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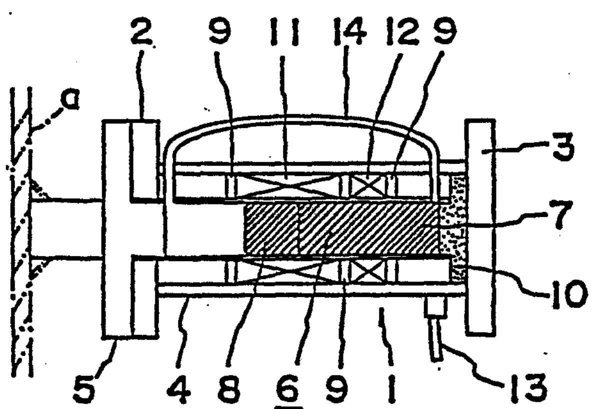
(54) HAMMERING DEVICE.

(57) An apparatus has a slide rod (6) provided movably in its axial direction within a hollow frame (4) fixed to the surrounding wall (a) of a hopper or a conduit line etc. to exert impact forces directly or indirectly on said surrounding wall (a), said slide rod (6) comprising a structure including a magnetic material (7) as a part thereof, at the same time electromagnetic coils (11), (12) which move said slide rod (6) in the direction of said surrounding wall (a) on supplying electricity being disposed around said slide rod (6). In the hammering device of this invention, electromagnetic forces are exerted on the magnetic material (7) of the slide rod (6) by controlling electric current to the electromagnetic coils (11), (12), causing said slide rod (6) to be moved to give impact forces on the surrounding wall (a), leading to shorter intervals of impact, increased number of impact per unit time and improved operation efficiency compared to conventional hydraulic or pneumatics devices. And increase or decrease of impact forces and cycles of impact can be optionally changed by adjusting supply conditions of electricity.



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DETAILED STATEMENT

HAMMERING DEVICE

[FIELD OF ART]

The present invention relates to a hammering device for separating powdery substances adhering from the inner walls of their storing hopper and conveying piping by application of shock thereto.

[BACKGROUND OF THE INVENTION]

In storing and conveying pulverized ceramics and other ceramic materials as well as powdered foodstuff, these pulverized substances tend to adhere to the inside of their vessels or paths. Large amounts of such pulverized matter adhered cause ratholes, bridges, and arching in storing hoppers, hampering pulverized matter from exhausting therefrom. Large quantities of powder adhering inside conveying pipes result in a reduction in path area, sometimes making it impossible to convey powdery goods.

In order to solve the problems in handling such pulverized matter a hammering device has conventionally been used against the walls of a hopper and piping causing a shock and thus removing powder adhering therefrom. Such a hammering device employs a hydraulic cylinder in which air serves as the working fluid, and is so constructed that an actuator collides at the edge directly against the hopper and pipe wall surfaces or an indirect impact is given to prevent the wall surfaces from being damaged. Some hammering devices can adjust the hammering force according to the nature of pulverized substances contained and the positions in which the hammering devices are mounted on the hoppers and the pipe lines.

However, the use of air as a working fluid necessitates the provision of a hydraulic circuit consisting of a compressor for pressurizing the working fluid, an oiler, and an air cleaner. This gives rise to the enlargement of the equipment itself as well as to the degradation of the working environment partly due to the operating noise of the compressor.

Moreover, notwithstanding a sealing mechanism provided to prevent powder from entering the sliding surfaces between the cylinder and the actuator, the intrusion of fines is unavoidable, causing faulty sliding which hampers appropriate hammering. Especially where air is used as a working fluid, the shortening of the interval between air feed and exhaust for reciprocating the actuator is limited because of a great influence of the compressibility of the fluid. Accordingly, the frequency by which the actuator gives a shock per unit time has an upper limit, preventing efficient operations of removing adhering powdery matter.

Therefore, the objects of the present invention are to simplify the equipment by using an electromagnetic force to move the hammering members and to improve the efficiency of the removing operation by an increase in hammering frequency.

[DISCLOSURE OF THE INVENTION]

According to the present invention the objects described above are achieved by providing a sliding rod mounted axially movable in a hollow frame secured on the outer wall of a hopper or a piping line to exert a direct or indirect impact on the wall, said sliding rod being a structure partly of a magnetic material, and a solenoid coil fitted around the sliding rod to energize the rod to travel toward the wall.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig.1 is a logitudinal section of a hammering device of the present invention with the sliding rod in its retreated position; Fig.2 is a logitudinal section of the device with the sliding rod in its hammering position; Fig.3 shows energizing time charts for an actuating solenoid coil and a retreating solenoid coil; and Fig.4 is the hammering device secured to the wall around a hopper of powdery matter. Fig.5 shows a further embodiment of the present invention; Fig.6 is a section on the line I-I in Fig.5 looking in the direction of the arrows; Fig.7 is a perspective view of the inner pipe and yoke disassembled; and Fig.8 shows energizing time charts for solenoid coils of the hammering device in Fig.5. Fig.9 is a still further embodiment of the present invention; Figs.10, 11 and 12 illustrating other embodiments; and Fig.13

shows energizing time charts for the solenoid coils of the device in Fig.12.

[DESCRIPTION OF PREFERRED EMBODIMENT]

The features of the present invention are described in detail making reference to the drawings attached herewith showing the embodiments of the invention.

Figs.1 and 2 are longitudinal sections showing a first hammering device embodying the present invention.

