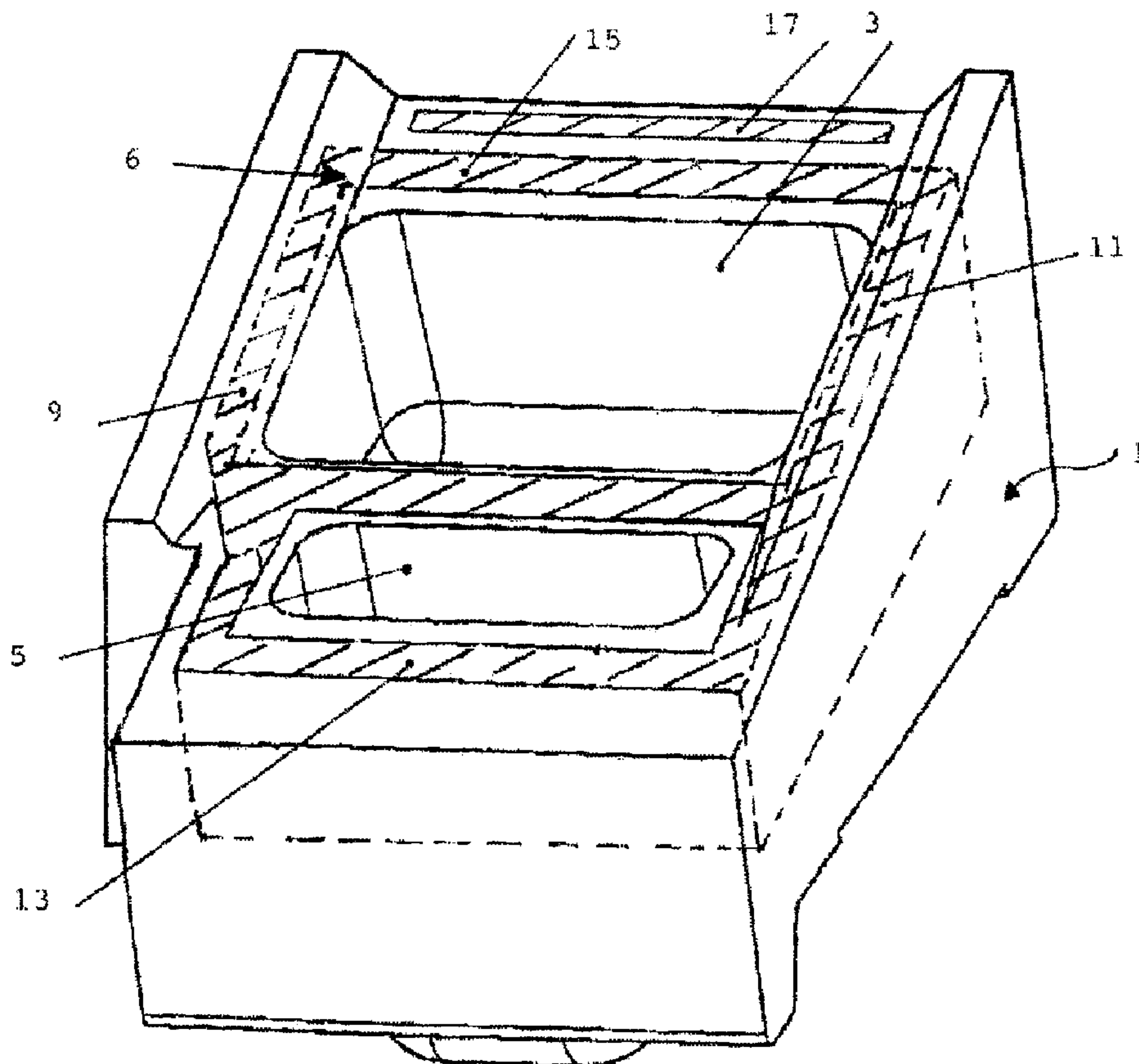




(86) Date de dépôt PCT/PCT Filing Date: 1999/03/16  
(87) Date publication PCT/PCT Publication Date: 1999/09/23  
(45) Date de délivrance/Issue Date: 2008/05/27  
(85) Entrée phase nationale/National Entry: 2000/09/05  
(86) N° demande PCT/PCT Application No.: BE 1999/000034  
(87) N° publication PCT/PCT Publication No.: 1999/047264  
(30) Priorité/Priority: 1998/03/17 (BE9800211)

(51) Cl.Int./Int.Cl. *B02C 13/18* (2006.01)  
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(54) Titre : EJECTEUR A UNE OU PLUSIEURS POCHEs  
(54) Title: EJECTOR WITH ONE OR SEVERAL POCKETS



(57) Abrégé/Abstract:

The invention concerns an ejector with one or several pockets, designed for centrifugal crushers with vertical axis and having a substantially parallelepiped shape, provided with a working surface of one or several cavities (3, 5) forming said ejector (1) pockets.

