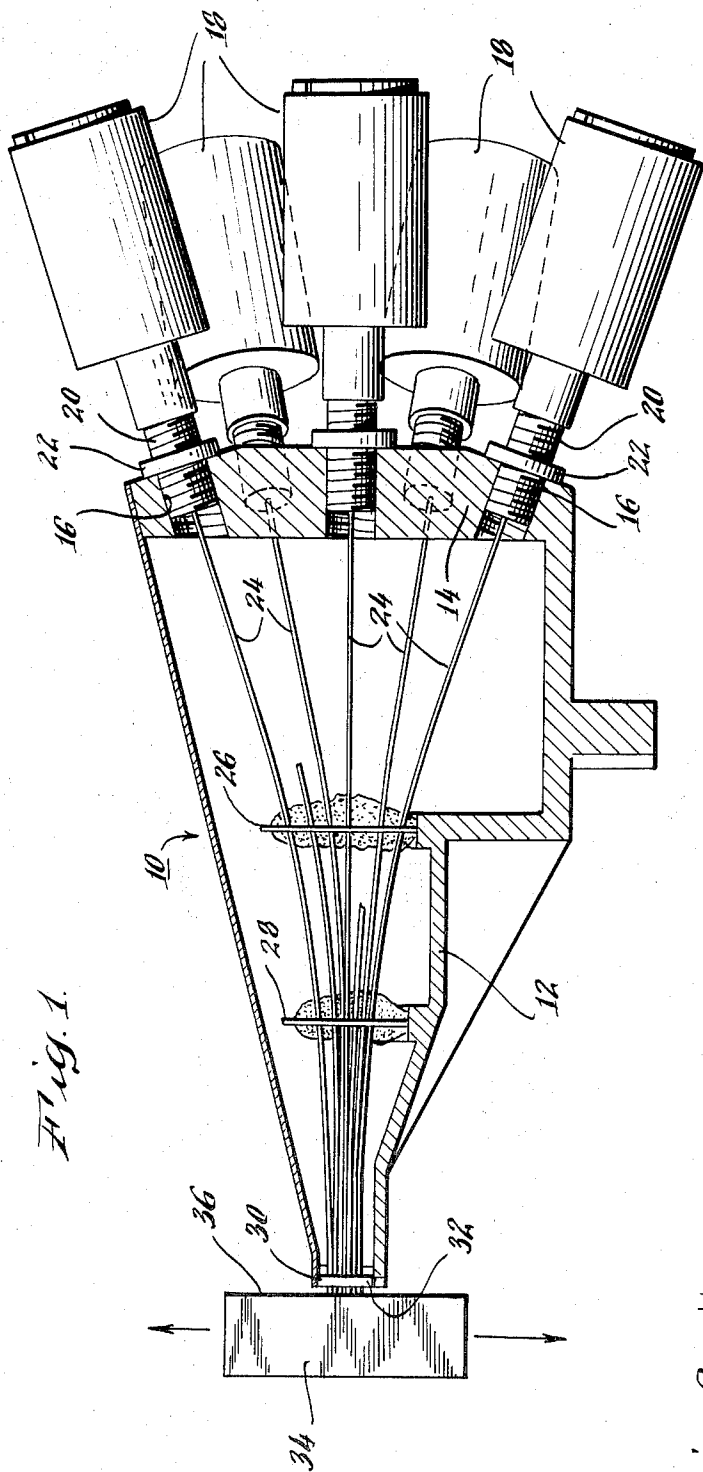


Fig. 2.

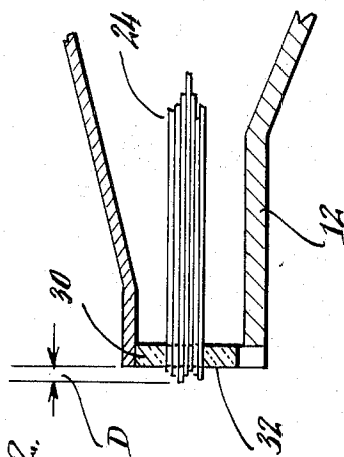
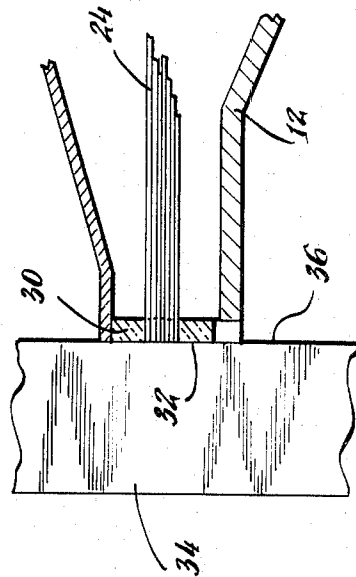


Fig. 3.



