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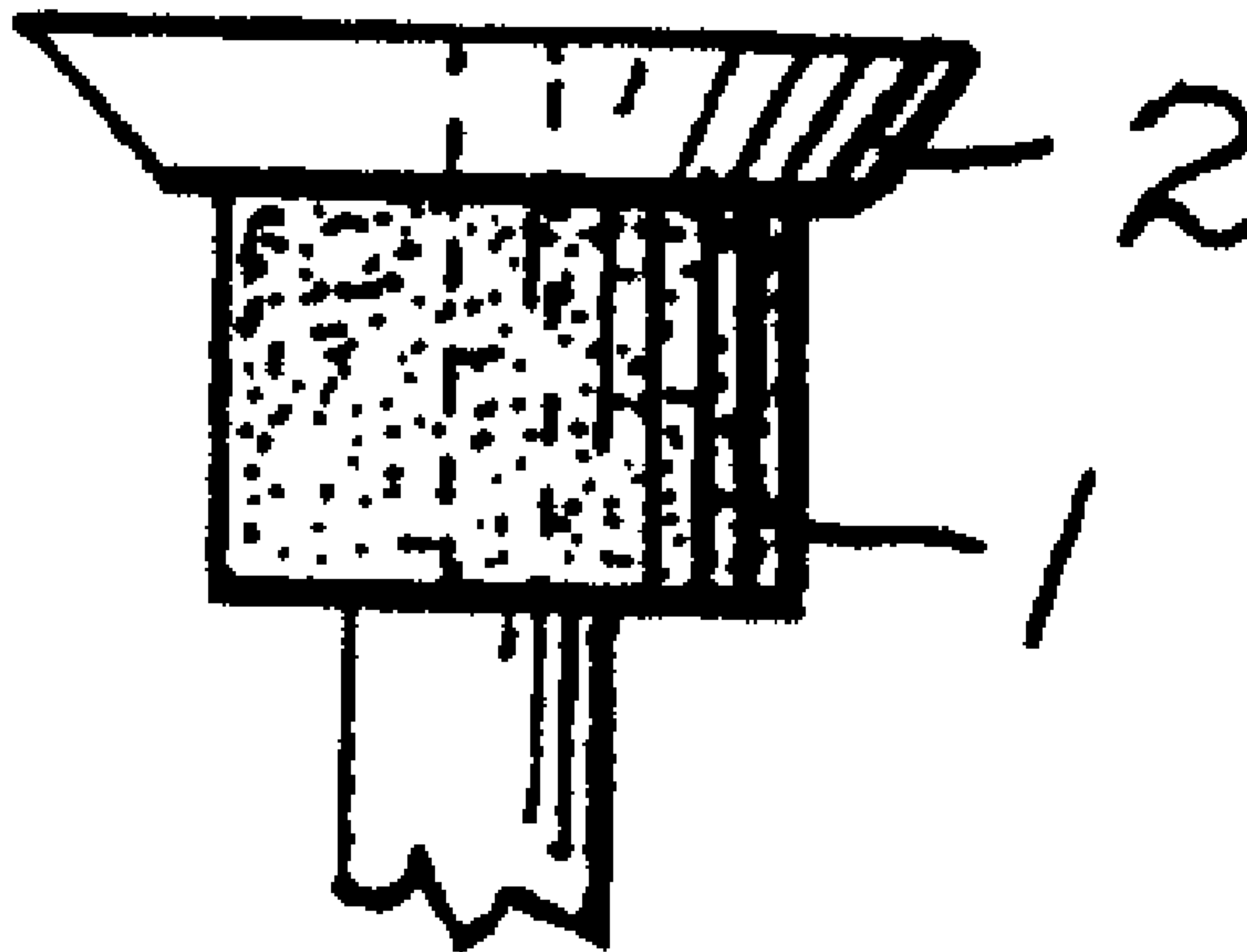
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(54) Titre : AMELIORATION DES MEULES DE MACHINE A TRAVAILLER LE MARBRE, LE GRANITE ET ANALOGUES

(54) Title: IMPROVEMENT AND ENHANCING OF GRINDING WHEELS FOR THE MACHINE WORKING OF MARBLE, GRANITE AND THE LIKE



(57) Abrégé/Abstract:

A shaped diamond wheel, at certain height, determined by both the type of grinding wheel which is being used and the working stage, is provided with a rotating feeling pin, consisting of a metal element a few millimeters high which projects for few hundredths of a millimeter with regard to the shape of grinding wheel. The rotating feeling pin does not interfere with the working of stone, with the exception of very small portion of stone which come into contact with the rotating feeling pin.



Abstract

A shaped diamond wheel, at certain height, determined by both the type of grinding wheel which is being used and the working stage, is provided with a rotating feeling pin, consisting of a metal element a few millimeters high which projects for few hundredths of a millimeter with regard to the shape of grinding wheel. The rotating feeling pin does not interfere with the working of stone, with the exception of very small portion of stone which come into contact with the rotating feeling pin.

without having to provide a shape each time it has to be used.

5 The grinding wheel consists of diamond wheel shaped in such a way as to achieve the desired shape during the machine working. It is divided, cross-wise, into two portions separated by a rotating feeling pin.

10 The feeling pin slightly projects for several hundredths of a millimeter with regard to the internal shape outlined by the two portions of the diamond wheel. Thus when the piece comes into contact with the rotating feeling pin during machine working, the two portions of the grinding wheel run idly, thus terminating their function.

15 In order to allow the perfect machine working of the piece of stone, the device is also provided with another feeling pin, installed on adjustable rotating balls, which allows all kinds of machine operations. These operations range from the grinding of curved slabs to the shaping of toroidal or other kinds of outline, with subsequent honing and polishing.