(57) **Abrégé(suite)/Abstract(continued):**

The invention is characterised in that all or part of the pocket periphery consists of a composite material reinforcing structure (6) itself made of an iron and ceramic based alloy highly wear resistant and produced in situ at the ejector spinner.



PCT

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## DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITE DE COOPERATION EN MATIÈRE DE BREVETS (PCT)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| (51) Classification internationale des brevets <sup>6</sup> :<br><br>B02C 13/18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | A1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (11) Numéro de publication internationale: WO 99/47264<br>(43) Date de publication internationale: 23 septembre 1999 (23.09.99) |
| <p>(21) Numéro de la demande internationale: PCT/BE99/00034</p> <p>(22) Date de dépôt international: 16 mars 1999 (16.03.99)</p> <p>(30) Données relatives à la priorité:<br/>9800211 17 mars 1998 (17.03.98) BE</p> <p>(71) Déposant: MAGOTTEAUX INTERNATIONAL S.A.<br/>[BE/BE]; Rue A. Dumont, B-4051 Vaux-sous-Chevremont (BE).</p> <p>(72) Inventeur; et<br/>(75) Inventeur/Déposant (US seulement): PONCIN, Claude<br/>[BE/BE]; Les Croisettes 76, B-4870 Trooz (BE).</p> <p>(74) Mandataires: VAN MALDEREN, Michel etc.; Office Van Malderen, Boulevard de la Sauvenière 85/043, B-4000 Liège (BE).</p> | <p>(81) Etats désignés: AL, AU, AZ, BA, BB, BG, BR, BY, CA, CN, CU, CZ, EE, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, RO, RU, SD, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, brevet ARIPO (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), brevet eurasien (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), brevet européen (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), brevet OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Publiée<br/>Avec rapport de recherche internationale.</p> |                                                                                                                                 |

