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(54) **Process for covering bodies with diamond patterns and machine**

Verfahren zur Beschichtung eines Formkörpers mit Diamantprägung und Maschine

Procédé pour recouvrir un article avec motifs en forme de diamant et machine

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**US-A- 4 754 535**

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**Description**Field of The Invention

- 5 **[0001]** The present invention relates to processes for diamond covering bodies substantially spherical, such as small balls or polyhedral articles being used in the jewelry field and machines being used for these processes.

Background of The Prior Art

- 10 **[0002]** It is known that one of the procedures used for increasing the aesthetic appearance of an object in the jewelry field is the procedure called diamond covering with which one gives to the surface of the object a play of lights which contribute in a determining manner to define the appearance of the jewelry article, no matter whether it is a bracelet, a necklace, a pin or other items.

- 15 **[0003]** The operation of diamond covering is carried out by means of machines which are provided with diamond edged tools, which are provided with diamond edged tools, which, removing some material from the surface of the object, create a plurality of faces having a mirror-like shine, which, being differently oriented create the desired bright aesthetic effect.

- 20 **[0004]** The operation of diamond covering results particularly simple if it is carried out on chain assemblies in which one removes up to 30% of the section of the thread which constitutes the single ring of the chain, generating a plurality of planar or convex surfaces while, on the contrary, this operation turns out to be complex when it is necessary to diamond cover surfaces of objects which are essentially spherical, when they are of small dimensions.

- 25 **[0005]** From US-A-3231455 is already known an automatic process in which a single object is deposited in a seat as a container and afterwards the same object is subjected to a punching action whereby a plurality of microcavities is generated on the surface of said object whereby the surfaces of each cavity are differently oriented thus increasing the plays of light.

- [0006]** In GB-A-458562 is described a machine for engraving rings in which a single object is positioned automatically at each punching action with a different portion of its surface up to a complete treatment of the entire surface being diamond covered.

30 Summary of The Invention

- [0007]** An object of the present invention is to provide an automatic process for diamond covering objects essentially spherical, such as small balls, microfused pieces, printed, drawn objects, used for the creation of articles in the jewelry field which are simpler than the known processes.

- 35 **[0008]** Another object of the invention is to provide an automatic process for diamond covering these articles which achieves the diamond covering of the surfaces without the removal of material so that it is not necessary to use removing tools.

- [0009]** Still another object is to provide a process for diamond covering in which the effect of the plays of light results stronger and aesthetically more effective than the known processes.

- 40 **[0010]** Still another object of the invention is to provide an automatic process which ensures a perfect and total diamond covering of the surface of the object being worked without the necessity of regulations or controls, on the part of the operator during the working phase.

- [0011]** Still another object of the invention is to provide a machine for diamond covering, essentially spherical objects which functions with the automatic process of the invention.

- 45 **[0012]** The automatic process of diamond covering of the invention requires in the first step, that a single object be deposited, always automatically, in a seat as a container, then, the same object is subjected to a punching action by means of a punching apparatus, of known construction, so that on the surface of the same object there is generated a plurality of microcavities which are differently oriented, thus magnifying the plays of the light with significant aesthetic effects.

- 50 **[0013]** The single object positions itself, automatically, to each successive action of punching with a different portion of its surface with respect to the top of the punching tool, up to the complete treatment of the entire surface to be diamond covered.

- 55 **[0014]** The invention regards an automatic process according to claim 1, suitable for diamond covering objects which are spherical, essentially spherical or polyhedral, of reduced dimensions, in which the continuous and different positioning of the object, referred to hereinbelow as "pallina", small ball, occurs automatically due to the fact that the ball is immersed in a turbulent flux of compressed air and the base of the seat for containing the ball is advantageously made of a material which has a certain amount of elasticity, which may be very small. In this manner the object is connected to a mechanism which puts the object in motion in a manner that the object is positioned, for every successive action of punching, with

a different portion of surface to be diamond covered.

[0015] With this constructive manner during the punching action, the ball is pushed upwardly so that it continuously hits the top of the tool due to the combination of two actions applied on the ball, the action of the turbulent motion of the compressed air and the action of the elastic reaction of the base against which the same ball is pushed after each punching because it is pushed downwardly by the vibrating alternating motion of the same top of the tool.