Referring to Fig.4, the hammering device 1 is secured onto the outer wall a of hopper A to give a shock thereto so as to cause pulverized matter B adhering to the inner wall to detatch therefrom. The hammering device is similarly fixed on the wall of the pipe line carrying powdery substances in such a manner that the device hammers the pipe wall.

Referring to Fig.1, the hammering device 1 comprises an enclosed cylindrical frame 4 having flanges 2 and 3 at the ends, a base plate 5 connected to said flange 2 being securely welded onto the outer wall a of the hopper A to give a shock thereto, which lends itself to transmitting to said outer wall a hammering force developed by the action of a sliding rod 6 in said frame 4.

The sliding rod 6, which has a body 7 of a magnetic metal such as iron integrated with a head 8 located on the side of the base plate 5, is so supported slidably in the axial direction by a given number of yokes 9 arranged in the frame 4 that said head 8 at one end of the rod 6 gets into contact with the base plate 5, exerting a hammering force thereon, said head 8 being made of a nonmagnetic metal such as stainless steel and a shock absorbing element 10 of rubber and others being fitted on the side of the flange 3 to receiver the body 7.

The sliding rod 6, whose iron body 7 is magnetic, can travel toward and from the base plate 5 due to an electromagnetic force developed when the actuating solenoid coil 11 or the retreating solenoid coil 12 are energized; i.e., said actuating and retreating solenoid coils 11 and 12 are disposed around the sliding rod 6 in the frame 4 in such a way that the sliding rod 6 travels to the positions in Figs.1 and 2 by the action of the magnetic field when these solenoid coils 11 and 12 are energized.

When the actuating solenoid coil 11 is energized to move the sliding rod 6 to the hammering position shown in Fig.2, the axial center of the body 7 aligns with the center of the actuating solenoid coil 11. It is, therefore, necessary to set half the axial distance of the head 8 plus the body 7 so that the head 8 can hammer the base plate 5.

Energizing these actuating and retreating solenoid coils 11 and 12 is achieved by means of a cable 13 connected to an external control panel (not shown). The energizing control is to be made in such a way as to change the travel speed and the traveling interval of the sliding rod 6. For example, an increase in traveling speed at the time of actuation can increase the hammering force exerted on the base plate 5, so that the magnitude of the hammering force can be adjusted freely by controlling the energizing current or voltage according to the service conditions. A change in energizing cycle of the solenoid coils 11 and 12 can alter the hammering frequency per unit time.

A connecting duct 14 is fitted outside the frame 4 to provide smooth travel of the sliding rod 6, said connecting duct 14 functioning to allow air from inside the frame 4, when the sliding rod 6 shifts, according to the travel direction thereof. In other words, the ends of the connecting duct 14 are opened toward the side of the base plate 5 and damping element 10 respectively, so that air flows right through the connecting duct 14 from inside the frame 4 when sliding rod 6 travels to the base plate 5 from the position in Fig.1. As a result, air is excluded from inside the frame 4 only on the side to which the sliding rod 6 is to travel, permitting the rod 6 to travel without being subject to the resistance of internal air.

In the above construction the magnetic field developed upon energizing the actuating solenoid coil 11 or the retreating solenoid coil 12 causes the sliding rod 6 to move. As shown in Fig.3, the application of a voltage with a pulse width of T_1 to the actuating solenoid coil 11 develops the magnetic field, which, in turn, attracts the solenoid coil 11, causing the sliding rod 6 to move to the position in Fig.2. Then, if the traveling speed of the sliding rod 6 due to the magnetic field increases to some extent, this causes the head 8 to collide with the base plate 5, which, in turn, hammers the outer wall a of the hopper A, simultaneously bringing the sliding rod 6 to a halt in the position in Fig.2. The inertia of the traveling rod 6 also helps its collision against the base plate 5, adding to the hammering force thereof. The head 8, of a nonmagnetic material, will not be absorbed even while the base plate 5 has been magnetized.

Next, applying a voltage with the pulse width T_3 to the retreating solenoid coil 12 a time T_2 after deenergizing the actuating solenoid coil 11 develops the magnetic field attracting the body 7 right, thereby returning the sliding rod 6 to the position shown in Fig.1.

Hereinafter, alternate operations are to be made in a cycle of time T_4 by energizing the actuating solenoid coil 11 to develop the magnetic field which attracts the body 7 toward the base plate 5 and energizing the retreating solenoid coil 12 to develop the magnetic field for returning the body 7 to its position in Fig.1 so as to provide the reciprocation of the sliding rod 6.

If a greater hammering force is required, this may be obtained by providing the energizing conditions which increase the electromagnetic force as well as by increasing the coil turns of the actuating solenoid coil 11. Accordingly, the energizing control allows desired changes in hammering force and the setting thereof according to the service positions.

The hammering frequency can be increased and decreased simply by changing the interval between voltage applications. While the possible hammering frequency per sec. obtained by using a pneumatic cylinder is about one because of time required for air charge, the device embodying the invention utilizing the electromagnetic force has increase the hammering frequency to three, thereby permitting efficient hammering operations in a short time.

In addition, the employment of the enclosed type of the frame 4 can prevent the intrusion of pulverized substances and the wear of the movable members such as the sliding rod 6, which improves the durability and lengthens the life of the hammering device. Especially in plants where salt, sugar and similar substances whose moisture absorption is very high are treated, it will prove to be very important in preventing the intrusion of those substances by the employment of such a full enclosed type. Unlike the pneumatic cylinder in which the sliding rod 6 is driven by the feeding and exhausting of fluid, the embodiment of the invention eliminates the need for the high accuracy of the sliding surfaces between the sliding rod 6 and the yokes 9, thus facilitating the machining of the sliding rod 6 and reducing the manufacturing cost as compared with the conventional hydraulic cylinder type.

