(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 629 505 A2**

(12) # EUROPEAN PATENT APPLICATION

(21) Application number : **94304287.9**

(51) Int. Cl.^{5} : **B41J 2/17**

(22) Date of filing : **14.06.94**

(30) Priority : **15.06.93 US 76877**

(43) Date of publication of application :
21.12.94 Bulletin 94/51

(84) Designated Contracting States :
CH DE FR GB IT LI SE

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(54) **Dual density foam inking member and method of making the same.**

(57) This invention relates to an inking member made from a single, foraminous material. The foraminous material, such as polyurethane, is placed into a press. The top platen of the press is raised to a temperature of 380 to 450° F and the material is subjected to a pressure of 8,618kg/force on a 165mm ram load for a period approximately of 3.5 minutes. What results is an inking member having small pores in the area adjacent to the heated platen and larger pores in those portions of the pad that are distant from the heated platen. This yields a foraminous, member that has utility as an inking member with the small pore portion acting as an ink metering layer and the large pore portion acting as an ink reservoir layer.

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In the printing operation of the impact type, a printhead is provided with ink, by an ink roller or ink pad, immediately before making contact with a medium such as paper. The inking member can be one of two types, one wherein ink is supplied continually to the inking member and the other where the inking member stores a quantity of ink and is replaced when that quantity of ink has been consumed. In a system where ink is continually supplied, a pump and ink reservoir must be provided that will keep up with the speed of printing. With regard to a self containing inking member, the advantages reside in not requiring a mechanism for supplying ink to the inking member, but the disadvantage is that the inking member must be replaced from time to time on a much more frequent basis. There is also a tendency for the print intensity to vary from dark to light as the ink in the roller or pad is slowly depleting. The instant invention is directed to an inking member that is capable of storing a relatively large quantity of ink, yet is able to meter the ink efficiently. Although the ink member has primary advantages as a self contained inking layer, it can, nevertheless, be used as an inking member that is continually supplied with ink.

Layered inking members have been developed recently; wherein, one layer serves as a reservoir for the ink and generally has large pores and the second layer serves as a metering layer and has smaller pores and tortuosity.

Prior art inking members had two layers of different pore sizes that were placed adjacent to one another and held in place by a fixture. Subsequently, an adhesive inking member was optimized to be used between the said two layers so as to connect the two layers and provide better contact therebetween without reducing the flow of ink. Although good results were achieved with providing two layers of different pore sizes with an adhesive therebetween, certain disadvantages did result therefrom. As time passed, the adhesive would lose its properties and the layers could tend to separate from one another. Also, the adhesive could cause the inking member to curl after a passage of time, due to differences in the swelling rates which is a well known polymeric material property. Also, if the adhesive layer is not chosen or the bonding not done perfectly each time the delicate pore structure will be altered affecting ink flow. Clearly, it would be advantageous to have an inking pad that has a metering portion and an ink storage portion that is formed from a unitary material. This would eliminate the whole bonding step in fabrication and would mean cost advantages and ease of manufacturing.

An inking member nas been conceived wherein the member is of unitary structure, but has a metering layer and an ink storage layer. The inking member has particular utility as a self contained, replaceable inking member. A foraminous material, such as polyurethane, is first formed into the required shape for a printing pad. The foraminous material is then placed into a press whose platen is at a temperature of 380 to 450°F. The foraminous material is then subjected to a pressure of 7,257 to 8,618kg/force on 165mm ram press load for a period of 2.5 to 4.5 minutes. That portion of the pad that is adjacent the heated platen will be permanently compressed, i.e. felted so that the pores of the portion immediately underneath thereof are reduced in size, without hurting the reticulation which is the key for ink flow. The portion distant from the heated platen and subjected to no heat will experience no permanent set or compacting. A felting process compacts the initial foam into the final shape size and thickness.

The resulting composition is a pad having a first portion with relatively small pores therein and second portion with relatively large pores. The first portion will allow air flow of 10 to 60 ml/min. whereas the unfelted portions will allow air to flow at the rate of 100 to 190 ml/min. by carefully controlling the time/temperature profile of the "felting" process. Clearly, the portion with the smaller pores will be that part of the pad that was in the vicinity of the heated platen. The portion with the larger pores will have the original pore size as it was not exposed to heat. With such a structure, one has, in effect, a metering layer with small pores and an ink reserve layer with large pores without the need of an adhesive therebetween. The air flow needs, once again, are selected and optimized for each application specifically.

Brief Description of the Drawing

FIG 1 shows a cross sectional view of a portion of an inking member that has been fabricated in accordance with the instant invention;

FIG 2 is a cross section view of a press with a foraminous material therein before pressure is applied; and

FIG 3 is a view similar to FIG 2 except showing pressure applied to the foraminous material.