[0016] During the micro motion of upwardly and downwardly within the seat of containing the ball, this ball rotates on itself, due to the two combined effects, in a casual manner so that the ball offers to the tool always a different and new surface to be punched, so that after a certain number of punchings, set forth by the operator, the entire surface is completely diamond covered.

[0017] The machine for diamond covering objects which have a shape essentially spherical and functioning according to the processes described hereinabove, comprises the group for feeding the objects to be diamond covered, the group with the seat for containing each object during the diamond covering and the group for supporting the puncher.

[0018] The characteristics of the processes of this invention and the machine functioning for the processes will be better understood by reference to possible embodiments provided as non-limiting illustration by reference to the drawings, of which

Figs. 1-4 and 5-8 show successive phases of two different manner of operation, always automatic, using objects which are essentially spherical or polyhedral;

Figs. 9-11 are elevational views of three different phases of operation of the machine functioning according to the processes of Figs. 1-8;

[0019] As shown in Fig. 1, the ball (1) to be diamond covered is placed in the interior of seat (2) for containment and rests on base (3) made of a material which has some elasticity, even minimal amount.

[0020] Fig. 2 shows the punching apparatus (4) which through nozzles (5) sends to seat (2) a flux of compressed air which raises the ball from the base so that it hits against tool (6) so that this tool cuts into the surface of the ball.

[0021] The tool (6) has a motion vibrating alternatively so that the ball in the contact receives a push downwardly which deforms due to compression the base (3) as shown in Fig. 3.

[0022] As a consequence the ball (1) is again pushed upwardly by the elastic base moving in a casual manner vertically and rotating on itself prior to coming in contact with the tool (6) (see Fig. 4).

[0023] The working phases described hereinabove are repeated up to the complete diamond covering of the surface of ball (1).

[0024] As shown in Figs. 5-8, also when the process does not use the flux of compressed air, the ball (1) is placed in the interior of seat (2) where it is contained and rests on base (3) made of a material having a certain amount of elasticity (see Fig. 5).

[0025] At the beginning of each punching action, the puncher (4) is lowered and the tip provides to cut into the surface of ball (1) generating in the meantime a push which deforms slightly due to compression base (3) (see Fig. 6).

[0026] Afterwards the puncher (4) rises and the ball (1), remaining free, is pushed upwardly by the elastic base (3), moving in a casual manner vertically and rotating on itself (in Fig. 7).

[0027] Finally the ball (1) falls into seat (2) positioning itself in a different manner such that, when the puncher (4) lowers itself a punching occurs in a new portion of the surface (see Fig. 7).

[0028] The working phases described hereinabove are repeated until the surface of the ball (1) is completely diamond covered.

[0029] As shown in Fig. 9, the machine which is used to carry out the processes described hereinabove comprise a storehouse (7) of balls (1) to be diamond covered which, through conduit (8) provided with pneumatic bulkheads (9) through conduit (8) provided with pneumatic bulkheads (9) are deposited singularly in container (10). This container is capable of undergoing a displacement due to the action of pneumatic cylinder (11) so as to position the ball (1) corresponding to the position of the puncher (4) and above the elastic base (3).

[0030] After the action of punching of the entire surface ends, the container (10) is further displaced to unload the balls with the diamond covering into the collector (11).

[0031] Obviously changes of the machine different from the described machine are possible without departing from the following claims.

## Claims

1. Automatic process for diamond covering essentially spherical objects (1) such as small balls, polyhedral objects, for use in the jewelry field of the type which avoids the removal of any material, in which a single object is deposited within a seat (2) as a container and afterwards the same object is subjected to a punching action whereby a plurality

of microcavities is generated on the surface of said object whereby the surfaces of each cavity are differently oriented thus increasing the plays of light, a single object being positioned automatically at each punching action with a different portion of its surface up to a complete treatment of the entire surface being diamond covered, the process including the step that the different automatic positioning of said object in the seat prior to each punching action occurs due to fact that said object is immersed in a turbulent flux of compressed air.

