THE JOINT EXAMINATION BOARD

PAPER P3

Preparation of Specifications for United Kingdom and Overseas Patents

Thursday, 3rd November 2005
10.00 a.m. – 2.00 p. m.

Please read the following instructions carefully. ***Time Allowed – FOUR HOURS***

1. The whole question is to be attempted
2. Marks to be awarded are given on page 3
3. Please note the following:
   a. Enter the Paper Number (P3) and your Examination number in the appropriate boxes at the top of each sheet of paper;
   b. The scripts are photocopied for marking purposes. Please write with a **dark inked pen** on one side of the paper only and within the printed margins, and do not use highlighters in your answer;
   c. Do not staple or join pages together in any way;
   d. Do not state your name anywhere in the answers;
   e. Write clearly, examiners cannot award marks to scripts that cannot be read;
4. Under the Examination Regulations **you may be disqualified from the examination and have other disciplinary measures taken against you if**:
   a. you are found with unauthorised printed matter or other unauthorised material in the examination room;
   b. your mobile phone is found to be switched on;
   c. you copy the work of another candidate, use an electronic aid, or communicate with another candidate or with anyone outside the examination;
   d. you continue to write after being told to stop writing by the invigilator(s). **NO WRITING OF ANY KIND IS PERMITTED AFTER THE TIME ALLOTTED TO THIS PAPER HAS EXPIRED.**
5. **At the end of the examination assemble your answer sheets in order and put them in the WHITE envelope provided**. Any answer script taken out of the examination room will not be marked.
6. This paper consists of eleven pages, including this page and comprises two pages of client's instructions and two sets of drawings, each of four sheets

Your client, a manufacturer of specialist alloys especially for aero-space applications, writes to you as follows:-

"Please find herewith four sheets of drawings showing my new system for vapour deposition of alloys which I should like you to patent for me. Basically, what happens is depicted in Fig. 1. The molten alloy is in the evaporator source above which is a cooled collector drum rotating slowly in a vacuum and upon which the alloy vapour condenses. Adjacent the collector drum is a peening device arranged to direct shot onto the surface of the newly collected and condensed alloy.

"I advise that vacuum deposition of vaporised aluminium alloys is a well-known technique. In a known example, a rotating drum, cooled to 250°C, acts as the collector upon which an aluminium alloy is deposited. To obtain this, the evaporator source is fed with an alloy mix; the proportions of which are arranged to provide exactly the desired alloy when deposited. The drum rotates at a rate, typically of the order of 10 rpm, so that, with a 3 metre diameter drum, a layer of alloy about 5μm thick is formed on the collector during each revolution, until a desired thickness of alloy is obtained. The chamber in which all the components are located and the process takes place is kept at a high vacuum, with a residual pressure of approximately 4 x 10-5 torr; so that oxidation of the newly-formed layer by exposure to residual oxygen and water in the vacuum chamber will be minimised. The deposited alloy is removed from the collector once a sufficient thickness has been built up.

"It is well established in our industry to mechanically work newly-formed aluminium alloys. For example, strips of deposited alloy are taken from the collector and passed between opposed pressure rollers whilst the alloy is still relatively warm and malleable. Mechanically working the alloy in this manner improves it's properties as it causes renucleation of the growing metal crystals and controls preferential crystal facet growth. All this results in fine grain size, high density and a lack of residual tensile stresses; which might otherwise lead to cracking of the alloy in use.

"The peening device is a rotor with blades arranged to be rotated in a housing. The housing has a well beneath the rotor to form a reservoir of small hard balls, known as shot. The shot material has to be resistant to fracture under operating conditions and may be made, for example, of quartz, which has a relatively low density, or tungsten, which has a relatively high density. I have found steel shot of about 1.2mm in diameter to be particularly effective; although shot with a diameter range of between 0.9mm and 1.6mm should work. Steel has a density of approximately 7.90×10^3 kilogram per cubic metre, between that of quartz 2.64×10^3 kilogram per cubic metre and tungsten 1.96×10^4 kilogram per cubic metre. The blades extend across the width of the housing with a running clearance both between the blades and housing sides and between the blade tips and the housing well. The running clearance is smaller than the diameter of the shot, to obviate shot from jamming the rotor in the housing. The blades may have rubber tips or be entirely of rubber.