Fig.5 is a logitudinal section of a second embodiment of the present invention, in which the components corresponding to those of the first embodiment of the invention are indicated by the same reference numbers, their detailed description being omitted.

The frame 4, preferably of a ferromagnetic metal, is pipelike utilizing an iron pipe intended for use in gas piping, in which an inner pipe 20 with the sliding rod 6 inserted slidably is coaxially disposed in the form of dual pipes, said inner pipe 20 being of a nonmagnetic material such as stainless steel. The base plate 5 connected to the flange 2 has the flat outer end face and is practically mounted on the hopper A with a metallic adapter (not shown) attached projected from the outer end face thereof. As shown in the first embodiment of the invention, the frame 4 has yokes 9 provided at three different points for holding the inner pipe 20.

The sliding rod 6 is made of a magnetic material such as S45C; the inner pipe 20, of nonmagnetic stainless steel, as described above; the frame 4, of a magnetic iron pipe; the base plate 5, of a nonmagnetic material such as stainless steel to prevent the absorption of the sliding rod 6; and the yokes, of magnetic SS. In this way, the members are made up of combinations of magnetic and nonmagnetic materials.

The sliding rod 6, entirely of the magnetic material, differs from the first embodiment of the invention in which the head 8 of a nonmagnetic material is connected to the magnetic body 7, said sliding rod being conditioned and preferably quenched to prevent strains due to its collision against the base plate 5. The sliding rod 6 is also chamfered around the edge so as to prevent burrs resulting from the hammering force exerted thereby on the base plate 5.

Fig.6 is a perspective section on the line I-I in Fig.5, and Fig.7 is a perspective view of the inner pipe 20 and the yoke 9 disassembled.

The three yokes 9 are arranged inserted into substantial engagement with the inner wall of the pipe-like frame 4, as illustrated in Fig.6, on the sides of the flanges 2 and 3, and in the vicinity of the center, each having four notches 21 around the peripheral surface so as to provide a clearance from the inner wall of the frame 4. The inner wall 20 the periphery of which the yokes 9 are mounted in engagement with has a plural number of ventilating holes 22 at the ends so as to allow for air circulation due to the travel of the sliding rod 6.

These yokes 9 and the inner pipe 20 are assembled in the frame 4 in such a way that the yoke 9 at each end of the pipe is disposed on the side of the axial center from the ventilating holes 22 of the inner pipe 20. When the sliding rod 6 travels, such a disposition allows air to pass from inside the inner pipe 20 through the ventilating holes 22 in the direction of the travel of the rod 6 into the external frame 4 and simultaneously permits the air to flow through the frame 4 thanks to the notches 21 of the yokes 9 until the air reenters the inner pipe 20 through the opposite ventilating holes 22. In this way, the inner pipe 20 is provided with the ventilating holes 22 and the notches 21 are formed on the yokes 9 to provide the clearance from the inner wall of the frame 4, so that the air resistance can be reduced to nearly zero when the sliding rod 6 travels. The above construction eliminates the connecting duct 14 described in the first embodiment of the invention and makes the entire equipment smaller.

In the second embodiment of the present invention so constructed as mentioned above, too, the sliding rod 6 is operated by the control over the energizing of the actuating solenoid coil 11 and the retreating solenoid coil 12.

Fig.8 shows energizing time charts revealing how to control the actuating solenoid coil 11 and the retreating solenoid coil 12, where, unlike the chart given in Fig.3 of the first embodiment, at the beginning of the operation, the retreating solenoid coil 12 is first pulse energized, and the actuating solenoid is then pulse energized at a given time after the completion of the first energizing. As a result of energizing the actuating solenoid coil 11 the sliding rod 6 travels toward the base plate 5 to give the hammering force thereto.

Such control that the retreating solenoid coil 12 is first energized to set the sliding rod 6 in its retreated position has the following advantages: for example, when the flange 3 is mounted in the lower position, the sliding rod 6 is kept down in the retreated position by the dead load thereof throughout the unoperational period. In this case, when the actuating solenoid coil 11 is first energized, the sliding rod 6 travels toward the base plate 5 upon the initial energizing to give a shock thereto. On the contrary, when the flange 2 is disposed in the lower position, the sliding rod 6 is kept down on the side of the base plate 5, thus leaving the sliding rod 6 as it is despite the energizing of the actuating solenoid coil 11 and effecting no hammering action. In order to avoid this inconvenience energizing the retreating solenoid coil 12 first moves up the sliding rod 6 from its down position. After that, the base plate 5 gets hammered by energizing the actuating solenoid coil 11.

In this way, the hammering action can be effected from the initial stage without any delay just by pulse energizing the retreating solenoid coil 12 first. Hence, efficient hammering can be provided regardless of the posture of the hammering device against the hopper A.

Additionally, in the second embodiment of the invention, the frame 4 and yokes 9 are made of ferromagnetic materials, where the lines of magnetic force of the actuating solenoid coil 11 and the retreating solenoid coil 12 form the magnetic circuit of the sliding rod 6 and the frame 4 both of magnetic materials. This results in the formation of a structure with few magnetic leaks by the energizing of the actuating and retreating solenoid coils 11 and 12, thus increasing the attraction to the sliding rod 6 and thereby the hammering force to the base plate 5, which also shortens the intervals between hammering and retreating and consequently provides a more efficient operation.

Fig.9 is a logitudinal section showing a third embodiment of the present invention, which is a partial modification of the construction of the second embodiment of the invention in Fig.5 with the description of the members common to those of the second embodiment omitted.