METHODS OF SQUARING ELEMENTS WITH A SURFACE IN WHICH THEY ARE MOUNTED

This invention relates to a method of squaring one or more elements having a predetermined hardness with a surface of a member in which the elements are mounted, the surface being of a material having a hardness greater than said predetermined hardness, and more particularly to a method of squaring the print wires of a wire matrix print head with the front face of the print head.

BACKGROUND OF THE INVENTION

In wire matrix print heads such as the print head described in co-pending application Ser. No. 378,744 entitled "Matrix Wire Print Head and Method For the Manufacture Thereof" filed on July 12, 1973 on behalf of Okun Kwan and James Vincent Masi and assigned to the assignee of the present application, the distance which the print wires are moved to effect a printing operation (the print stroke of the print head) would typically be about 20 mils. With such a small print stroke, it is imperative that the print wires be absolutely square with each other and with the front surface of the print head in order to assure uniform print quality and to prevent potential damage to the wires or other elements of the print head, to the print ribbon, or to the platen supporting the document being printed on. Heretofore the squaring of the wires has normally been manually accomplished by initially positioning the wires so that they all project slightly from the front face of the print head, and then carefully backing each individual wire off until a point is reached where the wire is no longer visible, or can no longer be felt by a gauge element. When this point is reached, the wire may then be moved forward slightly to be sure that it has not been backed off too far and then backed off again until the operator is satisfied that the wire is exactly flush with the front surface of the print head. This is obviously a slow tedious procedure which, even with a skilled operator, is only moderately successful in assuring exact squaring of the print wires. When it is considered that the print stroke is only 20 mils, and thus an error of 2 to 4 mils in initial position of the wire results in an error of 10 to 20 percent, the difficulty in achieving required position precision utilizing the technique described above becomes readily apparent.

Another problem with this procedure is that the wires, when received, have normally either been cut or ground to desired length, and frequently have slight overhangs or burrs at their ends. These burrs effectively enlarge the end of the print wire causing smearing or other irregularities in the printing. The burrs also wear against the jewel in the front face of the print head in which the wires are mounted, creating friction, and thus heat, which can damage the wire or the jewel.

Another technique which is sometimes utilized for squaring the print wires is to again adjust the wire positions so that they all extend beyond the end of the front face of the print head (i.e. beyond the end of the jewel) and to then either cut or grind the wires so that they are all aligned with each other. The wires are then all backed off by the same amount so that they are aligned in the print head. However, the backing off is still done manually so that the difficulty of determining the exact position for the wires still exists, and there is a further problem of backing the wires off by exactly the same

amount where even a few mils error is significant. The cutting or grinding operation also results in burrs on the ends of the wires, the undesirable effects of which have been discussed above. This procedure is thus even less desirable than the first procedure.

A need therefore exists for a relatively quick and simple procedure for squaring all the wires in a wire matrix print head precisely flush with the front face of the head. Similar problems also exist in other devices where a requirement exists to precisely square an element or elements with a surface of a member in which the elements are mounted.

SUMMARY OF THE INVENTION

In accordance with the above, this invention provides a method of squaring one or more elements such as the print wires of a wire matrix print head with a surface of a member, such as the front face of a print head, in which the elements are mounted, the elements being of a material having a predetermined hardness and the surface being of a material having a hardness greater than the predetermined hardness. For the print head, the hardness of the front face of the print head, which is a jewel for the preferred embodiment of the invention, is harder than the material of the print wires. The first step of the method is to adjust the position of all of the elements relative to the surface so that they extend slightly from the surface. The extending portions of the elements are then ground with an element having an abrasive surface, the material of the abrasive surface having a hardness which is greater than the predetermined hardness but less than the hardness of the material for the surface in which the elements are mounted. The grinding step is terminated when the material of the abrasive surface starts being worn away by the harder material of the surface in which the elements are mounted.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a cutaway side view of a wire matrix print head on which the teachings of this invention may be utilized, illustrating the head during the grinding step.

FIG. 2 is an enlarged view of the front portion of the print head shown in FIG. 1 after the adjusting step of the operation has been completed.