"The alloy is peened as each layer is deposited on the drum, this mechanically works the deposited alloy while it is warm and malleable.

"For a 60mm wide rotor rotating at 1750 rpm, anything between 6,000 and 12,000 balls of shot works well. A much wider rotor risks the migration of shot to one side or the other of the well; this can be impeded by using internal well dividers (not shown).

"The housing is arranged and shaped to project the shot onto the surface of the newly deposited alloy on the collector. It is however vital that no shot spills and drops down into the evaporator source. For this purpose the housing mouth is surrounded by a row of wire brushes to seal against the collector and direct stray shot back into the housing.

As can be seen from Fig. 4, the housing mouth is narrower than the width of alloy deposited on the collector, this means that only a portion of the deposited alloy can be shot peened by the peening device. Peening of the whole width of deposited alloy is achieved either by providing multiple peening devices arranged to peen overlapping portions of deposited alloy or by moving the peening device across the collector as the collector rotates (neither shown).

"As an alternative, peening can be accomplished using metal flails on a rotor but if the flails are not properly adjusted a too regular and consequently inadequately thorough working of the whole surface of the deposited alloy can result.

We wish to secure the widest possible patent protection for this new idea ."

oooOOOooo

You are uncertain as to the meaning of the term "peening"; a Web search reveals the following definitions:-

1 When a material is bombarded with small, round steel shot (i.e. ball bearing's, buckshot) at high velocities, it is termed shot peening. This process will increase the resistance to fatigue failure by adding dislocations and hardening the surface, which is where a crack may begin due to surface flaws.

2 Impacting the surface layer of a material a multitude of times; for example by bombarding it with a selected medium (usually round steel shot) under controlled conditions.

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Draft a Patent specification, without an abstract, but with claims, suitable for filing at the UK Patent Office.

Marks to be awarded:-

Introduction	5%
Specific Description	20%
Main Claim(s)	55%
Dependent Claims(s)	20%

Enclosures:-
Clients four sheets of drawings with explanatory legends.
Further set of blank drawings.

Fig.1.