20 According to one aspect of the invention, there is provided a grinding system for forming a product having a contour, said grinding system comprising a stone working shaping device, said shaping device, comprising a first shaping wheel rotatable about a central axis thereof, said
25 first shaping wheel having a contoured shaping surface for shaping the outer surface of a stone; and first travel limiting means rotatable about a central axis thereof and being separate from but adjacent to said first shaping wheel, said first travel limiting means having

a non-abrasive surface for contacting a stone to be machine worked by said shaping device only when an outline of the stone coincides with the contour of the shaping device, said first travel limiting means contacting a stone at a first location and preventing relative movement of the shaping device and the stone towards one another when contact between the first travel limiting means and the stone occurs at said first location and thereby leaving an unworked portion at said first location.

10 The invention also provides a grinding system, wherein said shaping device comprises a second shaping wheel rotatable about a central axis thereof, said second shaping wheel having a contoured shaping surface for shaping the outer surface of a stone, said first travel limiting means
15 being disposed between said first shaping wheel and said second shaping wheel.

 The invention provides a grinding system further comprising a stone working honing device for forming a product having a finished contour, said honing device having
20 the same contour as said shaping device and comprising a honing wheel rotatable about a central axis thereof and having a contoured honing surface for honing the outer surface of a stone; and second travel limiting means rotatable about a central axis thereof and being separate
25 from but adjacent to said honing wheel; said second travel limiting means having a non-abrasive surface for contacting a stone to be machine worked by said honing device only when an outline of the stone coincides with the contour of the honing device, said second travel limiting means contacting

a stone at a second location and preventing relative movement of the honing device and the stone towards one another when contact between the second travel limiting means and the stone occurs at said second location, said
5 second location being different from said first location so that said honing surface machine works said first location to provide a final contour at said first location.

The invention provides a grinding system further comprising a polishing wheel rotatable about a central axis
10 thereof and having the same contour as said shaping device, said polishing wheel having a polishing surface for polishing the outer surface of a stone.

According to another aspect of the invention, there is provided a grinding system, wherein said grinding system
15 further comprising a body, said shaping wheel rotatably mounted on said body, means for moving said body in a direction substantially perpendicular to said central axis and toward a stone to be machine worked, and travel limiting means connected to said body for movement with said body to
20 limit movement of said body toward a stone to be worked, said travel limiting means comprising small rotatable balls which allow the body to be guided along the contour of a stone, said travel limiting means being separated from said shaping wheel and preventing advancement of the body and
25 shaping wheel toward a stone to be machine worked when said travel limiting means are prevented from further traveling along the contour of a stone.

The travel limiting means of the grinding system are adjustably positioned with respect to said body.

The travel limiting means of the grinding system is aligned at a 90° angle with respect to the longitudinal axis of said body.

5 The travel limiting means of the grinding system are connected to said body by a square. The square has adjusting screws to adjust the position of said travel limiting means with respect to said body.

10 According to a further aspect of the invention, there is provided a method of forming a stone product having a contour comprising the steps of providing a first shaping wheel having a central axis and a contoured abrasive shaping surface, providing a first travel limiting means adjacent
15 said first shaping wheel and having a central axis and a first non-abrasive surface, rotating said first shaping wheel and said first travel limiting means about the respective axes thereof, causing relative movement between a piece of stone and said first shaping wheel and first travel limiting means to cause advancing movement of the piece of stone and the abrasive shaping surface toward and into
20 contact with one another, removing stone from said piece of stone as the advancing movement continues, continuing the advancing movement until the piece of stone contacts said first non-abrasive surface at a first location on the piece of stone, removing said piece of stone from contact with
25 said first shaping wheel and said first travel limiting means.

The invention provides a method further comprising the steps of providing a second shaping wheel adjacent said first travel limiting means and having a central axis and a

contoured abrasive shaping surface for shaping the outer surface of a stone, said first travel limiting means being disposed between said first shaping wheel and said second shaping wheel, rotating said second shaping wheel about its axis, causing relative movement between the piece of stone and said second shaping wheel and first travel limiting means to cause advancing movement of the piece of stone and the abrasive shaping surface of the second shaping wheel toward and into contact with one another, and removing stone from said piece of stone as the advancing movement continues.

The invention provides a method of forming a stone product having a finished contour further comprising the steps of providing a honing wheel having a central axis and a contoured abrasive honing surface, providing a second travel limiting means adjacent said honing wheel and having a central axis and a second non-abrasive surface, rotating said honing wheel and said second travel limiting means about the respective axes thereof, causing relative movement between the piece of stone and said honing wheel and second travel limiting means to cause advancing movement of the piece of stone and the abrasive honing surface toward and into contact with one another to remove stone at said first location on said piece of stone as the advancing movement continues, and continuing the advancing movement until the piece of stone contacts said second non-abrasive surface at a second location on the piece of stone different from said first location.

The invention provides a method further comprising the steps of providing a polishing wheel having a central axis and a contoured polishing surface, rotating said polishing wheel about its axis, causing relative movement between a piece of stone and said polishing wheel to cause advancing movement of the piece of stone and the polishing wheel toward and into contact with one another, and removing stone from said piece of stone as the advancing movement between the polishing wheel and the piece of stone continues.

10 According to yet another aspect of the invention, there is provided a method further comprising the steps of providing a body, the shaping wheel being mounted on the body, rotating said shaping wheel about said central axis, causing relative movement between a piece of stone and said body to cause advancing movement of the piece of stone and the abrasive shaping surface toward and into contact with one another in a direction substantially perpendicular to said central axis, providing separate travel limiting means spaced from and connected to said body, said travel limiting means including small rotatable balls in contact with and movable along a surface of said piece of stone, continuing said advancing movement to remove stone from said piece of stone while said balls move along said surface until said balls are prevented from moving farther along said surface, and removing said piece of stone from said grinding wheel.