The third embodiment of the invention differs from the second embodiment thereof in that the base plate 5 is provided with an opening 23 coaxial with the sliding rod 6, a hammering head 24 fitted at the edge of the sliding rod 6 protruding and retreating through the opening 23 to give the hammering force directly to the outer wall a of the hopper A. Namely, the sliding rod 6 is integrated at the edge with the hammering head 24 of a nonmagnetic material such as stainless steel, said hammering head 24 being so constructed as to protrude and retreat through the opening 23 and of such a size that it can protrude as much as illustrated from the opening 23 when the sliding rod 6 has traveled to the side of the base plate 5.

Although the provision of the opening 23 through which the hammering head comes out and retreats has lost the frame 4 of the sealing performance, the air resistance against the sliding rod 6 can be lessened by the employment of such a construction as shown in Fig.5 having the inner pipe 20 and the yokes 9. The way of controlling the energizing of the actuating and retreating solenoid coils 11 and 12 is the same as with the second embodiment.

Fig.10 is a schematic view showing a fourth embodiment of the present invention, with the description of the members corresponding to those of the aforesaid embodiments omitted, wherein only the actuating solenoid coil 11 is disposed in the vicinity of the axial center of the frame 4, the sliding rod 6 has the edge of the magnetic body 7 integrated with the hammering head 25 of a nonmagnetic material such as stainless steel, and a compression coil spring 26 is provided between the base plate 5 and the body 7 to excite the sliding rod 6 in such a direction as to separate from the base plate 5, said hammering head 25 having a smaller diameter than that of the body 7 and being surrounded by the compression coil spring 26. The inner pipe 20 and the yokes 9 containing the sliding rod 6 are identical to those described in the aforesaid embodiments, the yokes 9 and the inner pipe 20 being provided with notches and ventilating holes (not shown) respectively.

In the above construction with the single actuating solenoid coil 11 the magnetic field developed by the energizing thereof permits the sliding rod 6 to travel toward the base plate 5 as shown in Fig.10 (b) to exert the hammering force thereon, while upon the deenergizing of the actuating solenoid coil 11 the magnetic force is extinguished, allowing the sliding rod 6 to return to its original position as in Fig.10 (a) under the excitation of the compression coil spring 26.

As described above, the construction including the single solenoid coil can be used as an intermittent hammering device by providing an appropriate mechanical means for reciprocating the sliding rod 6.

Fig.11 shows the construction of the fourth embodiment in Fig.10 partly modified, wherein the retreating solenoid coil 12 is disposed separate from the base plate 5 and the compression coil spring 26 is located on the side of the flange 3, the edge of the body 7 being integrated with the hammering head 25 of the nonmagnetic material.

In this construction the retreating solenoid coil 12 serves to attract the body 7 of the sliding rod 6 and the compression coil spring 26 excites the sliding rod 6 toward the base plate 5 to give the hammering force thereto; i.e., upon the energizing of the retreating solenoid coil 12 the electromagnetic force develops to attract the body 7 to be held in the nonoperated position as in Fig.11 (a); and the deenergizing thereof liberates the sliding rod 6 from the magnetic force to travel to the base plate 5 as in Fig.11 (b) under the excitation of the compression coil spring 26 to exert the hammering force thereon.

In the embodiments provided with the single solenoid coil as shown in Figs.10 and 11 the desired hammering operations can be accomplished by controling appropriately the energizing of the solenoid coil.

Additionally, Fig.12 shows an example of the arrangement provided with four solenoid coils.

The frame 4 contains a first, a second, a third, and a fourth solenoid coil 27, 28, 29 and 30 disposed coaxial with the travel axis of the sliding rod 6, each of the coils being provided with an energizing control circuit, and the sliding rod 6 being made entirely of a magnetic material. The dimensional relation between the sliding rod 6 and each of the solenoid coils 27~30 is such that the axial length of the sliding rod 6 is slightly longer than any two adjacent solenoid coils. the embodiment illustrated has the same basic construction as given in Figs.5 and 9 except for the yokes which are not shown.

Fig.13 shows time charts for energizing the solenoid coils 27~30, which indicate that only the second solenoid coil 28 gets pulse energized in the state as in Fig.12 (a) to cause the sliding rod 6 to travel to the position (b) under the electromagnetic force, that energizing only the first solenoid coil 27 when the sliding rod 6 has reached the position (b) moves the rod 6 further left until the rod hammers the base plate 5 as in (c), that upon energizing the third solenoid coil 29 the sliding rod 6 gets retreated to the position (d), and that the energizing of the fourth solenoid coil 30 causes the sliding rod 6 to retreat to the original position (a).

As described above, the sequential energizing of the plural number of solenoid coils disposed along the traveling direction of the sliding rod 6 causes the sliding rod 6 to hammer the base plate and retreat to its original position. In the hammering operation these solenoid coils attract the sliding rod to travel smoothly and continuously and accelerate the travel speed thereof, consequently strengthening the hammering force to the base plate 5. In addition, sequentially energizing the solenoid coils speeds up the action of the sliding rod 6 as well as increases the hammering times per unit time, resulting in an increase in hammering force and a reduction in hammering intervals, and thus providing a very efficient operation.