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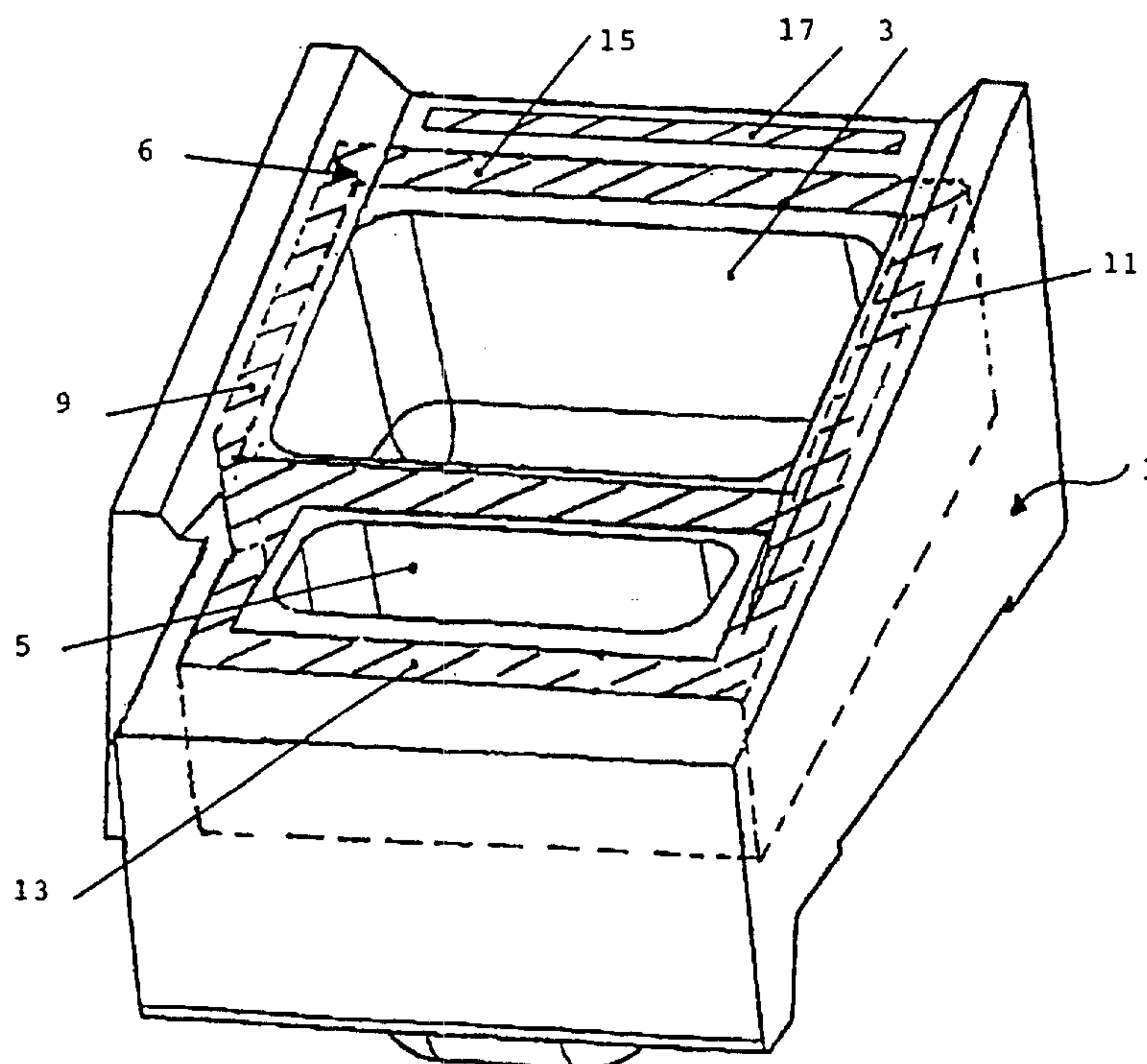
(54) Titre: EJECTEUR A UNE OU PLUSIEURS POCHES

## (57) Abstract

The invention concerns an ejector with one or several pockets, designed for centrifugal crushers with vertical axis and having a substantially parallelepiped shape, provided with a working surface of one or several cavities (3, 5) forming said ejector (1) pockets. The invention is characterised in that all or part of the pocket periphery consists of a composite material reinforcing structure (6) itself made of an iron and ceramic based alloy highly wear resistant and produced in situ at the ejector spinner.

## (57) Abrégé

Ejecteur à une ou plusieurs poches, destiné à des concasseurs de type centrifuge à axe vertical et ayant une forme essentiellement parallélépipédique, pourvu sur sa face de travail d'une ou plusieurs cavités (3, 5) formant les poches dudit éjecteur (1), caractérisé en ce que toute ou une partie de la périphérie de la ou des poches est constituée d'une structure de renfort (6) d'un matériau composite lui-même formé d'un alliage à base de fer et de céramique très résistant à l'usure et créé in situ à la coulée de l'éjecteur.



5

EJECTOR WITH ONE OR SEVERAL POCKETS10 Subject of the invention

The present invention relates to a production method of throw shoe with one or more pockets, which is intended for crushers of the centrifugal type with a vertical shaft (called VSI crushers).

15

Technological background forming the basis of the invention

The aforementioned centrifugal-type crushers are known in the prior art for crushing all kinds of materials, especially rock aggregate. They are used, for example, in quarries and cement works. These centrifugal crushers comprise a cylindrical tank containing a turntable which is supported by a vertical bearing and which comprises means for making the table rotate about the central axis of the crusher. Furthermore, the crusher includes a series of throw shoes fixed to the turntable, as well as a series of anvils arranged on the internal vertical wall of the cylindrical tank, around the turntable.

30

Throw shoes are essentially in the form of a parallelepiped generally made of cast iron, which is fixed to the turntable of the crusher. That face of the throw shoe which faces the axis of rotation of the table is called the nose of the throw shoe, while the face parallel to the anvils of the cylindrical tank forms the exit face of the throw shoe.

35

The front face of the throw shoe, called the working face, is that which the material to be crushed encounters and which precedes the rear face in the direction of rotation of the throw shoe.

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This front working face of the throw shoe may be provided with one or more cavities which do not pass right through the structure of the throw shoe. These cavities form the pockets of the throw shoe, which fill  
5 up when the crusher is rotating.