BRIEF DESCRIPTION OF THE DRAWING

For a better understanding of the foregoing brief summary a more detailed description follows, making reference to the specified illustrations wherein:

5 FIG. 1 shows a side view of a diamond wheel according to the present invention;

FIG. 2 shows a cylindrical diamond wheel according to the present invention;

10 FIG. 3 shows a diamond wheel for shaping according to the present invention;

FIG. 4 shows a diamond wheel for honing according to the present invention;

FIG. 5 shows a diamond wheel for polishing according to the present invention; and

15 FIG. 6 shows a feeling pin with rotating balls according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The grinding wheel works in the following manner.
20 During the machine working of a slab of marble, for example, which needs to be cut along a non-linear profile, normal machines require the use of a template which faithfully reproduces the shape to be obtained. The template is usually made of wood. The template guides the machine so
25 that the slab of marble is cut according to the desired shape. Such a procedure is not cost effective for small jobs, because it is necessary to prepare a template for each piece.

The grinding wheel of the present invention does not require any template in order to obtain a certain shape because it abrades a piece of marble only up to a certain depth. This is accomplished by a rotating feeling pin. In the embodiment shown in FIG. 3, the feeling pin is inserted between two parts of the grinding wheel, each part comprising an grinding surface. In the embodiments shown in FIGS. 1, 2 and 4, the feeling pin is not disposed between two parts of the grinding wheel but rather adjacent a grinding wheel.

At the beginning of the machine work, the grinding wheel abrades and shapes a piece. According to the embodiment shown in FIG. 3, the feeling pin is placed in between the two grinding surfaces. During the beginning of machine work, the rotation of the grinding surfaces is translated to rotational movement of the feeling pin. When the shape of the piece to be machined coincides with the shape of the grinding wheel, the rotating feeling pin prevents the grinding wheel from abrading any further, that is, it prevents the grinding surfaces from cutting the stone any deeper. The rotating feeling pin acts as a stop between the machined piece and the grinding wheel. The wheels are not able to abrade the stone deeper than the depth allowed by the feeling pin. This makes it possible to eliminate the template required by normal marble cutting machines.

The depth feeling pin shown in FIG. 6 is used with the chafing wheel shown in FIG. 2 and its job is to keep the bevel of the wheel close to the bevel of the piece of stone.

The chafing wheel is used to correct vertical profile showing irregularities.

The feeling pin may or may not protrude from the grinding surfaces of the grinding wheel. If the pin does protrude, it is only for a few hundredths of a millimeter, in order to make sure that when the machined piece touches the pin there is no further abrasion. When the piece begins contacting the feeling pin, the piece can no longer advance toward the wheel. When the feeling pin comes into contact with the machined piece, the grinding wheel does not have to stop rotating but the abrading surfaces of the grinding wheel can no longer reach the stone to abrade it.

With reference to the above figures, the grinding wheels specified in this invention consist of a shaped diamond wheel (1) which, at a certain height determined by both the type of grinding wheel which is being used and the stage of machine working, is provided with a rotating feeling pin (2).

The rotating travel limiting member (2) consists of a metal element, having a thickness of a few millimeters and which is suitable for the function it has to fulfill. The element projects a few hundredths of a millimeters with regard to the contour of the grinding wheel.

The rotating travel limiting member, therefore, does not influence the machine working of the stone until it is nearly finished. In fact, only when the outline of the stone coincides exactly with the outline of the grinding wheel adds a small part of the stone (3) come into contact with the rotating travel limiting (2). The contact member

between the travel limiting member and the stone prevents the upper and lower parts of the grinding wheel from carrying out their task, thus ending the first step of the machine working.

5 Obviously, during this first step of the working, a small portion of un-machined stone will remain under the travel limiting member, this will be completed by another specific grinding wheel, such as the one shown in FIG. 4 which features a travel limiting member (2) located in a
10 different position, with regard to the previous grinding of FIG. 3, thus allowing the partially unworked stone to be finished.

As may be seen from the Figures, besides being easily perceived, the grinding wheels may have different shapes, so
15 as to be able to execute all the various possible working stages.

For example, the grinding wheel shown in FIG. 1 is particularly recommended for grinding and carrying out the so-called "owl's beak" shape.

20 The grinding wheel shown in FIG. 2 is useful for grinding a slab to be treated.

FIG. 5 shows an extremely fine grained grinding wheel, as you may easily see, without the rotating feeling pin and which is especially useful for polishing and finishing the
25 previously machined piece.

In order to fix and to maintain the working depth of the piece as precisely as possible, the grinding system further comprises a body (7) on which the diamond wheel (1) is rotatably mounted for rotation about a central axis

thereof, as shown in Figure 6. Means is provided for moving the body (7) in a direction substantially perpendicular to the axis of rotation and toward a stone to be machine worked. Travel limiting members (12) are connected to the
5 body (7) by a square (8) for movement with the body (7) to limit movement of the body (7) toward a stone to be worked. The diamond wheel (1) has a contoured grinding surface for grinding the outer surface of a stone.

The travel limiting members (12) are in form of small
10 rotatable balls (14) which allow the body (7) to be guided along the contour of a stone. The travel limiting members (12) are separated from the diamond wheel (1) and prevent advancement of the body (7) and the diamond wheel (1) toward a stone to be machine worked when the travel limiting
15 members (12) are prevented from further traveling along the contour of a stone.

The travel limiting members (12) are adjustably positioned with respect to the body (7) by means of adjustable screws (9) provided on the square (8). As
20 illustrated in Figure 6, the travel limiting members (12) are aligned at a 90° angle with respect to the longitudinal axis of the body (7).

The foregoing invention may undergo all and any modifications, suggested by the practical employment of the
25 tool and by expert technicians, without going beyond the invention defined in the following claims.