Detailed Description of the Preferred Embodiment

With reference to FIG 1, a view is shown of a portion of a foraminous structure with which the instant invention can be practiced. The foraminous structure has use as an inking member in an impact printer. The inking member is shown generally at 10 in the form of a pad and has a first portion 12 that serves as a metering layer having small pores 14 therein. The pores 14 of the first portion 12 can have a size of approximately 10µ to 20µ Confluent with the first portion 12 is a second portion 16 that has large pores 18 and serves as an ink reservoir. The pores 18 of the second portion 16 can have a size of 200µ to 500µ. More importantly, the first portion 12 will have of tortuosity that allows air to flow at 33ml/min. and the second portion 16 will allow air to flow at a rate of 100 to 190ml/min. In practice, the pad 10 would be confined within a structure, but the structure is not shown as it does not form part of the invention.

The first portion 12 is contacted by the print elements of a printhead for the purpose of having the pad 10 supply ink to such fonts. After contact with the print pad 10, the fonts would contact a medium such as paper to transfer ink thereto and complete the printing operation, as is well known in the art. The first portion 12 acts as a metering layer and will release ink slowly to control the amount of ink supplied to the fonts of a printhead. As ink is transferred from the metering layer 12 to the fonts, replacement ink is supplied from the second portion 16 to the first portion 12, because of their confluence. The second portion 16 acts as an ink reservoir and has large pores 18 that are capable of holding a relatively large amount of ink. Needless to say, after the ink has been sufficiently depleted in the course of the printing operations, the pad 10 would be replaced with a pad having a full supply of ink if it were not supplied with ink continually. If it were supplied with ink by an ink reservoir, the second portion 16 would still serve as a reservoir.

With reference to FIGs 2 and 3, a method of forming a dual density ink pad 10 is accomplished by heating the top of the pad 10 and applying pressure thereto. The material from which the pad 10 is made can be any suitable foraminous material such as polyurethane, polyethylene, other polyolefines, polychloroprene, and the like. The important consideration is that the foraminous material be an open cell foam and that it be compatible with the ink that is to be dispensed. It should also have all the other mechanical and flow properties that are essential. The preferred material is polyurethane, for the class of inks that are generally used for the type of printing intended.

The method of controlling the density of the top layer 12 is by compressing a fixed thickness of foam. A foam material 10 having a length of 130mm and a width of 38.6mm was placed on a base 20 of a press 25 and between two shims 22. The top platen 24 of the press 25 was heated to a temperature of 380 to 450°F and a load of 8,618kg of force on 165mm ram press load was applied with a hydraulic pressure applied through a shaft 26 to the top platen for 2.5 to 3.5 minutes. It should be noted that the load is not critical as it is only necessary that the top platen 24 engage the shims 22. A load as low as 45.4kg was found sufficient. The distance "x" between the top of the shim 22 and the top of the foam material 10 before pressure was applied was 1.27mm. This yielded a top layer 12 with a thickness of approximately .762mm. Preferably, the top layer 12 thickness will be in the range of .432mm to 1.4mm. The balance of the foraminous material will retain its original pore size. Preferably, the thickness of the bottom portion will be 5.1 mm to 7.62mm. The details of the "felting" process is optimized for each end use that takes into consideration the ink solvents, solid contents, viscosity and amount needed for each print cycle etc.

In a preferred embodiment, a polytetrafluoroethylene coated plate having a thickness of 6.477mm was placed between the top platen 24 and the foam material 10. The same conditions applied as described above except that a lesser temperature was required, 390° to 420°F. Clearly, in place of a coated plate, the contacting surface of the top platen 24 could be coated with polytetrafluoroethylene.

The preferred foraminous material is polyurethane because of its versatility and compatibility for this type of ink. Compression strength, comformance, compliance tear and tensile strength characteristics are some of the advantages of polyurethane. It has good wear resistance, high void volume, allows ink to flow readily through the pad thickness, and manufacturing variables are well established. In addition, minimum odor is generated during the felting process, and has a good ink hold out. Ink does not tend to run out of the pad during any type of inversion. At ambient temperatures the inked pads have good hyrdrolytic stability.

Although the invention is described as applied to an inking pad, it could be utilized equally well with other forms of inking members such as inking rollers.

The advantages of the instant printing pad and method of making is that of simplicity in manufacture and versatility of the material that results in improved quality in an inking member at a much lower cost. When used as a self contained inking member it had a life of 10,000 printing cycles. The fact that only one elastomeric foam material is used to form the dual density pad is advantageous since quality control can be more easily achieved. Furthermore, one need not be concerned with adhesive losing its properties with the passage of time as could occur with prior dual density inking members joined by an adhesive.

The above embodiments have been given by way of illustration only, and other embodiments of the instant invention will be apparent to those skilled in the art from consideration of the detailed description.

Claims

1. A composition of matter that serves as an inking member after ink is added thereto, comprising:
   a one piece body composed of foraminous material, said foraminous material having a first portion with a pore density that allows air to flow at a rate of 10 to 60 ml/min. and second portion confluent with said first portion and having a pore size that allows air to flow at a rate greater than 100 ml/min.