[INDUSTRIAL FEASIBILITY]

As described above, the hammering devices embodying the present invention have the sliding rod made partly of the magnetic material disposed in the frame, said sliding rod being allowed to reciprocate by the use of the electromagnetic force developed by the solenoid coils and the reciprocating movement being conversible to the direct or indirect hammering force to objects. Since an increase and a decrease in the hammering force and the hammering cycle can be changed freely by altering the conditions of energizing the solenoid coils for reciprocating the sliding rod, the use of the hammering device, if attached to containers such as a hopper, permits efficient operation of removing pulverized substances in accordance with the service conditions. Unlike the hammering devices utilizing hydraulic pressure which has such problems as delay in operation due to the hydraulic compressibility and the limitation of the hammering cycle, the embodiments of the invention provide smooth and proper movement of the sliding rod and increasing the hammering cycle thereof.

WHAT IS CLAIMED IS:

1. A hammering device comprising a hollow frame to be secured onto the outer wall of a hopper or a pipe line, a sliding rod mounted slidably along the axial line thereof in said frame to apply a direct or indirect hammering force to said outer wall, said sliding rod being a structure made partly of a magnetic material, and solenoid coils disposed around said sliding rod to move said sliding rod toward said outer wall when energized.

2. A hammering device, as set forth in claim 1, wherein said frame is of an enclosed construction having a base plate at one end which is to be secured onto the outer wall of said hopper or pipe line.

3. A hammering device, as set forth in claim 1 or 2, wherein said frame contains an actuating solenoid coil which moves said sliding rod toward said base plate to apply a hammering force thereto and a retreating solenoid coil which returns said sliding rod to the retreated position thereof.

4. A hammering device, as set forth in claim 1, wherein said frame also contains a compression coil spring which excites the sliding rod in the hammering or retreating direction.

5. A hammering device, as set forth in claim 1, wherein a plural number of solenoid coils are arranged around said sliding rod along the axis thereof.