2. A process according to claim 1 **characterized by** the fact that the different automatic positioning of said object in the seat prior to each punching action occurs due to the fact that the base (3) of the seat which contains said object is made of a material which has a certain amount of elasticity, even a minimum amount.

3. A process according to claims 1 and 2 **characterized by** the fact that during the punching action, the object to be diamond covered which has a spherical or anyhow a polyhedral shape, a small ball, said ball (1) is pushed upwardly in order to continuously bounce against the punching tool because of the combined effect of two actions, one action due to the turbulent motion of the compressed air and another action due to the reaction of the base (3) which is slightly elastic and said ball after each punching is pushed downwardly by the vibrating motion of the top of said punching tool(4).

4. The process according to claim 3 **characterized by** the fact that during the micromotion of upwardly and downwardly of the ball (1) within the seat containing the ball, said ball rotates on itself in casual manner whereby said ball offers to the punching tool (4) a different and new surface to be punched whereby after a determined number of punching established by the operator the entire surface is completely diamond covered.

5. The process according to claims 1 and 2 **characterized by** the fact that during the punching action the ball (1) remains still and the pushing force of the tool on the surface of the ball which is necessary to generate the microcavity pushes the ball against the base (3) and the base undergoes a micrometric deformation.

6. The process according to claim 5 **characterized by** the fact that at the end of each punching action, when the tool moves away from the surface of the ball, the ball remaining free is projected upwardly by the push generated by the elastic action of the deformed base (3) whereby during the motions upwardly and downwardly, the ball (1) rotates on itself whereby the ball is deposited again on the base in a position different from the preceding one thus offering to the tool a new portion of surface to be punched.

7. The process according to one or more of the preceding claims **characterized by** the fact that the degree of rotation of said object on itself is casual and different in each action whereby after a certain number of punching, established by the operator, the entire surface is completely diamond covered.

8. A machine for diamond covering bodies which have a spherical or anyhow polyhedral shape, small balls, and functioning according to the process described in one or more of the preceding claims **characterized by** the fact that it comprises a storehouse (7) for balls (1) to be diamond covered, conduit (8) provided with pneumatic bulkheads (9) whereby the balls are deposited singularly within seat (2), said seat being capable of undergoing a displacement due to the action of a pneumatic cylinder (10) whereby each ball (1) is positioned corresponding to puncher (4) and above an elastic base (3) and after the punching operation of the entire surface of the ball has ended, the seat is displaced further to unload the ball into collector (11).

9. The machine according to claim 8, **characterized by** the fact that the seat (2) containing the object to be diamond covered is made of a material, for instance PVC, which has a significant hardness value but does not harm the diamond covered surface of the body which moves in the interior of said container.

## Patentansprüche

1. Automatischer Vorgang zur Diamantenverkleidung vor allem sphärischer Gegenstände (1), wie zum Beispiel kleiner Kugeln, polyedrischer Objekte, die im Juwelierbereich benutzt werden, welcher jegliche Abtragung von Material verhindert, in dem ein einzelner Gegenstand in einen behälterartigen Sitz (2) eingelagert wird, wonach derselbe Gegenstand einem Stanzprozess unterzogen wird, wobei eine Vielfalt von mikroskopischen Vertiefungen auf der Oberfläche dieses Gegenstandes hergestellt werden, wobei die Oberflächen einer jeden Vertiefung verschiedenartig ausgerichtet werden, wodurch die Lichtspiele erhöht werden, wobei ein einzelner Gegenstand automatisch jedem Stanzprozess mit einem anderen Teil seiner Oberfläche ausgesetzt wird, bis eine vollständige Behandlung seiner

gesamten Oberfläche mit der Diamantenverkleidung erreicht ist, wobei dieser Vorgang den Schritt voraussetzt, dass die verschiedene automatische Positionierung des Gegenstandes im Sitz vor jedem Stanzprozess **dadurch** stattfindet, dass dieser Gegenstand einem turbulenten Pressluftstrom ausgesetzt wird.