I claim:

1. A grinding system for forming a product having a contour, said grinding system comprising a stone working shaping device, said shaping device, comprising:

a first shaping wheel rotatable about a central axis thereof, said first shaping wheel having a contoured shaping surface for shaping the outer surface of a stone; and

first travel limiting means rotatable about a central axis thereof and being separate from but adjacent to said first shaping wheel, said first travel limiting means having a non-abrasive surface for contacting a stone to be machine worked by said shaping device only when an outline of the stone coincides with the contour of the shaping device, said first travel limiting means contacting a stone at a first location and preventing relative movement of the shaping device and the stone towards one another when contact between the first travel limiting means and the stone occurs at said first location and thereby leaving an unworked portion at said first location.

2. A system as in claim 1, wherein said shaping device comprises a second shaping wheel rotatable about a central axis thereof, said second shaping wheel having a contoured shaping surface for shaping the outer surface of a stone, said first travel limiting means being disposed between said first shaping wheel and said second shaping wheel.

3. A system as in claim 1 or 2 further comprising a stone working honing device for forming a product having a finished contour, said honing device having the same contour as said shaping device and comprising:

a honing wheel rotatable about a central axis thereof and having a contoured honing surface for honing the outer surface of a stone; and

second travel limiting means rotatable about a central axis thereof and being separate from but adjacent to said honing wheel; said second travel limiting means having a non-abrasive surface for contacting a stone to be machine worked by said honing device only when an outline of the stone coincides with the contour of the honing device, said second travel limiting means contacting a stone at a second location and preventing relative movement of the honing device and the stone towards one another when contact between the second travel limiting means and the stone occurs at said second location,

said second location being different from said first location so that said honing surface machine works said first location to provide a final contour at said first location.

4. A system as in claim 3, further comprising a polishing wheel rotatable about a central axis thereof and having the same contour as said shaping device, said polishing wheel having a polishing surface for polishing the outer surface of a stone.

5. A grinding system as in claim 1, wherein said grinding system further comprising a body, said shaping wheel rotatably mounted on said body, means for moving said body in a direction substantially perpendicular to said central axis and toward a stone to be machine worked, and travel limiting means connected to said body for movement with said body to limit movement of said body toward a stone to be worked,

said travel limiting means comprising small rotatable balls which allow the body to be guided along the contour of a stone, said travel limiting means being separated from said shaping wheel and preventing advancement of the body and shaping wheel toward a stone to be machine worked when said travel limiting means are prevented from further traveling along the contour of a stone.

6. A grinding system as in claim 5, wherein said travel limiting means are adjustably positioned with respect to said body.

7. A grinding system as in claim 5, wherein said travel limiting means is aligned at a 90° angle with respect to the longitudinal axis of said body.

8. A grinding system as in claim 5, wherein said travel limiting means are connected to said body by a square.

9. A grinding system as in claim 8, wherein said square has adjusting screws to adjust the position of said travel limiting means with respect to said body.

10. A method of forming a stone product having a contour comprising the steps of providing a first shaping wheel having a central axis and a contoured abrasive shaping surface, providing a first travel limiting means adjacent said first shaping wheel and having a central axis and a first non-abrasive surface, rotating said first shaping wheel and said first travel limiting means about the respective axes thereof, causing relative movement between a piece of stone and said first shaping wheel and first travel limiting means to cause advancing movement of the piece of stone and the abrasive shaping surface toward and into contact with one another, removing stone from said piece of stone as the advancing movement continues, continuing the advancing movement until the piece of stone contacts said first non-abrasive surface at a first location on the piece of stone, removing said piece of stone from contact with said first shaping wheel and said first travel limiting means.

11. The method as defined in claim 10, further comprising the steps of providing a second shaping wheel adjacent said first travel limiting means and having a central axis and a contoured abrasive shaping surface for shaping the outer surface of a stone, said first travel limiting means being disposed between said first shaping wheel and said second

shaping wheel, rotating said second shaping wheel about its axis, causing relative movement between the piece of stone and said second shaping wheel and first travel limiting means to cause advancing movement of the piece of stone and the abrasive shaping surface of the second shaping wheel toward and into contact with one another, and removing stone from said piece of stone as the advancing movement continues.

12. The method as defined in claim 10 or 11 of forming a stone product having a finished contour further comprising the steps of providing a honing wheel having a central axis and a contoured abrasive honing surface, providing a second travel limiting means adjacent said honing wheel and having a central axis and a second non-abrasive surface, rotating said honing wheel and said second travel limiting means about the respective axes thereof, causing relative movement between the piece of stone and said honing wheel and second travel limiting means to cause advancing movement of the piece of stone and the abrasive honing surface toward and into contact with one another to remove stone at said first location on said piece of stone as the advancing movement continues, and continuing the advancing movement until the piece of stone contacts said second non-abrasive surface at a second location on the piece of stone different from said first location.

13. The method as defined in claim 12, further comprising the steps of providing a polishing wheel having a central

axis and a contoured polishing surface, rotating said polishing wheel about its axis, causing relative movement between a piece of stone and said polishing wheel to cause advancing movement of the piece of stone and the polishing wheel toward and into contact with one another, and removing stone from said piece of stone as the advancing movement between the polishing wheel and the piece of stone continues.

14. A method as defined in claim 10 further comprising the steps of providing a body, the shaping wheel being mounted on the body, rotating said shaping wheel about said central axis, causing relative movement between a piece of stone and said body to cause advancing movement of the piece of stone and the abrasive shaping surface toward and into contact with one another in a direction substantially perpendicular to said central axis, providing separate travel limiting means spaced from and connected to said body, said travel limiting means including small rotatable balls in contact with and movable along a surface of said piece of stone, continuing said advancing movement to remove stone from said piece of stone while said balls move along said surface until said balls are prevented from moving farther along said surface, and removing said piece of stone from said grinding wheel.