During the crushing operation, the material to be crushed is poured into the centre of the turntable by known means. Due to the effect of the centrifugal force and to the impact with the working face of the  
10 throw shoe, the material is thrown towards the anvils, against which it is crushed before it drops, in crushed form, to the bottom of the crusher from where it is removed. While the material is being thrown, the throw shoes are subjected to very high stresses and they are  
15 consequently subject to rapid wear.

#### Description of the solutions according to the prior art

The throw shoes with pockets used make it possible, in some applications, because of the  
20 accumulation of material in the pockets, to increase the lifetime of these throw shoes considerably.

However, in this type of throw shoe, it is observed that the wear occurs preferentially around the exit edge of the pockets, i.e. at the point where the  
25 abrasion due to the particles thrown by the centrifugal force is highest.

Document US 3,044,720 A describes a centrifugal-type impact crusher provided with a pocket which has a protection device in the form of a  
30 reinforcement consisting of attached plates.

Similarly, for the same type of crusher, document US 3,149,793 A also proposes attached  
reinforcing plates.

Document WO 89/04720 A proposes ceramic liners  
35 of the aluminium-oxide type for the material exit ducts in anvil crushers.

The technological background of the invention, in particular the design of the crushers, may also be

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illustrated by documents US 3,346,203 A and  
US 4,787,564 A.

Attempts have also been made to attach a  
ceramic reinforcement, preferably made of tungsten  
5 carbide, to the edges of the pockets. This type of  
material resists the abrasion at the exit of the throw  
shoe very well.

Nevertheless, the wear produced is often  
localized along certain preferential paths, outside the  
10 initial cavities of the throw shoe. These preferential  
wear paths propagate over the entire structure of the  
throw shoe, the consequence of which is that eventually  
a piece is obtained in which practically only the  
reinforcement is intact.

15 Furthermore, when uncrushable materials, for  
example metallic materials, or larger size aggregate,  
are introduced into the crusher, these destroy the  
tungsten carbide ceramic reinforcement. When the  
reinforcement is broken, the turntable supporting the  
20 throw shoes operates in an unbalanced manner.

The throw shoes must then be removed and  
replaced, in order to avoid any vibration of the  
crusher.

## 25 Objects of the invention

The object of the present invention is  
essentially to avoid, or at least reduce, the drawbacks  
which result from the wear of the throw shoes of the  
prior art. In particular, the object of the invention  
30 is to **produce** a throw shoe with one or more pockets  
which resists the impact of the particles to be crushed  
and which almost no longer suffers any deterioration in  
its initial structure.

## 35 Main features of the invention

According to the invention a production process  
is provided for a throw shoe with one or more pockets,  
which is intended for centrifugal-type crushers with a

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vertical shaft and having an essentially parallelepipedal shape, provided on its working face with one or more cavities forming the pockets of the said throw shoe, characterized in that all or part of the periphery of the pocket or pockets is made of a reinforcing structure made of a composite which is itself formed from an iron-based alloy and very wear-resistant ceramic particles and which is formed in situ when the throw shoe is being cast by infiltration of the liquid metal which serves to form the body of the object.

Thus, a reinforcement made of a wear-resistant ceramic composite is formed around the cavities constituting the pockets so as to obtain protection not only along the exit edge of the throw shoe but also around the contour of the pocket or pockets. In this way, the entire structure of the throw shoe is protected from abrasion by the material to be crushed without the use of an attached piece. Likewise, an appropriate structure of the reinforcement, suitable for a defined number of pockets of defined geometrical shape and size, allows the material in the pocket or pockets to be centred and thus prevents the problems of preferential wear.

The key feature of the present invention resides in the choice of a composite formed by an iron-based alloy (steel or cast iron) and a ceramic in order to constitute the reinforcing element, which is created in situ while the throw shoe is being cast.

Advantageously, the reinforcement according to the invention will be produced from a metal/ceramic composite which is produced from agglomerated ceramic particles based on alumina and/or zirconia or on alumina-zirconia, which, during casting, are infiltrated by the liquid metal serving to form the body of the piece.

Other features and advantages of the invention will become apparent from reading the description and

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the claims which follow, which illustrate various embodiments of the invention.