- 5     **2.** Ein Vorgang nach Anspruch 1, **dadurch gekennzeichnet, dass** die verschiedene automatische Positionierung dieses Gegenstandes im Sitz vor jedem Stanzprozess dank der Tatsache stattfindet, dass die Basis (3) des Sitzes, der diesen Gegenstand enthält, aus einem Material gefertigt ist, das eine gewisse Elastizität besitzt, wenn auch nur eine geringe.
- 10    **3.** Ein Vorgang nach Anspruch 1 und 2, **dadurch gekennzeichnet, dass** während des Stanzprozesses der mit der Diamantenverkleidung zu behandelnde Gegenstand, der eine sphärische oder in irgend einer Weise polyedrische Form besitzt, eine kleine Kugel, diese kleine Kugel (1) nach oben gedrückt wird, sodass sie ständig aufgrund der Vereinigung von zwei Wirkungen gegen das Stanzgerät prallt: eine Wirkung aufgrund der turbulenten Bewegung der Pressluft und eine weitere Wirkung aufgrund der Reaktion der Basis (3), die leicht elastisch ist, und **dadurch**  
15    **gekennzeichnet dass** die Kugel nach jedem Stanzprozess durch die Vibrationsbewegung des Kopfes des Stanzgerätes (4) nach unten gedrückt wird.
- 20    **4.** Ein Vorgang nach Anspruch 3, **dadurch gekennzeichnet, dass** während der kleinen Auf- und Abbewegung der Kugel (1) im Sitz, sich diese Kugel willkürlich um sich selbst dreht, wobei diese Kugel dem Stanzgerät (4) ständig einen anderen und neuen Teil seiner Oberfläche zur Bearbeitung anbietet, wobei nach einer gewissen Anzahl von Stanzungen, die von einem Bedienungsmann entschieden wird, die gesamte Oberfläche komplett mit Diamanten überzogen ist.
- 25    **5.** Ein Vorgang nach Anspruch 1 und 2, **dadurch gekennzeichnet, dass** während des Stanzprozesses die Kugel (1) unbeweglich bleibt und die Stosskraft des Gerätes auf die Kugeloberfläche, die notwendig ist, um die mikroskopischen Vertiefungen zu erhalten, die Kugel gegen die Basis (3) drückt, die eine winzige Deformierung nach unten erhält.
- 30    **6.** Ein Vorgang nach Anspruch 5, **dadurch gekennzeichnet, dass** am Ende eines jeden Stanzvorganges, wenn sich das Gerät von der Kugeloberfläche entfernt, die so freigewordene Kugel durch den Druck nach oben gestoßen wird, der durch die elastische Bewegung der deformierten Basis (3) hervorgerufen wird, wobei sich die Kugel (1) während der Auf- und Abbewegung um sich selbst dreht und die Kugel erneut in der Basis abgelagert wird, jedoch in einer anderen Stellung als vorher, wodurch dem Gerät eine neue Position der Oberfläche zur Stanzung angeboten wird.
- 35    **7.** Ein Vorgang nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Rotationsgrad dieses Gegenstandes um sich selbst bei jedem Vorgang willkürlich und unterschiedlich ist, wobei nach einer gewissen Anzahl von Stanzungen, die von einem Bedienungsmann entschieden wird, die gesamte Oberfläche vollständig mit Diamanten überzogen ist.
- 40    **8.** Eine Maschine zur Diamantenverkleidung von Gegenständen, die eine sphärische oder in irgendeiner Weise polyedrische Form haben, kleine Kugeln, und die gemäß dem Prozess funktioniert, wie er in einem oder mehreren der vorhergehenden Ansprüche beschrieben wurde, **dadurch gekennzeichnet, dass** sie ein Lager (7) für Kugeln (1) enthält, die mit Diamanten überzogen werden sollen, und eine Röhre (8), die mit pneumatischen Schotten (9) versehen ist, wobei die Kugeln einzeln im Sitz (2) abgelagert werden, wobei dieser Sitz dank der Bewegung eines pneumatischen Zylinders (10) verschoben werden kann, wobei jede Kugel (1) gegenüber dem Stanzer (4) und über  
45    einer elastischen Basis (3) gesetzt wird und, nachdem der Stanzprozess der gesamten Kugeloberfläche beendet ist, der Sitz verschoben wird, um die Kugel in einem Sammelbehälter (11) abzuladen.
- 50    **9.** Die Maschine nach Anspruch 8, **dadurch gekennzeichnet, dass** der Sitz (2), der den Gegenstand enthält, der mit Diamanten verkleidet werden soll, aus einem Material gefertigt ist, zum Beispiel PVC, welches einen hohen Härtegrad aufweist, der aber der mit Diamanten verkleideten Oberfläche des Gegenstandes, der sich im Inneren des Behälters bewegt, keinen Schaden zufügt.