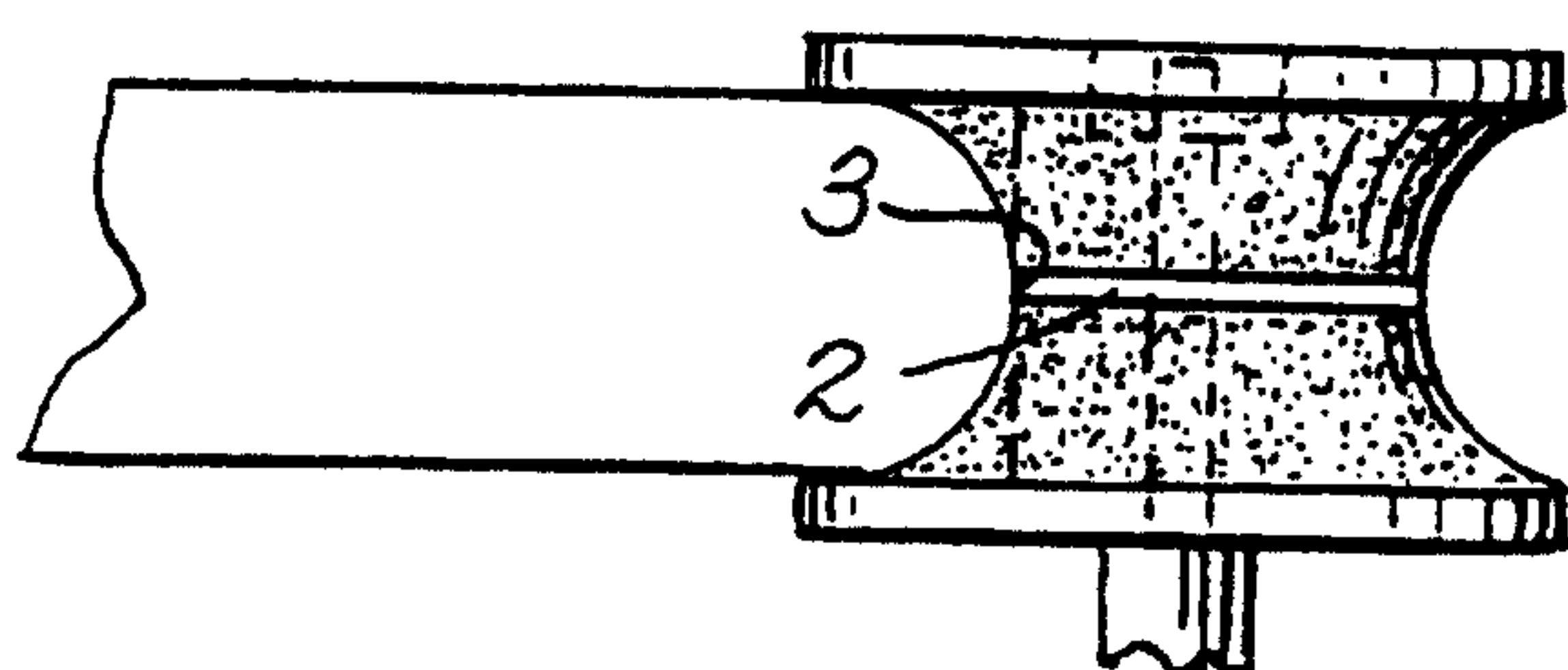
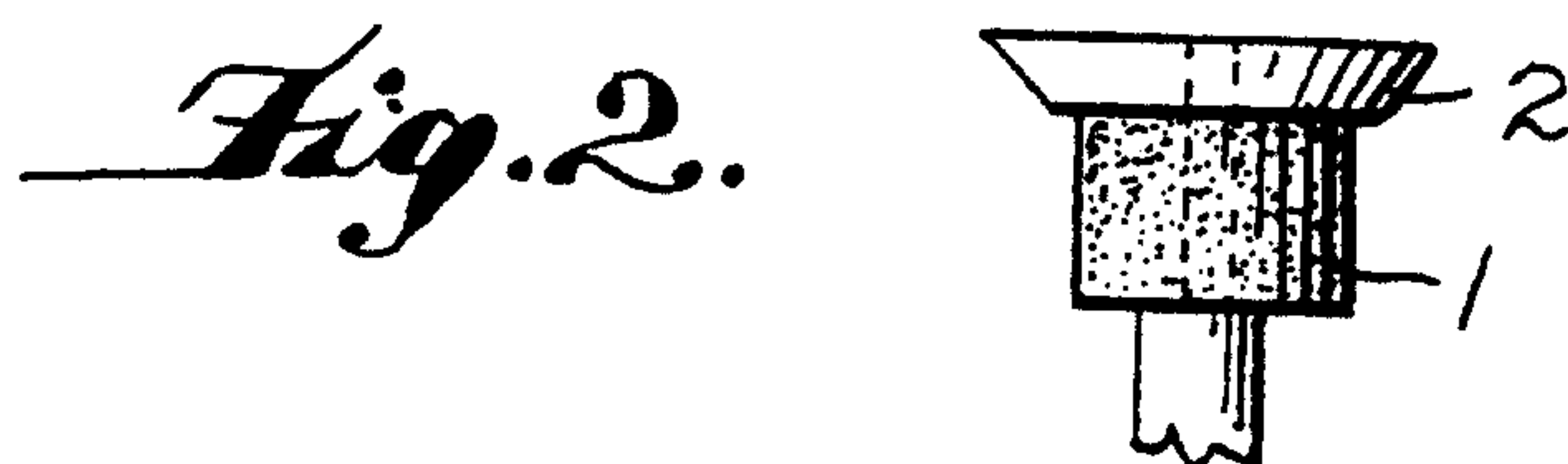
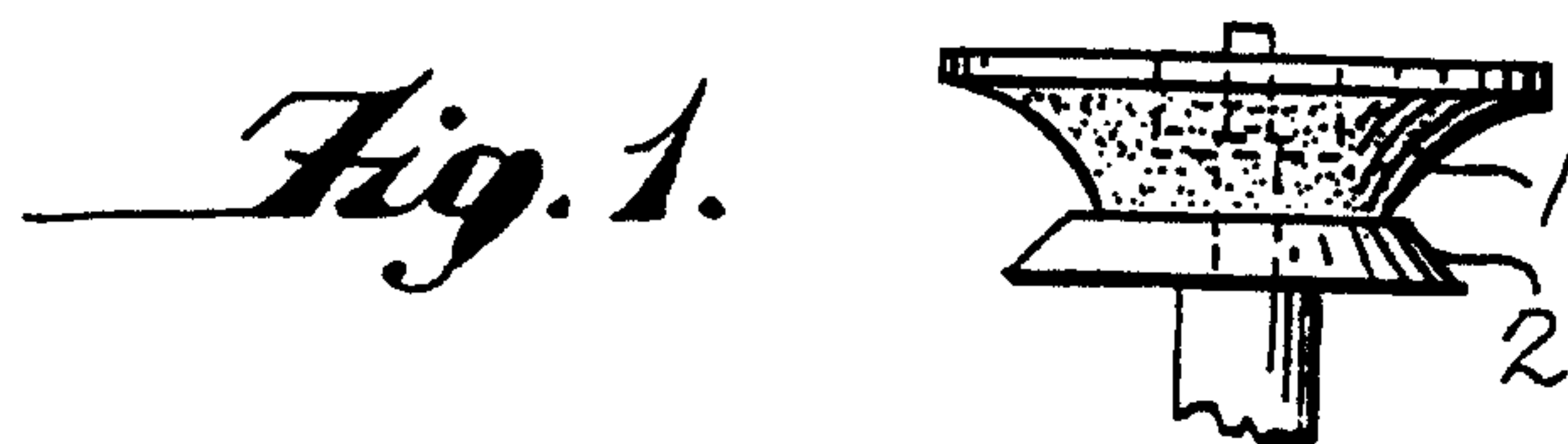