Brief description of the figures

5           Figure 1 shows a perspective view of a throw shoe with two pockets according to the invention.

          Figure 2 shows a photograph illustrating the throw shoe with a single pocket according to the invention.

10           Figure 3 shows a photograph of the throw shoe with two pockets according to the invention.

          Figures 4 and 5 show two photographs of a throw shoe with two pockets according to the prior art, illustrating preferential points of wear.

15

Description of the various preferred embodiments of the invention

          Figure 1 illustrates diagrammatically the throw shoe, bearing the general reference 1, with two pockets  
20   3 and 5 according to the invention, comprising the composite reinforcement identified by the general reference 6 and shown in hatched lines.

          This composite is preferably made from an agglomerate of ceramic particles based on  
25   alumina-zirconia. These ceramic particles are manufactured conventionally by electrofusion by sintering, by thermal spraying or by any other process allowing the two constituents to be fused together.

          The structure of the composite reinforcement is  
30   produced around the perimeter of the pockets of the throw shoe at a minimum distance of 5 mm from the edges of the pockets, thus preventing a throw shoe from wearing at the lower edge 9 and the upper edge 11, as well as at the nose 13 and the exit 15 of the throw  
35   shoe.

          A complementary reinforcing structure 17 (also shown in hatched lines) may be provided on the exit face of the throw shoe 1.

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As illustrated, the composite reinforcing structure does not necessarily have to be placed over the entire width, length or depth of the throw shoe in order to prevent deterioration of the structure.

5           Figures 2 and 3 show two throw shoes of different configurations, one having a single pocket and the other having two pockets.

          The geometry of the structure of the composite is tailored to the geometrical configuration of the  
10 throw shoe, this configuration being chosen depending on the material to be crushed.

          The particular configuration of the composite structure as illustrated was chosen so as, on the one hand, to limit wear of the entire piece of the throw  
15 shoe and, on the other hand, to allow easy production of the throw shoe provided *in situ* with the reinforcing structure when the throw shoe is being cast.

          The throw shoe therefore consists of a heterogeneous element, but without attached pieces,  
20 which has, in the regions predominantly exposed to wear, a reinforcement integrated into the throw shoe in the form of a structure based on a composite which is formed from an iron-based alloy (steel or cast iron) on the one hand and a ceramic having the property of wear  
25 resistance for the envisaged uses, on the other.

          Figures 4 and 5 show photographs of a throw shoe with two pockets according to the prior art, in which the preferential wear is essentially localized at the nose of the throw shoe as well as at the lower edge  
30 of the pockets in contact with the turntable.

#### Example

          A throw shoe with a composite reinforcement, as shown in Figure 2, was compared with an identical throw shoe without this composite reinforcement in an  
35 application involving the crushing of rhyolite having an incoming particle size of between 3 and 40 mm.

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The lifetime of the throw shoe with a composite reinforcement is twice that obtained with equivalent throw shoes without this reinforcement.

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CLAIMS

1. Production method of a throw shoe with one or more  
5 pockets, which is intended for centrifugal-type crushers  
with a vertical shaft and having an essentially  
parallelepipedal shape, provided on a working face with  
one or more cavities forming the pockets of the said  
throw shoe, in which all or part of the periphery of the  
10 pocket or pockets is made of a reinforcing structure made  
of a composite which is itself formed from an iron-based  
alloy and wear-resistant ceramic particles and which is  
formed *in situ* when the throw shoe is being cast by  
infiltration of the liquid metal which serves to form the  
15 body of the object.
2. Process according to Claim 1 in which the  
reinforcing structure which is created *in situ* is only  
achieved over a portion of the width or a portion of the  
length or a portion of the depth of the throw shoe.
- 20 3. Process according to Claim 1 or 2 in which the  
reinforcing structure is tailored to the number, the size  
and the geometrical shape of the pocket or pockets of the  
throw shoe.
4. Process according to any one of Claims 1 to 3 in  
25 which the reinforcing structure located around the  
periphery of the pocket or pockets located around the  
periphery of the pocket or pockets furthermore comprises  
a complementary reinforcing structure located on an exit  
face of the throw shoe.
- 30 5. Process according to any one of Claims 1 to 4 in  
which the ceramic constituting the reinforcing structure  
is produced from agglomerated ceramic particles based on  
alumina, zirconia or aluminum-zirconia.