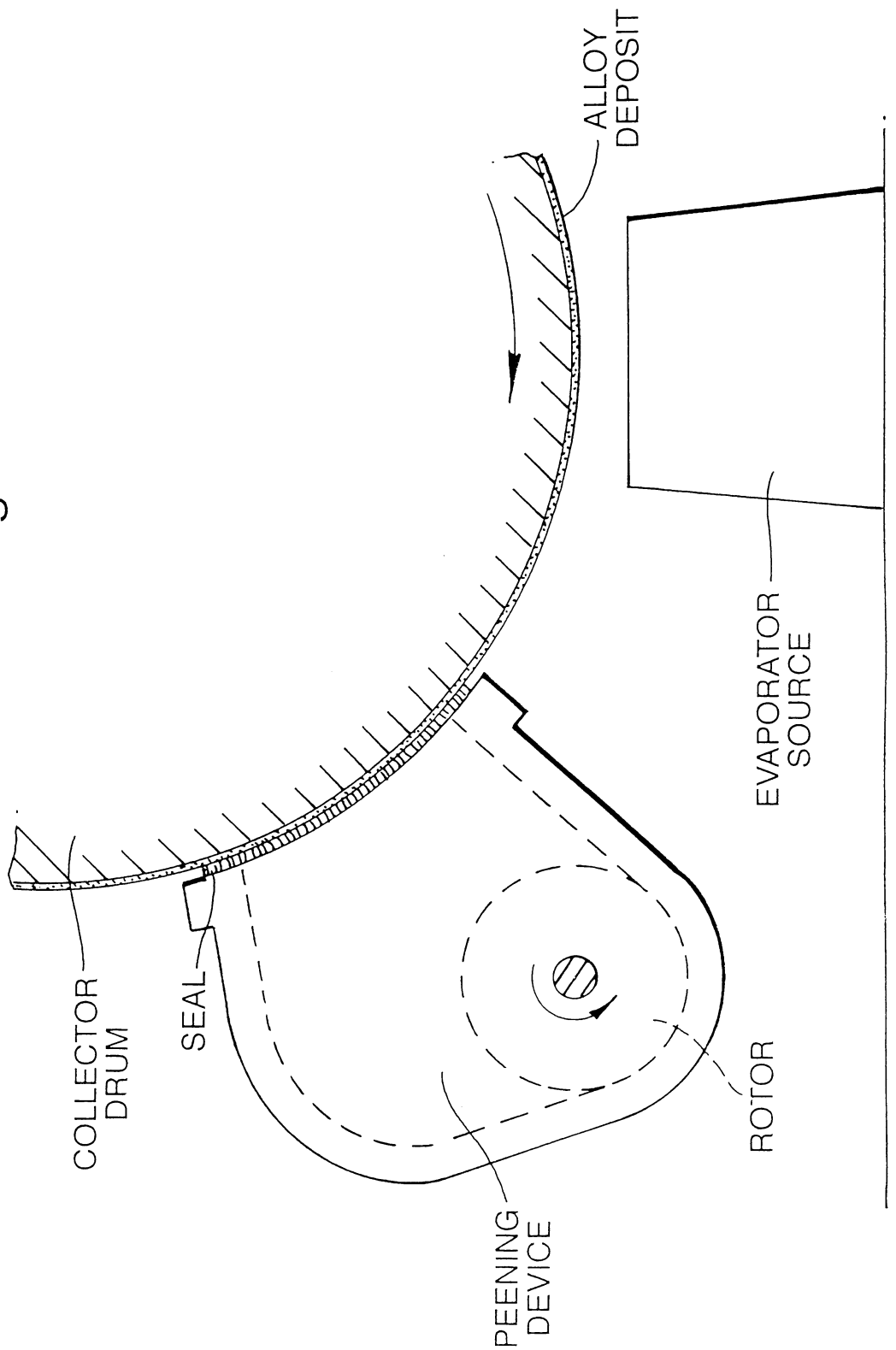
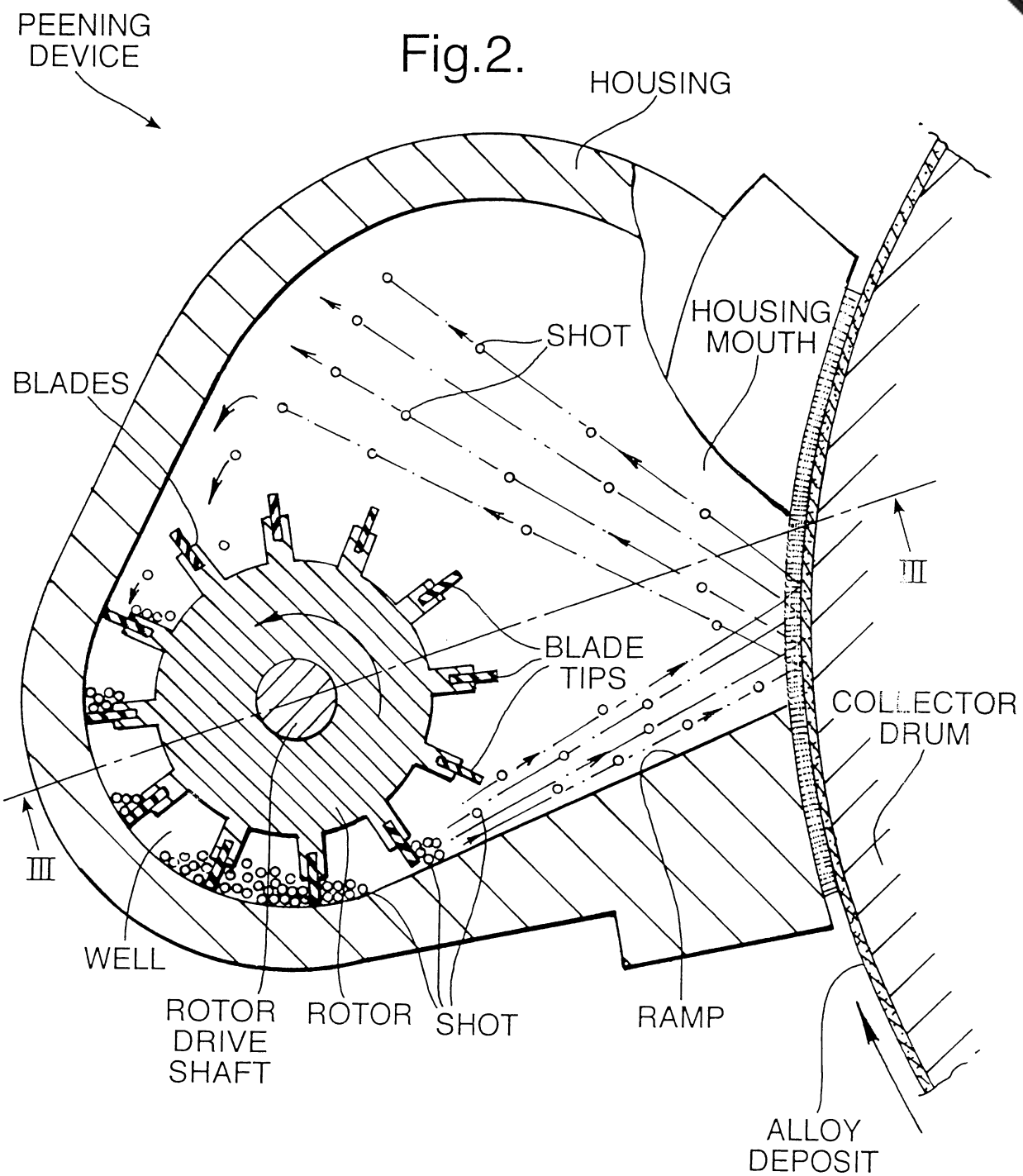