Fig. 3.

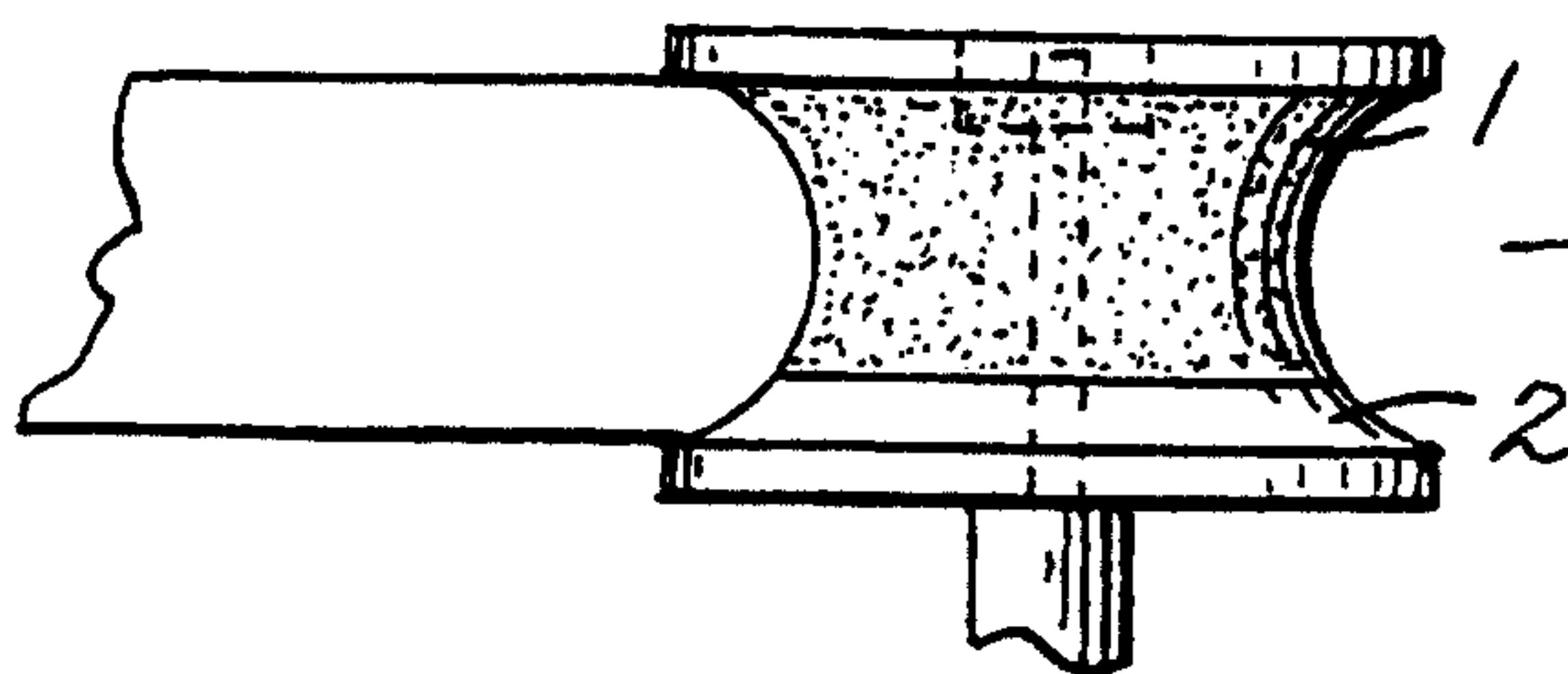


Fig. 4.