2. The composition of matter of Claim 1 wherein the foraminous material is an open cell foam.

3. The composition of matter of Claim 2 wherein said second portion allows air to flow at a rate of 100 to 190 ml/min.

4. The composition of matter of Claim 2 wherein said foraminous material is polyurethane.

5. The composition of matter of Claim 2 wherein said member is in the form of a pad.

6. A printing pad comprising:
a one piece, homogeneous unitary pad composed of a foraminous material, said foraminous material having a first portion with a thickness of approximately .432mm to 1.4mm inches and a pore size of 10 to 20μ, and a second portion having a pore size of 140 to 180μ.

7. The printing pad of Claim 6 wherein said foraminous material is polyurethane.

8. The printing pad of Claim 6 wherein said second portion has a thickness of approximately 5.1mm to 7.62mm.

9. In a method making a dual density ink pad, the steps comprising:
placing a quantity of an open cell foam in a press between two platens,
heating one of the platens of the press to a temperature between 380 and 450°F,
placing a shim having a thickness smaller than the thickness of the quantity of foam between the platens,
positioning the quantity of foam within the shim with a portion of the foam extending between the shim and the heated platen before pressure is applied, and
applying pressure to the heated platen until the heated pad engages the shim.

10. The method of Claim 9 further including the step of applying heat for a period in excess of 2.5 mins. after the heated platen engages the shim.

11. The method of Claim 9 further including the step of placing a plate having a polytetrafluoroethylene surface between the heated platen and the quantity of open cell foam.

12. The method of Claim 9 wherein said step of placing a quantity of open cell foam comprises placing a quantity of polyurethane between the two platens.

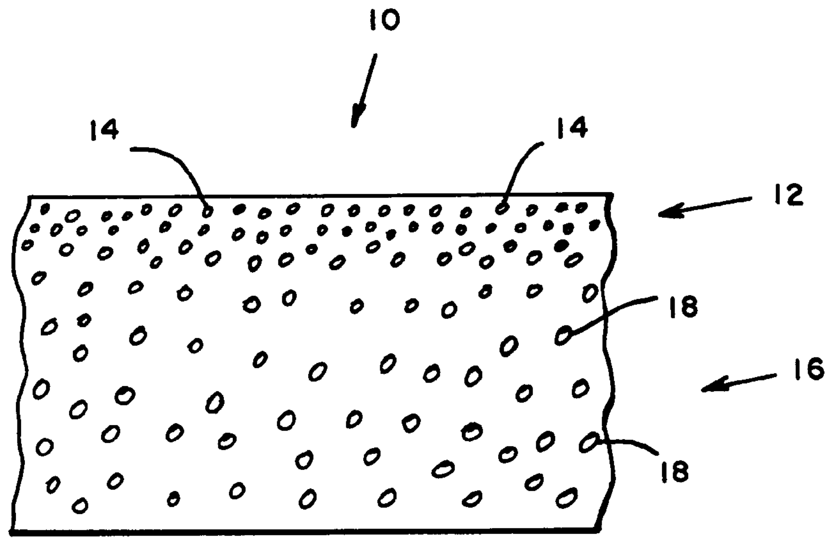

FIG. 1

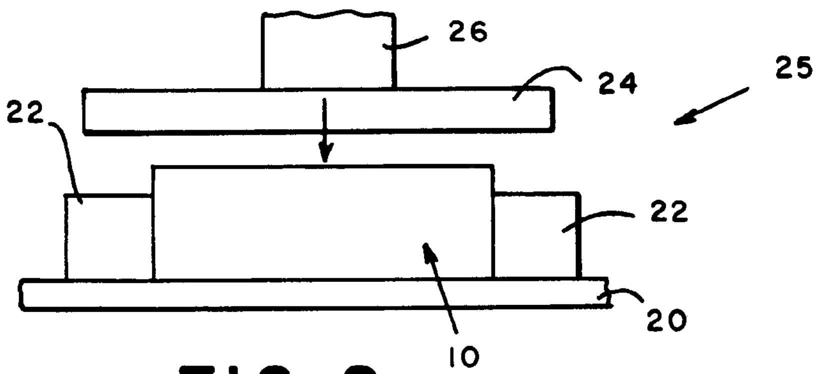

FIG. 2

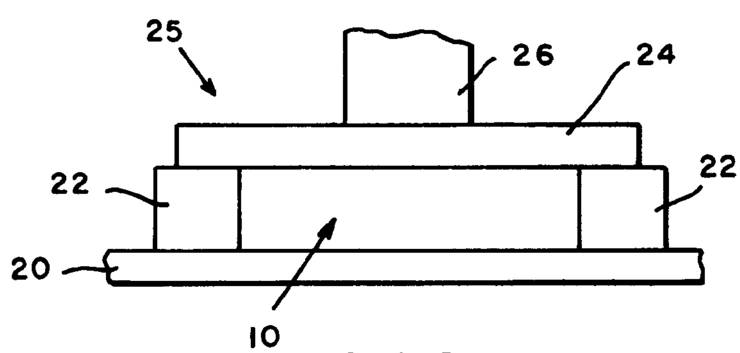

FIG. 3