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6. Throw shoe with one or more pockets, which is intended for centrifugal-type crushers with a vertical shaft and having an essentially parallelepipedal shape, provided on a working face with one or more cavities forming the pockets of the said throw shoe, in which all or part of the periphery of the pocket or pockets consists of a reinforcing structure made of a composite which is itself formed from an iron-based alloy and a wear-resistant ceramic and which is created *in situ* when the throw shoe is being cast.

7. Throw shoe with one or more pockets according to Claim 6 in which the reinforcing structure created *in situ* is only located over a portion of the width or a portion of the length or a portion of the depth of the throw shoe.

8. Throw shoe with one or more pockets according to Claim 6 or 7 in which the reinforcing structure is tailored to the number, the size and the geometrical shape of the pocket or pockets of the throw shoe.

9. Throw shoe with one or more pockets according to any one of Claims 6 to 8 in which the reinforcing structure located around the periphery of the pocket or pockets furthermore comprises a complementary reinforcing structure located on an exit face of the throw shoe.

10. Throw shoe with one or more pockets according to any one of Claims 6 to 9 in which the ceramic constituting the reinforcing structure is produced from agglomerated ceramic particles based on alumina, zirconia or alumina-zirconia.

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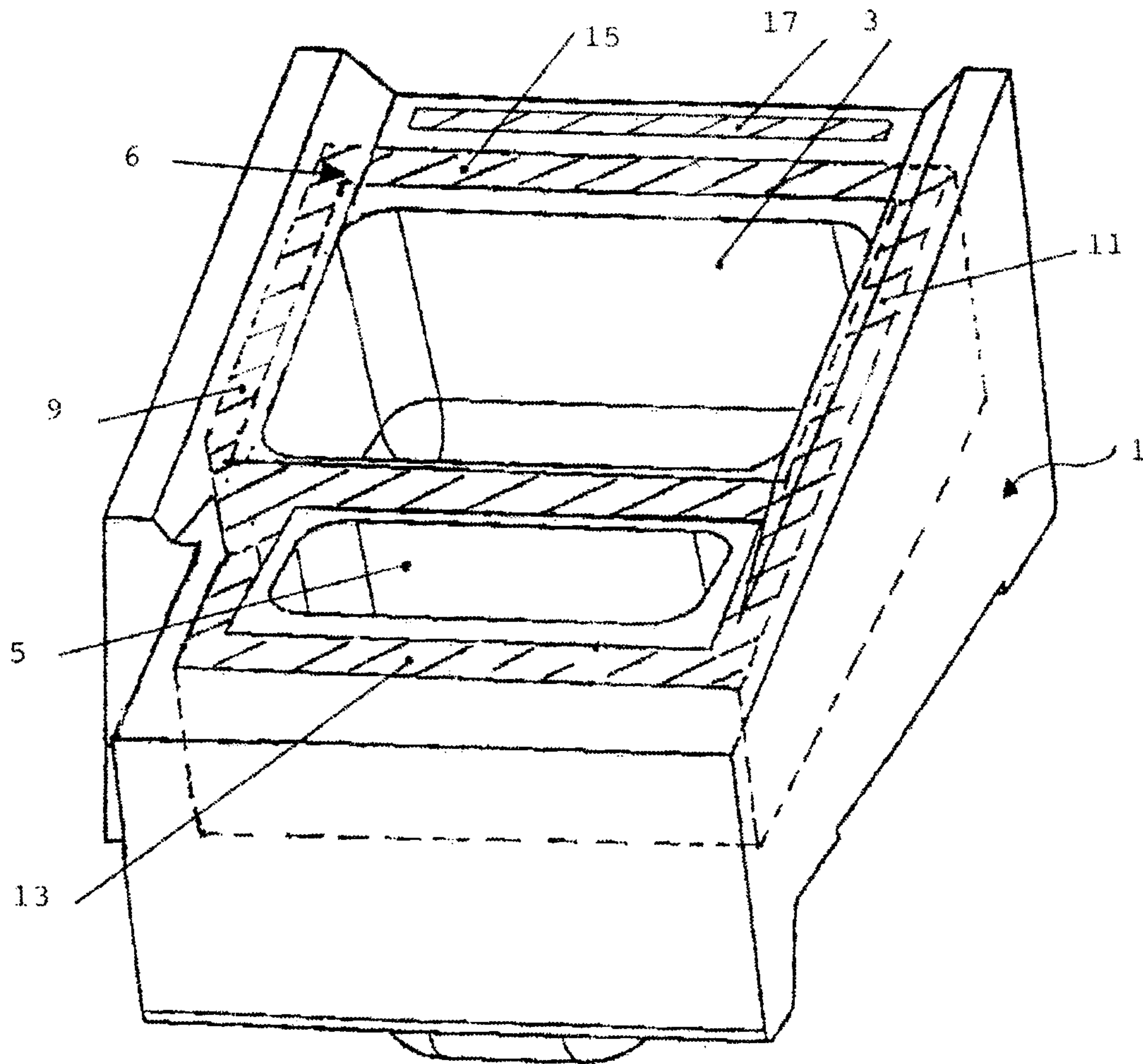