## 55    **Revendications**

1. Processus automatique pour diamanter des objets essentiellement sphériques (1), tels que petites balles, objets polyédriques, pour tout usage dans le secteur de la joaillerie, du type qui empêche l'enlèvement de n'importe quel

matériau, où un seul objet est déposé à l'intérieur d'un siège (2) en tant que récipient et, ensuite, le même objet est soumis à une action de poinçonnage moyennant quoi une pluralité de microcavités est générée dans la surface dudit objet, les surfaces de chaque cavité étant diversement orientées, ce qui augmente les jeux de lumière, un seul objet étant positionné automatiquement lors de chaque action de poinçonnage avec une portion différente de sa surface jusqu'à un traitement complet de la surface tout entière étant diamantée, le processus comportant la phase en ce que le positionnement automatique différent dudit objet dans le siège avant chaque action de poinçonnage a lieu en raison du fait que ledit objet est immergé dans un flux turbulent d'air comprimé.

2. Un processus selon la revendication 1, **caractérisé en ce que** le positionnement automatique différent dudit objet dans le siège avant chaque action de poinçonnage a lieu en raison du fait que l'embasement (3) du siège qui contient ledit objet est constitué d'un matériau qui présente un certain degré d'élasticité, même un moindre degré.
3. Un processus selon les revendications 1 et 2, **caractérisé en ce que** durant l'action de poinçonnage, l'objet à diamanter qui a une forme sphérique ou quand même polyédrique, une petite balle, ladite balle (1) est poussée vers le haut pour qu'elle rebondisse en continu contre l'outil de poinçonnage en raison de l'effet combiné de deux actions, l'une due au mouvement turbulent de l'air comprimé et l'autre due à la réaction de l'embasement (3) qui est légèrement élastique, et qu'après chaque poinçonnage ladite balle est poussée vers le bas par le mouvement vibratoire du sommet de l'outil de poinçonnage (4) susdit.
4. Le processus selon la revendication 3, **caractérisé en ce que** durant le micromouvement vers le haut et vers le bas de la balle (1) à l'intérieur du siège contenant la balle, ladite balle tourne sur elle-même d'une façon casuelle, ce qui permet à ladite balle d'offrir à l'outil de poinçonnage (4) une surface différente et nouvelle à poinçonner, moyennant quoi la surface tout entière est complètement diamantée après un nombre déterminé de poinçonnages fixés par l'opérateur.
5. Le processus selon les revendications 1 et 2, **caractérisé en ce que**, durant l'action de poinçonnage, la balle (1) demeure immobile et que la force propulsive de l'outil dans la surface de la balle, qui est nécessaire pour générer la microcavité, pousse la balle contre l'embasement (3) et que l'embasement est soumis à une déformation micro-métrique.
6. Le processus selon la revendication 5, **caractérisé en ce qu'à** la fin de chaque action de poinçonnage, aussitôt que l'outil s'éloigne de la surface de la balle, la balle demeurant libre est projetée vers le haut par la poussée qu'a générée l'action élastique de l'embasement déformé (3) ce qui permet à la balle (1), durant les mouvements vers le haut et vers le bas, de tourner sur elle-même, moyennant quoi la balle est déposée à nouveau sur l'embasement dans une position différente par rapport à la précédente, ce qui offre à l'outil une nouvelle portion de surface à poinçonner.
7. Le processus selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** le degré de rotation dudit objet sur lui-même est casuel et différent dans chaque action, ce qui permet à la surface tout entière d'être complètement diamantée après un certain nombre de poinçonnages fixés par l'opérateur.
8. Une machine pour diamanter des corps qui ont une forme sphérique ou quand même polyédrique, petites balles, et fonctionnant selon le processus décrit dans l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'elle** comporte un logement (7) pour balles (1) à diamanter, un tube de protection (8) muni de cloisons pneumatiques (9), ce qui permet aux balles d'être déposées individuellement à l'intérieur du siège (2), ledit siège étant capable d'être soumis à un déplacement dû à l'action d'un cylindre pneumatique (10) moyennant quoi chaque balle (1) est positionnée à proximité du poinçonneur (4) et au-dessus d'un embasement élastique (3) et, l'opération de poinçonnage de la surface tout entière de la balle achevée, le siège est déplacé ultérieurement pour décharger la balle dans le collecteur (11).
9. La machine selon la revendication 8, **caractérisée en ce que** le siège (2) contenant l'objet à diamanter est constitué d'un matériau, par exemple du PVC, qui a une valeur de dureté considérable mais qui n'endommage pas la surface diamantée du corps qui bouge à l'intérieur dudit récipient.