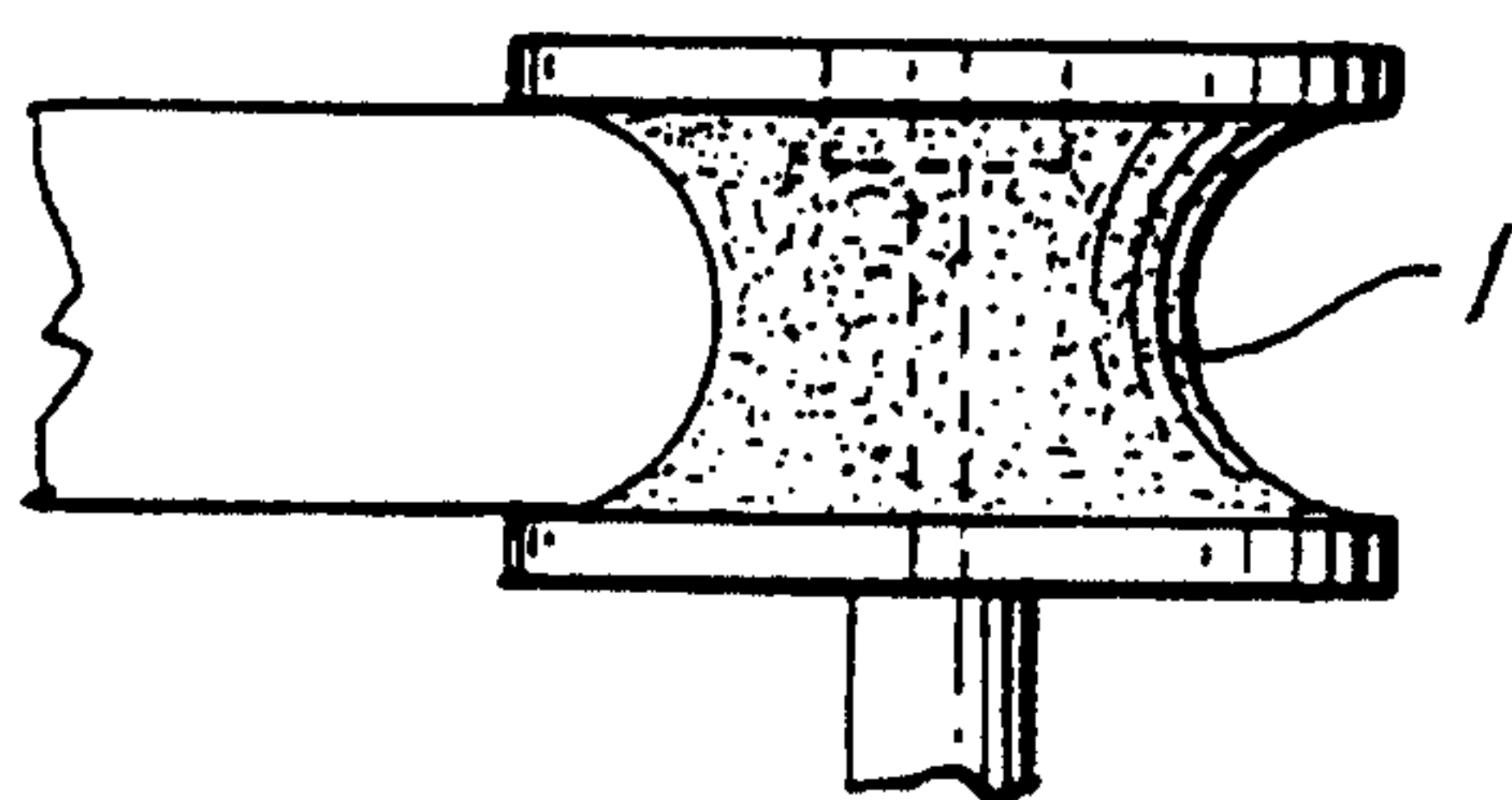
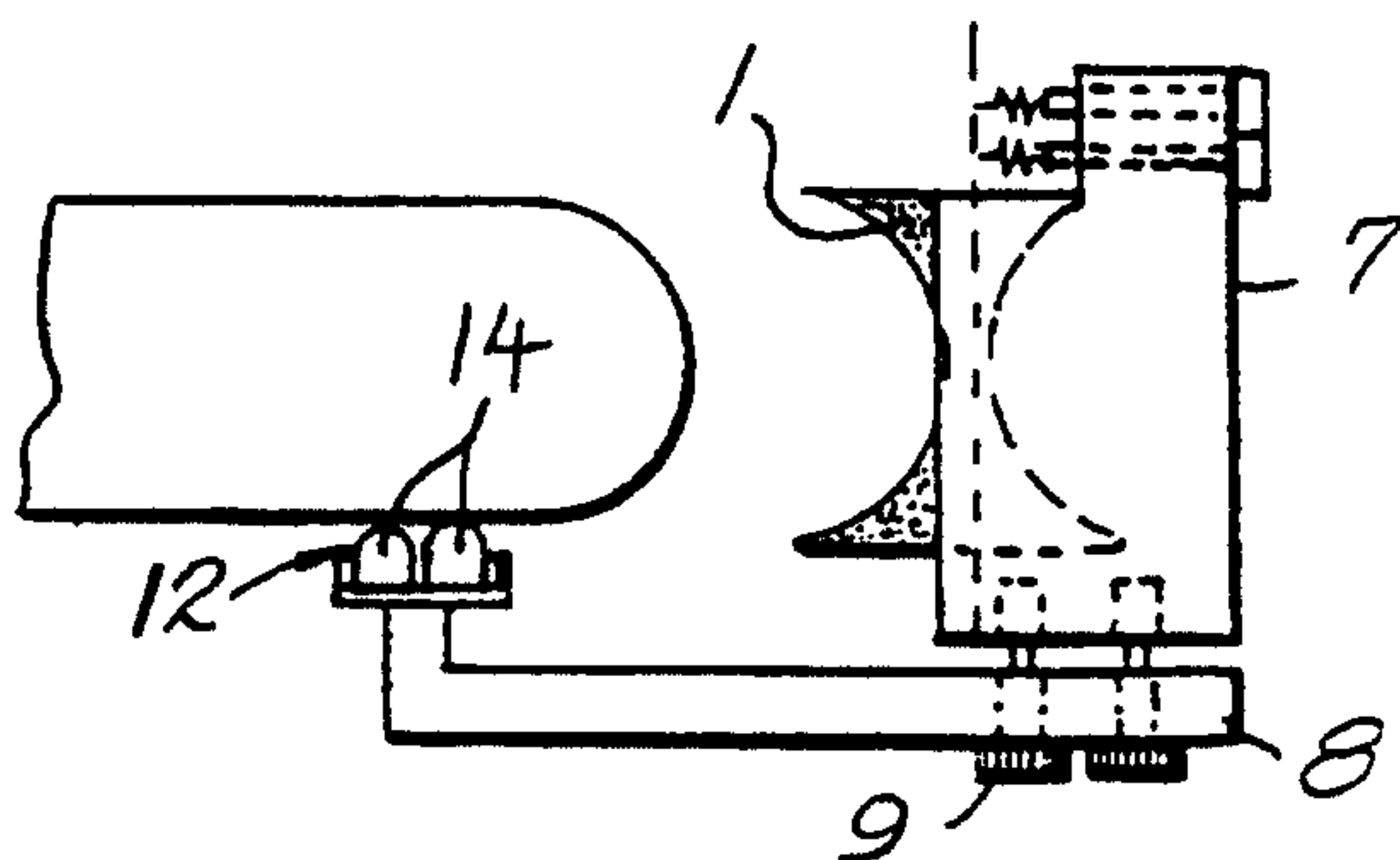