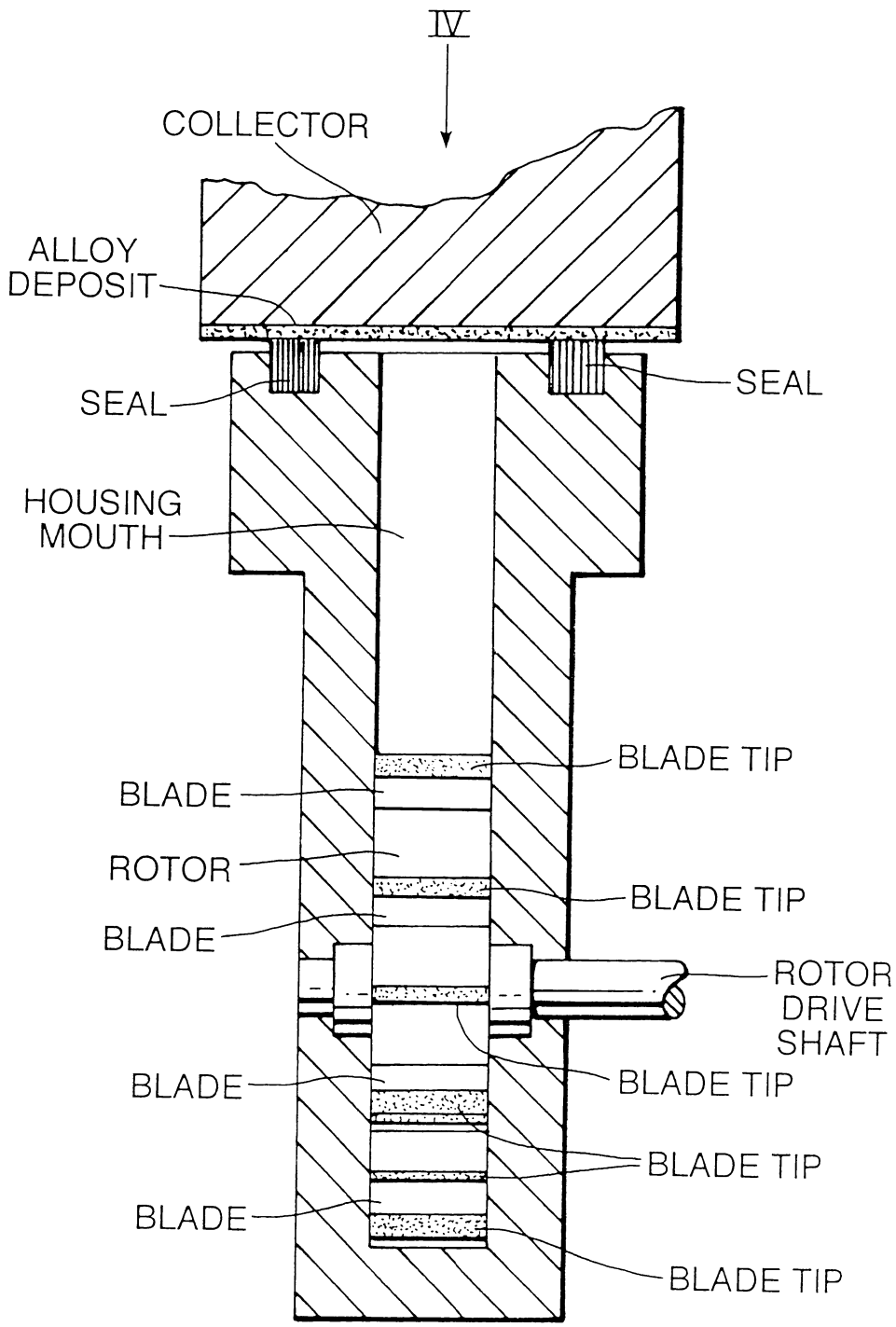