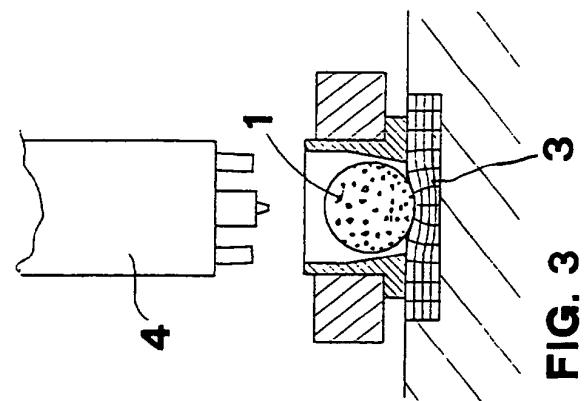


FIG. 3

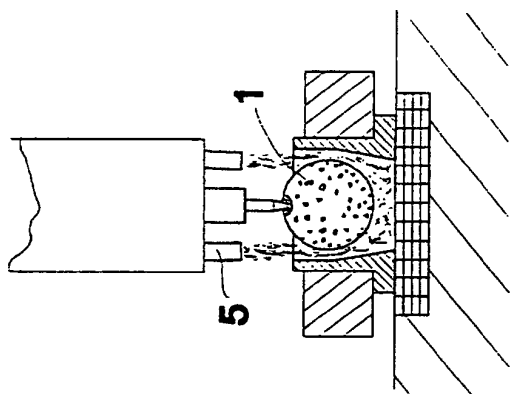


FIG. 2

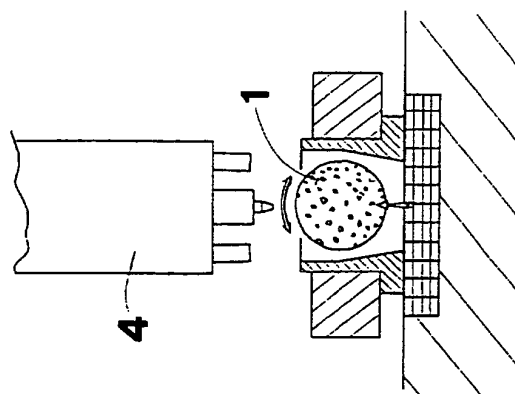


FIG. 4

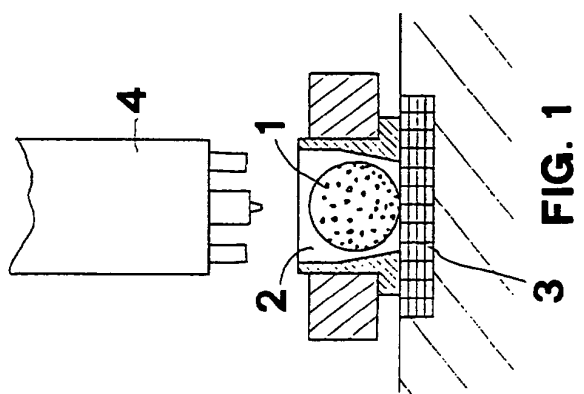


