THE JOINT EXAMINATION BOARD

PAPER P3

PREPARATION OF SPECIFICATIONS FOR UNITED KINGDOM AND OVERSEAS PATENTS

13th November 1998

10:00 a.m. - 2:00 p.m.

Please read the following instructions carefully. This is a **FOUR HOUR** paper.

1. Check the contents of this envelope. You should have ***three (3) sheets*** of question paper including these instructions and ***two (2)*** sets *of* ***the drawings (one with and one without Legends) each set being of two (2) numbered sheets and making seven (7) sheets in ail.***

2. In the appropriate boxes at the top of each sheet please enter the designation of the paper (P3), the question number and your examination number. You should write only on one side of the paper using **BLACK** ink. Please do NOT staple pages together. You must NOT write your name anywhere in the answers.

3. NO printed matter or other written material may be taken into the examination room.

4. Answers **MUST be legible.** If the examiners cannot read a candidate's answer then no marks will be awarded.

Your client manufactures composite materials. He writes to you as follows.

"I'd like you to file a patent application for me in order to protect a system we have come up with for the alignment of fibres to be used in a fibre reinforced material. As you will appreciate, in order to control the physical properties of a fibre reinforced material – including tensile and shear strength in one or more directions, and fatigue strength - it is well known and important to be able to control the alignment of the fibres in the material. This applies whether material is metal, including a sintered metal, or a plastics material. It does not necessarily follow that we want the fibres all to be aligned in the same direction. We may want to have a layer in one direction adjacent another in another direction, which may or may not be at right angles. We have previously made composite materials containing woven fabric and non-aligned fibres

Composite materials with aligned fibres are currently very expensive because of the difficulties in aligning the fibres. Sometimes the fibres are short, sometimes they are brittle. Sometimes they are relatively long and somewhat flexible. Combing or carding, which the industry has been using, is not particularly satisfactory with reinforcing fibres for two reasons. Firstly, flexible fibres tend to clog the comb, requiring frequent clearing, and secondly, brittle fibres are often broken or damaged by the comb.

In the drawings you will see an apparatus we have put together for producing an array of aligned fibres. In the reservoir, we place a pool of liquid containing the fibres. The pool is gated to provide control over the flow of liquid through the apparatus to allow a film of the liquid with the fibres to run onto the moving endless belt whence it passes to a screw which lies transverse the belt and touches it. The screw vibrates longitudinally of its length, by an amplitude up to about the pitch of the screw thread (identified by P in Fig. 3) but preferably about 0.8 pitch, and at a rate between about 180 and 330 cycles per second. For silicon nitride crystal whisker fibres which have a diameter of 1--2 microns and a length of 0.1 to 10 mm, a 0.125 inch radius bar (identified by R in Fig. 3) with a 0.025 inch pitch and depth screw thread (identified by D in Fig. 3) works quite well. The bar aligns the fibres in the liquid and it carries the aligned fibres to the roller. The roller is porous and the pump serves to draw the liquid through the roller pores. The fibres adhere-to the roller and the belt continues around.

The system works best if the liquid is more viscous than water, as this assists in maintaining the alignment of the fibres and in ensuring that they adhere to the belt and cohere when on the roller. Thus when a sufficiently thick layer of fibres has accumulated on the roller, the apparatus is stopped, the roller removed and the layer of fibres lifted from the roller.

With glycol used as the liquid, we disperse fibres in the liquid in a proportion of about 5 gm. per litre, while the reservoir is gated and the belt speed is such, about 2 ft per minute, that the liquid pool on the belt is about 0.05 inches deep. If we arrange for the peripheral speed of the roller to be about 5-10% greater than the belt speed, this assists in ensuring and maintaining fibre alignment.

The use of a screw thread, which does not rotate, is a convenient way of providing suitable channels presented to the pool on the belt and this assists the alignment, while the vibration of the screw thread serves to reduce or prevent clogging. Obviously, larger fibres will require a larger screw pitch and a lower vibration frequency, but it is preferable that whatever is the range of pitches that might be used for any given fibre, the larger it is, the less is the tendency for the thread to clog.

We have also found that that silicon nitride fibres as mentioned above can be aligned by being dispersed in an ammonium alginate solution in volumetric concentrations of up to 5% fibres, The alginate solution comprising 1 to 5% pure alginate in water."

Prepare a specific description and claims for filing in the British Patent Office.

Marks will be awarded as follows: -

Claims	75%
Specific Description	25%

Fig.1.