Fig.2.



DETAIL CROSS SECTION
OF PEENING DEVICE

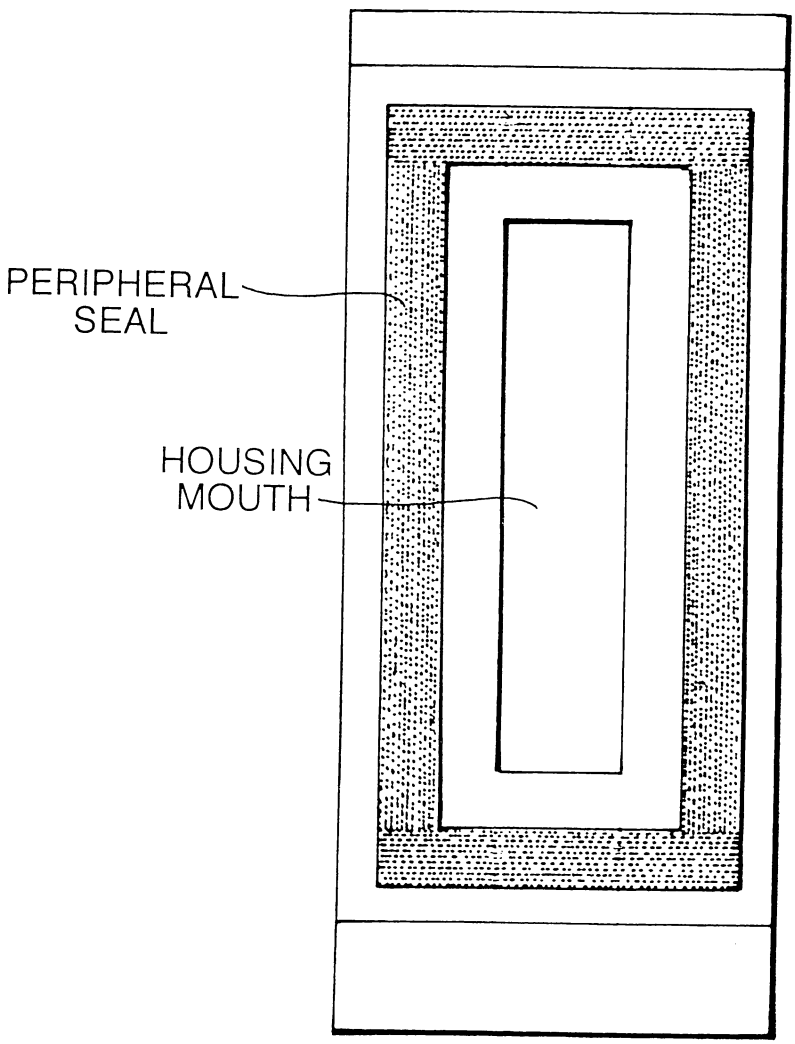
Fig.3.



SECTION ON THE LINE III - III
OF Fig.2.

NOTE THE SHOT IS NOT SHOWN
IN THIS VIEW FOR CLARITY

Fig.4.



VIEW IN DIRECTION OF ARROW IV IN Fig.3.

COLLECTOR DRUM AND ROTOR NOT SHOWN