FIG. 1

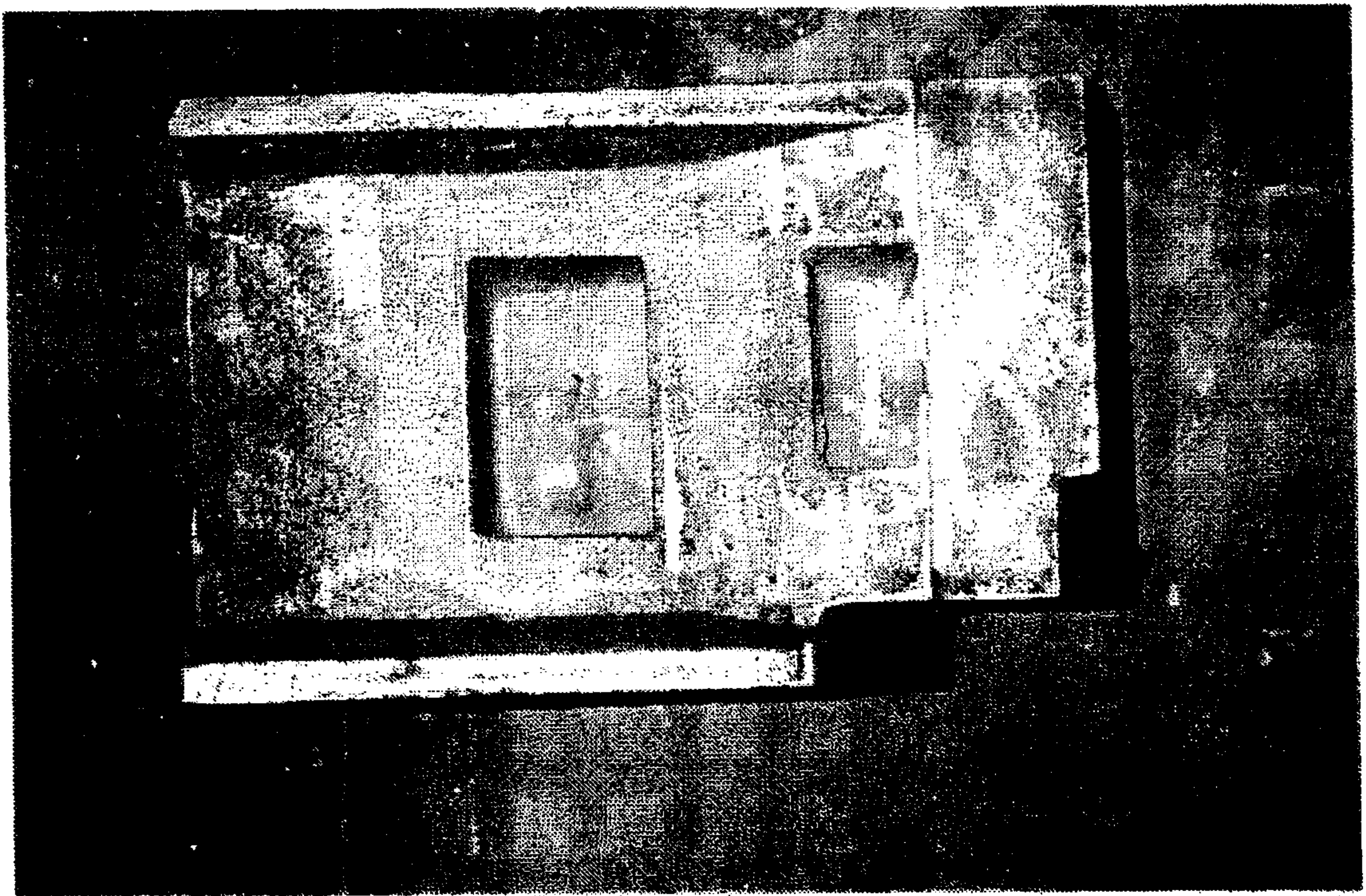


FIG. 2