FIG. 3 is an enlarged view of the front portion of the print head when the squaring operation has been completed.

DETAILED DESCRIPTION

Referring now to the figures, a print head 10 is shown having a housing 12 with a rear wall 14 having a plurality of threaded openings 16 formed therein. A print solenoid 18 having a threaded shaft 20 is mounted at a predetermined angle in each of the openings 16. A lock nut 22 is mounted on a screw threaded portion of each shaft 20 and, when tightened against the rear surface of wall 14, prevents rotation of the shaft 20 in the opening 16.

Extending from each print solenoid 18 is a print wire 24 which passes through an opening (not shown) in a guide plate 26, an opening (not shown) in a guide plate

28, and an opening (not shown) in a jewel 30 which forms the front face of the print head 10. In order to assure uniform print quality, it is important that every one of the wires 24 be exactly flush with (i.e. squared with) the front face 32 of jewel 30.

In practicing the print wire squaring method of this invention, lock nuts 22 are initially loosened and each of the solenoid 18 screwed into the corresponding opening 16 by an amount sufficient to cause the print wire 24 projecting therefrom to extend slightly beyond surface 32 of jewel 30. The lock nuts 22 are then tightened to prevent further rotation of the solenoids and thus to assure that the position of the wires is maintained. The exact amount by which each of the wires extends beyond surface 32 is not critical and, as shown in FIG. 2, it is not necessary that the wires be aligned at this point. The maximum distance D by which the wires extend beyond surface 32 should, however, be approximately 1/64th of an inch.

When the adjusting step described above has been completed, the wires are then ground or stoned by a suitable element 34 having an abrasive surface 36. For a preferred embodiment of the invention, the element 34 is a medium Indiana oil stone. It is noted that the wires 24 being, for example, of tungsten steel or a similar material, have a hardness of for example 60 to 65 Rockwell, while the jewel 30 has a significantly greater hardness (for example 1525 to 2000 Knoop). By selecting a grinding element 34 having an abrasive surface 36 of a material such as Indiana oil stone (for example medium type 30 J, K, or N) with a hardness which is greater than that of wires 24, but less than that of jewel 30, the wires may be ground absolutely flush with surface 32, including the grinding off of any burrs or overhangs, without any danger of damaging the jewel. In practice, the grinding operation, would normally be performed manually, with the operator moving the oil stone or other element 34 up and down against the projecting portions of the wires until a point is reached where the wires are all flush with surface 32 and the surface 36 of oil stone 34 starts to be worn away, as shown in FIG. 3, by the harder surface or jewel 30 against which it is rubbing. When this occurs, the desired squaring of the wires with surface 32 has been accomplished and the grinding operation may be terminated.

A quick simple method for squaring the print wires with the front surface of a matrix wire print head 10 has thus been provided which method squares the wires

with a higher and more uniform level of precision than has been previously attainable. It is apparent that the material utilized for the abrasive surface 36 of grinding element 34 would vary with the material of the element being ground and with the material of the surface in which the element being ground and squared is mounted. In each instance, the material of the abrasive surface would be harder than the material of the element being ground and squared, but would have a hardness less than the hardness of the material of the supporting surface. It is also apparent that, while in the discussion above, all steps in the operation have been indicated as being performed manually, the grinding and/or other steps of the operation could be performed mechanically. Thus, while the invention has been particularly shown and described above with reference to a preferred embodiment thereof, it will be apparent to those skilled in the art that the foregoing and other changes in form and detail may be made therein while still remaining within the spirit and scope of the invention.

I claim:

1. A method of squaring the print wires of a wire matrix print head to the front face of the print head, the front face of the print head through which said print wires project being of a material which is harder than the material of said print wire, comprising the steps of:

adjusting the position of all of said print wires so that they extend slightly from said front face; and grinding the extending portions of the wires with an element having an abrasive surface, the material of said abrasive surface having a hardness which is greater than that for the material of said print wires but less than that for the material of said front face; and

terminating said grinding step when the material of said abrasive surface starts being worn away by the harder material of said front face.

2. A method as claimed in claim 1 wherein said front face is a jewel.

3. A method as claimed in claim 1 wherein said element having an abrasive surface is an oil stone; and wherein said grinding step is a stoning step.

4. A method as claimed in claim 1 wherein, during said adjusting step, the wires are adjusted to project approximately 1/64th of an inch from said front face.

* * * * *

50

55

60

65