FIG. 1

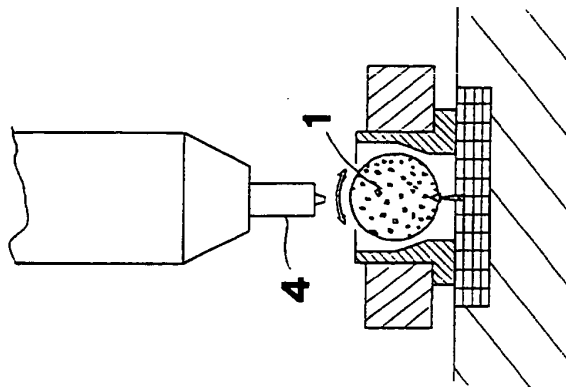


FIG. 7

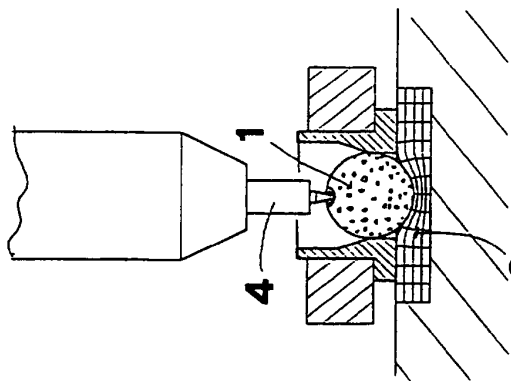


FIG. 6

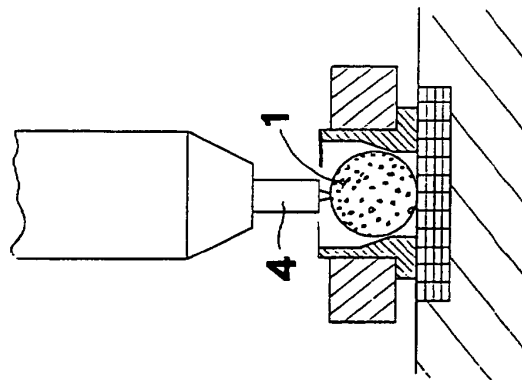


FIG. 8