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FIG.1

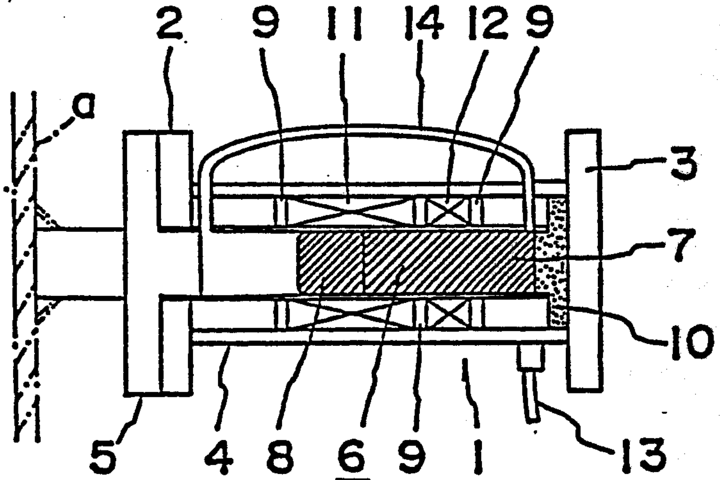

FIG.2

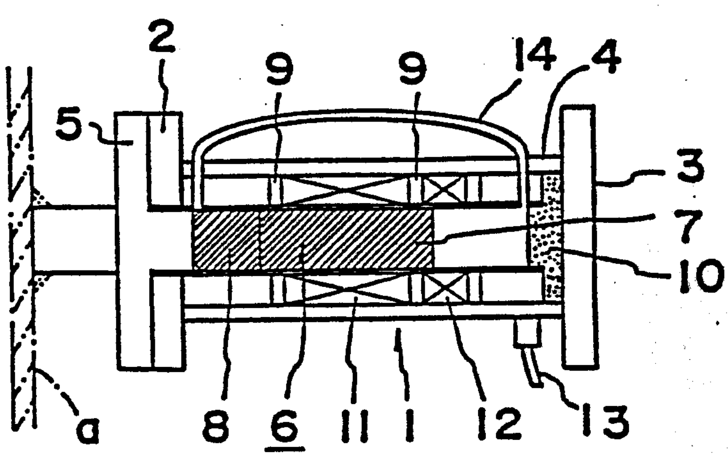

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FIG.3

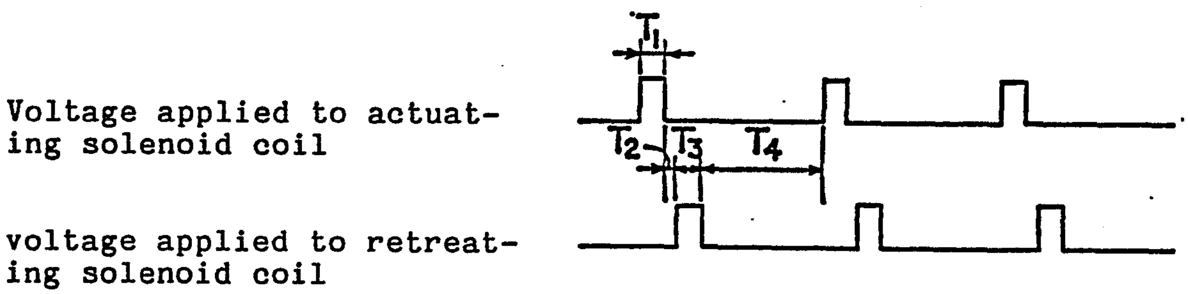

FIG.4

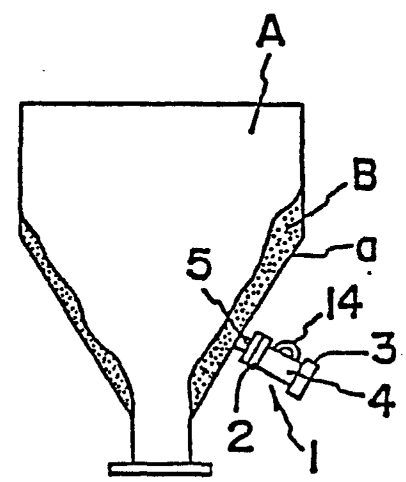

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FIG.5

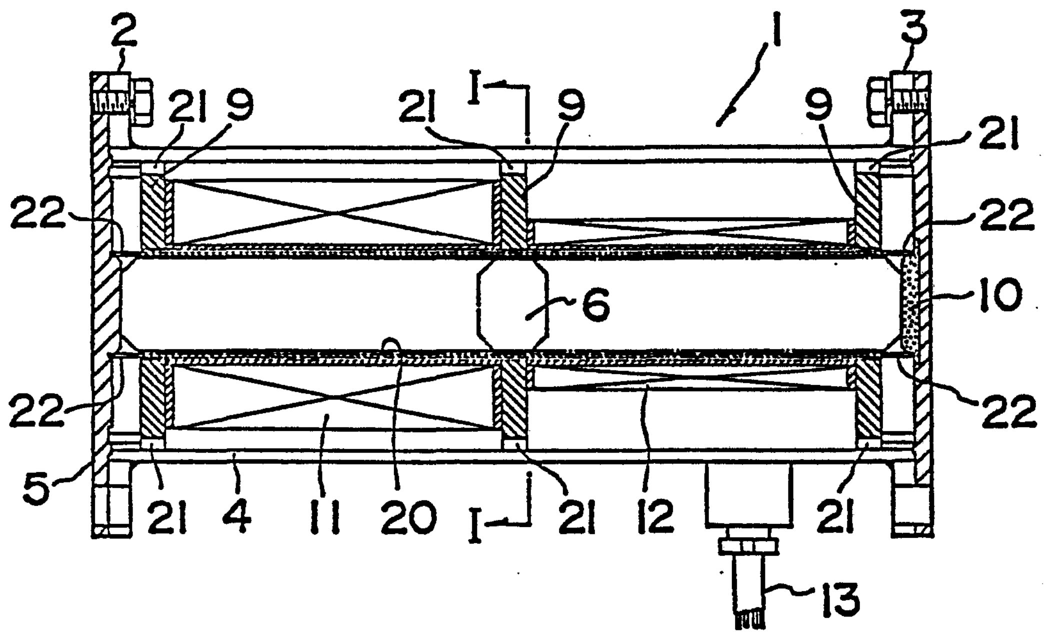

FIG.6

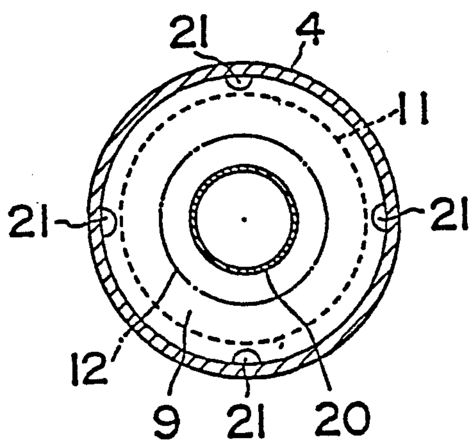

FIG.7

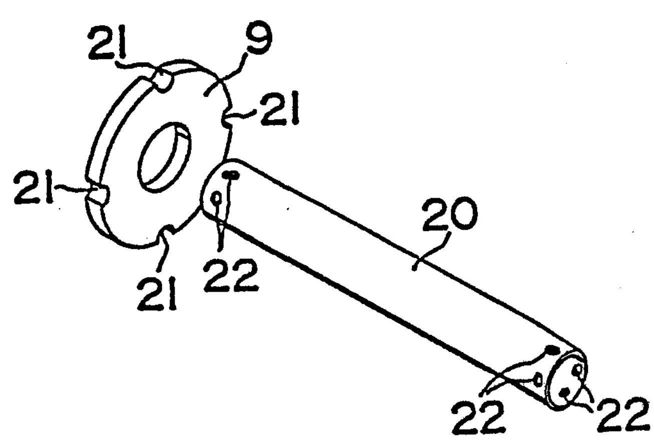

FIG.8

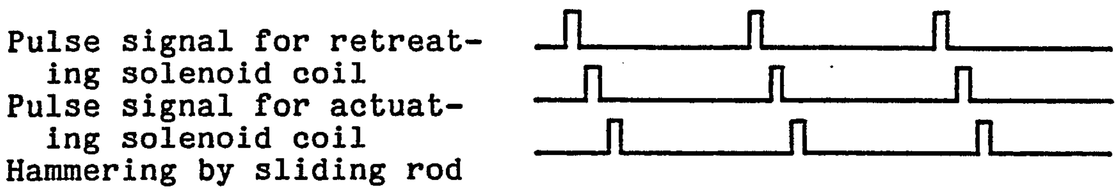
Pulse signal for retreating solenoid coil
Pulse signal for actuating solenoid coil
Hammering by sliding rod