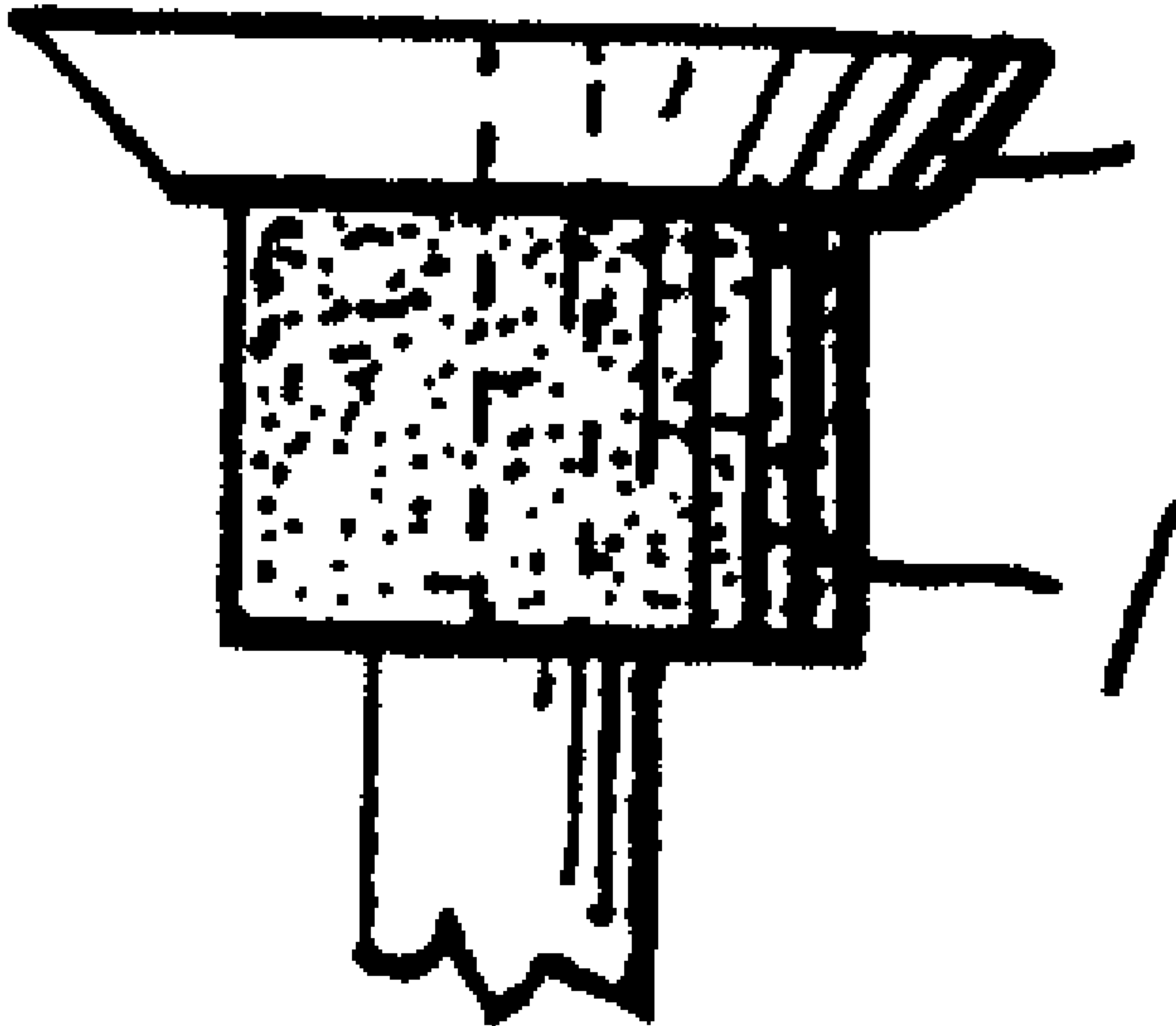


Fig. 6.

Fig. 5.





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