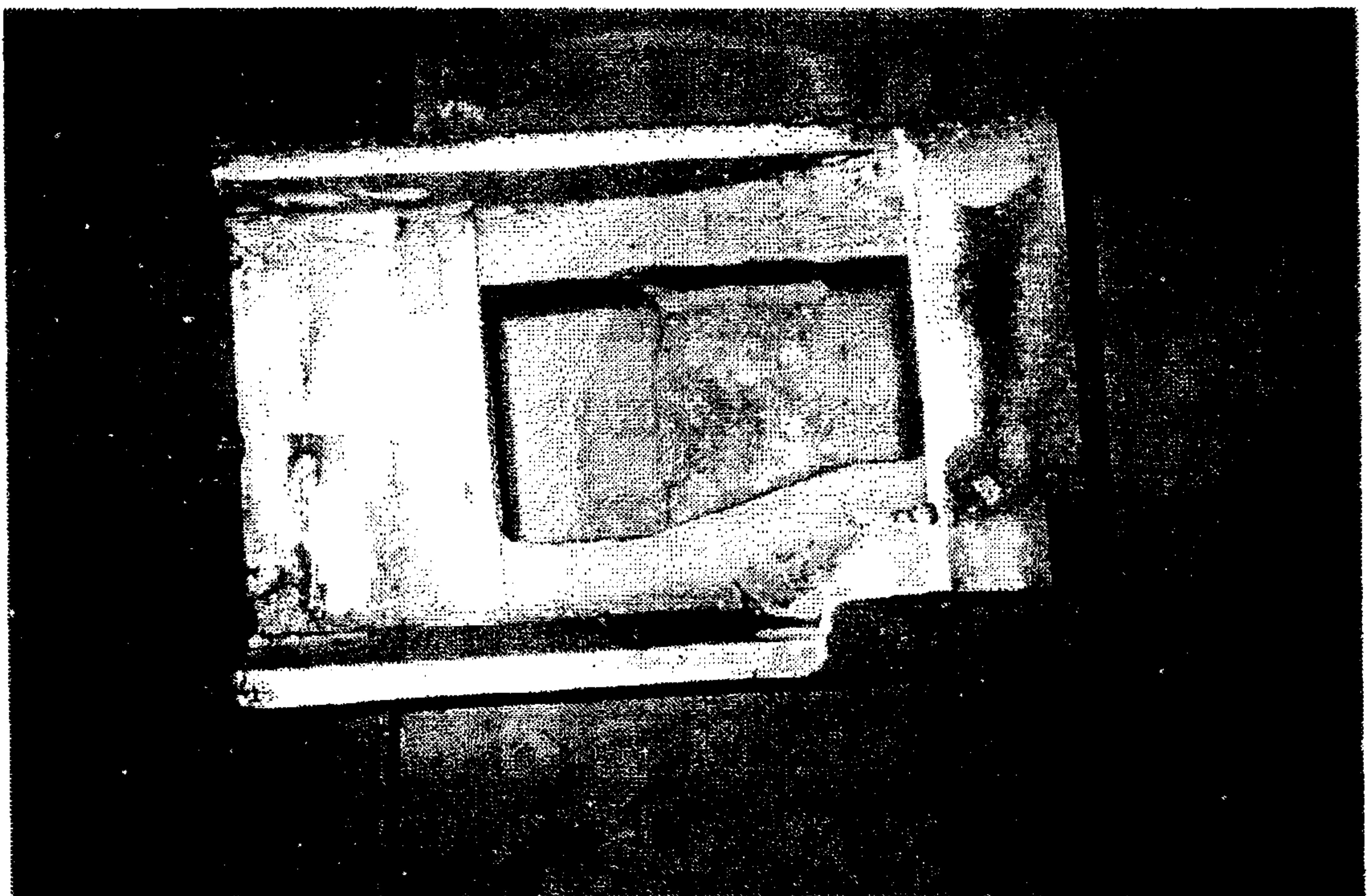


FIG. 3



FIG. 4



FIG. 5