FIG.9

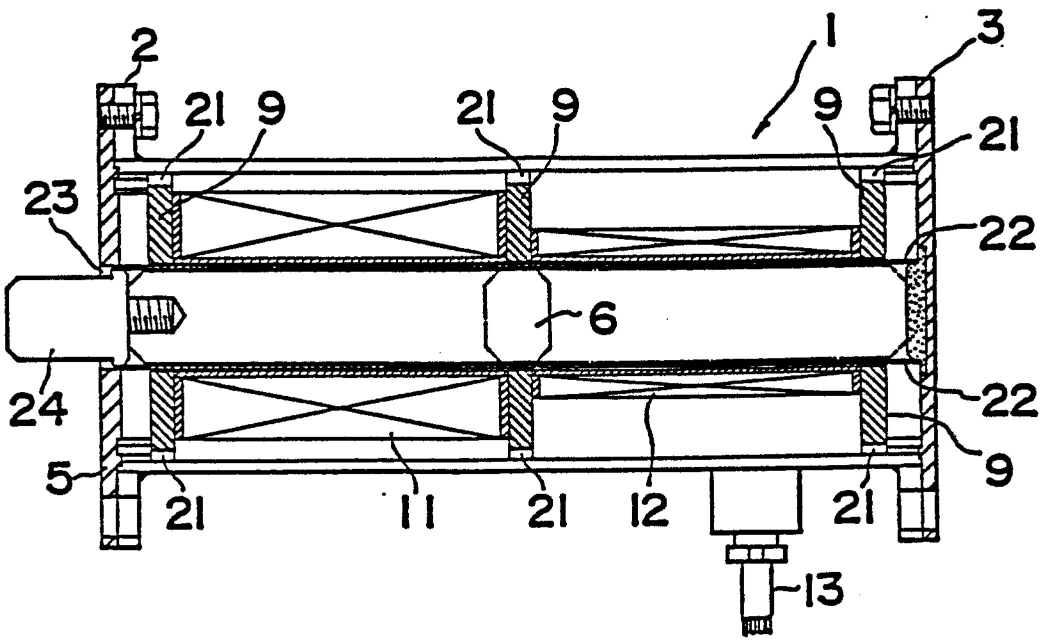
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FIG.10