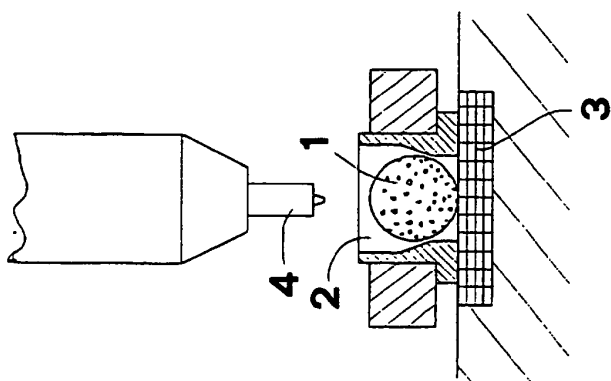


FIG. 5



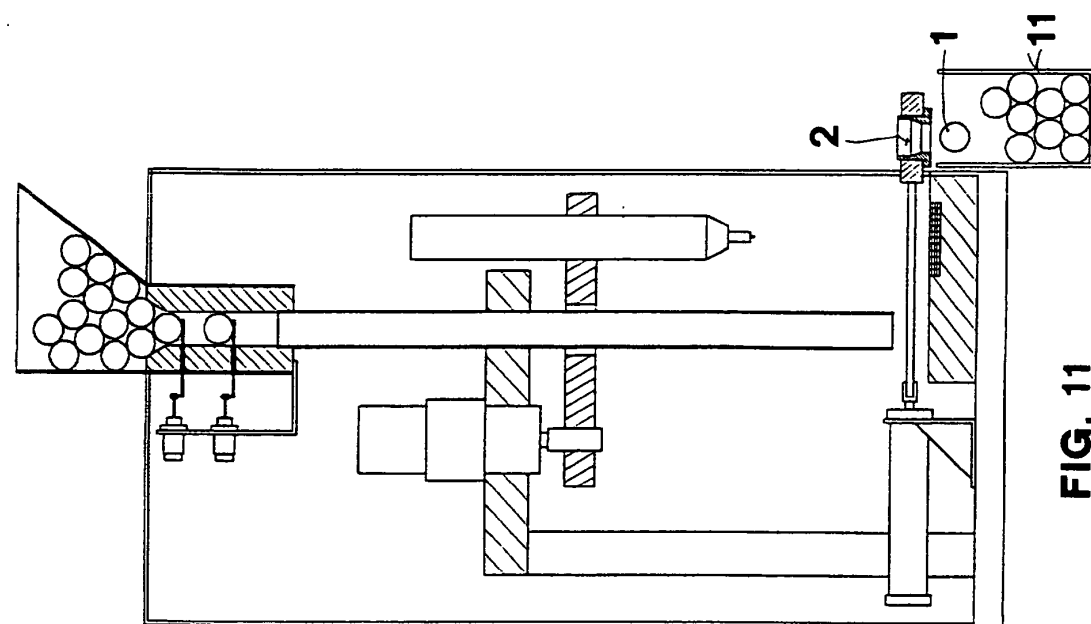


FIG. 11

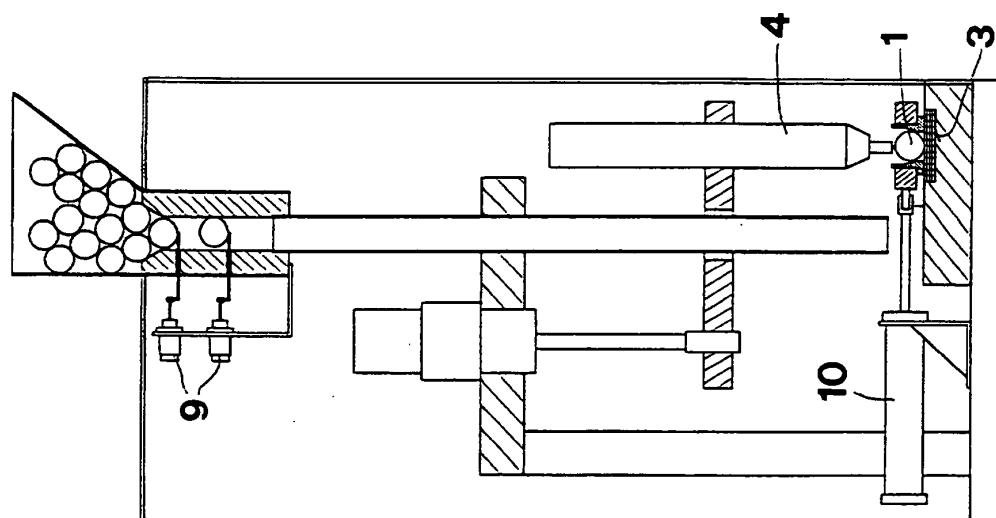


FIG. 10

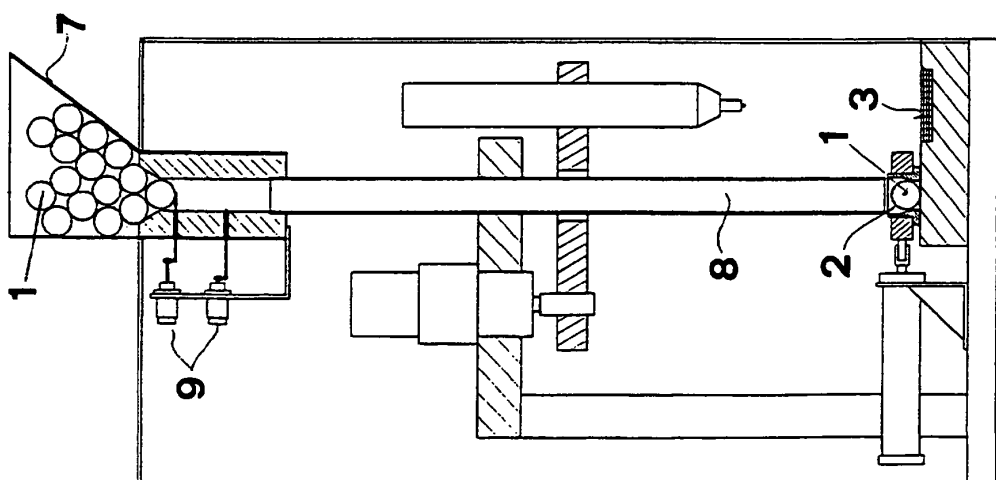


FIG. 9