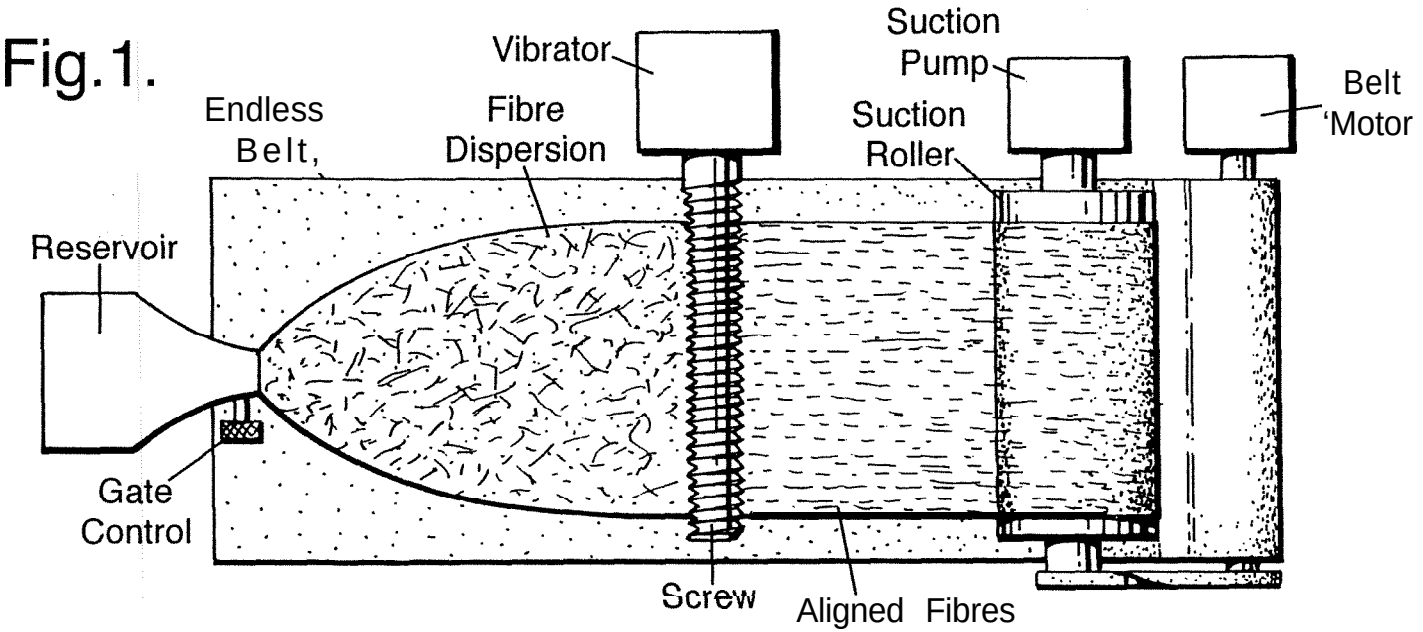

Fig.2.

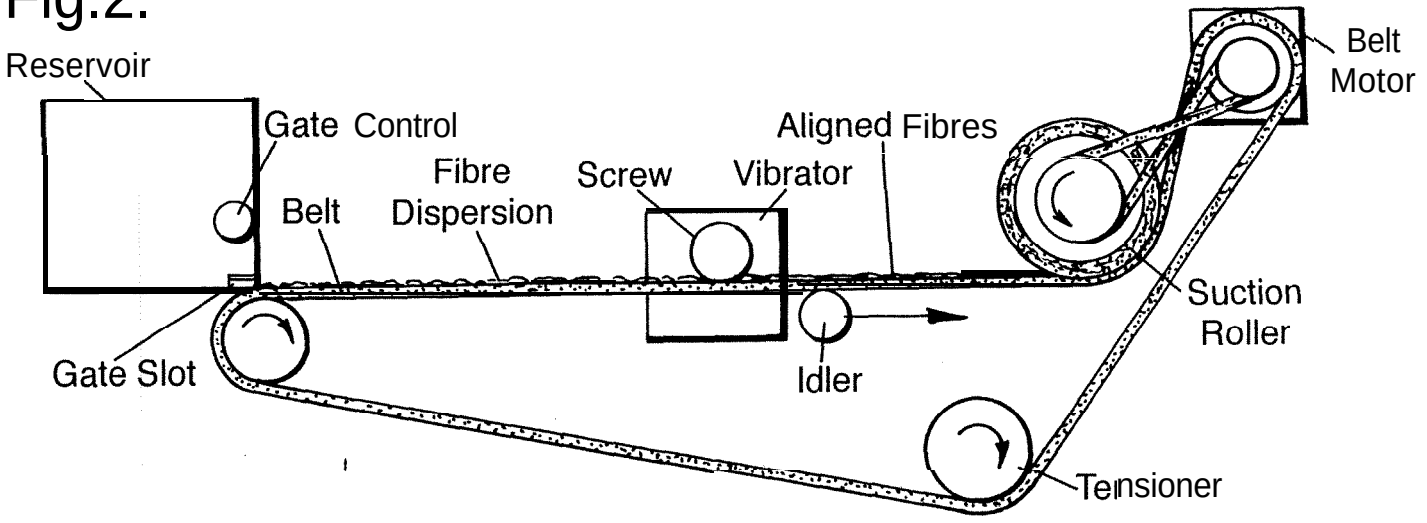

Fig.3.