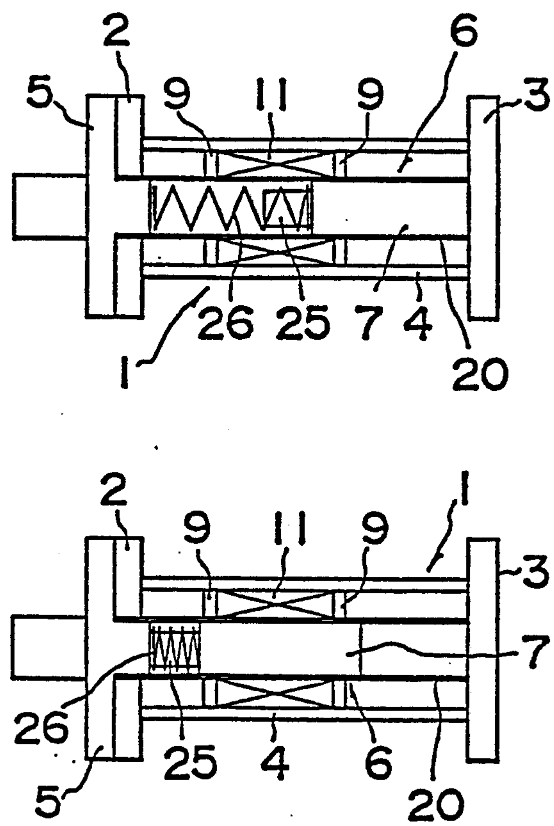

FIG.11

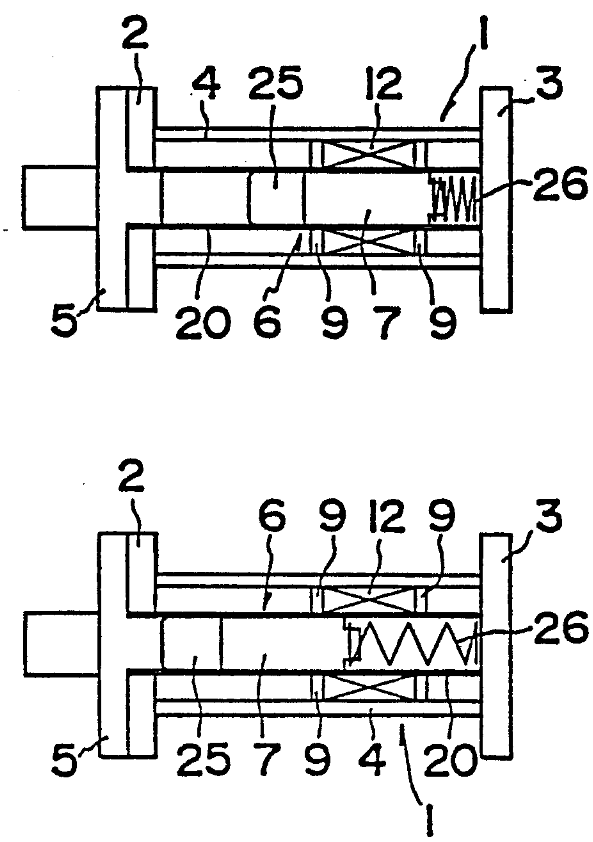

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FIG.12

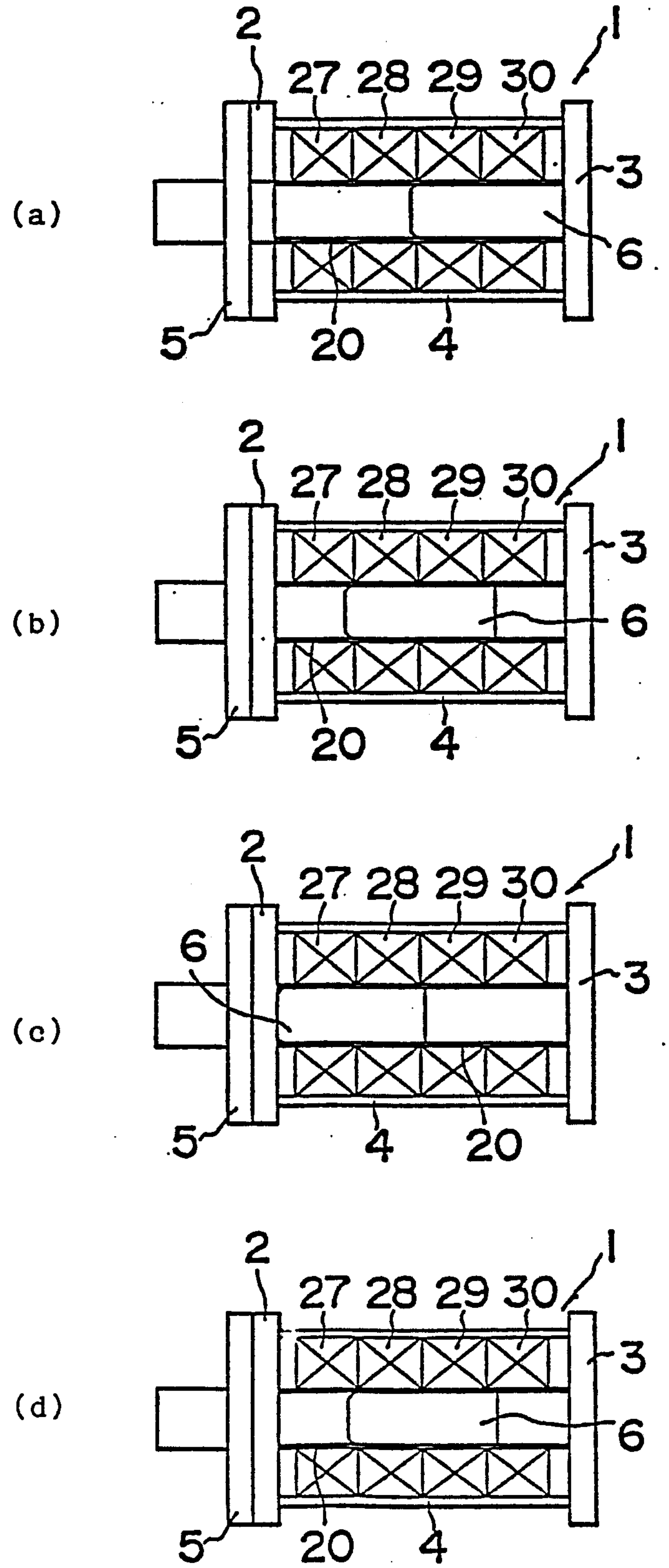
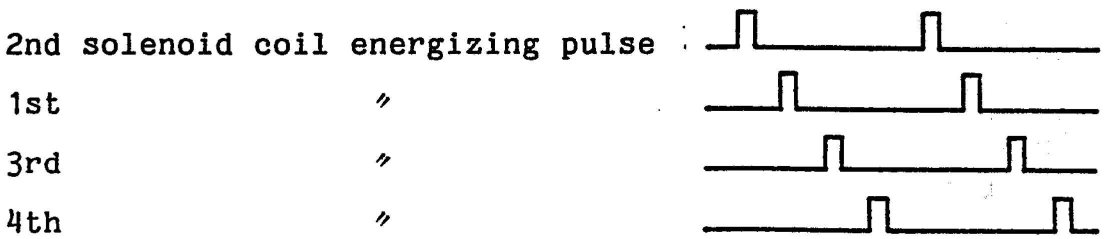


FIG.13



国際調査報告

0286680

国際出願番号PCT/JP87/00075

I. 発明の属する分野の分類

国際特許分類（IPC） Int. $C\ell^4$

B06B1/04

II. 国際調査を行った分野

調査を行った最小限資料

分類体系	分類記号
IPC	B06B1/04

最小限資料以外の資料で調査を行ったもの

日本国実用新案公報 1920−1986年

日本国公開実用新案公報 1971−1986年

III. 関連する技術に関する文献

引用文献のカテゴリー※	引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示	請求の範囲の番号
Y	JP,A,61−127480（日本ヒーター機器株式会社）14. 6月. 1986（14. 06. 86）（ファミリーなし）	1
X	JP,Y1,15−810（有江源治）25. 1月. 1940（25. 01. 40）（ファミリーなし）	1−3
X	JP,A,60−202315（株式会社 東芝）12. 10月. 1985（12. 10. 85）（ファミリーなし）	1，4
Y	JP,A,59−183871（スペツイアルノエ・プロエクトノーコンストルクトルスコエ・イ・テクノロギチエスコエ・ブジュロ・ポ・ポグルジノム・エレクトロオボルドワニジュ・ドリア・ブレニア・スクワジンイ・ドブチ・ネフテイ）19. 10月. 1984（19. 10. 84）（ファミリーなし）	5

※引用文献のカテゴリー

「A」特に関連のある文献ではなく、一般的技術水準を示すもの

「E」先行文献ではあるが、国際出願日以後に公表されたもの

「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）

「O」口頭による開示、使用、展示等に言及する文献

「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献

「T」国際出願日又は優先日の後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの

「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの

「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの

「&」同一パテントファミリーの文献

IV. 認証

国際調査を完了した日 23. 04. 87	国際調査報告の発送日 11.05.87
国際調査機関 日本国特許庁（ISA/JP）	権限のある職員 5D 7205 特許庁審査官 石川伸一