(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 058 530**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **82300696.0**

(22) Date of filing: **12.02.82**

(51) Int. Cl.³: **B 28 D 1/06**

(30) Priority: **13.02.81 GB 8104519**
24.06.81 GB 8119527
07.10.81 GB 8130211

(43) Date of publication of application:
25.08.82 Bulletin 82/34

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

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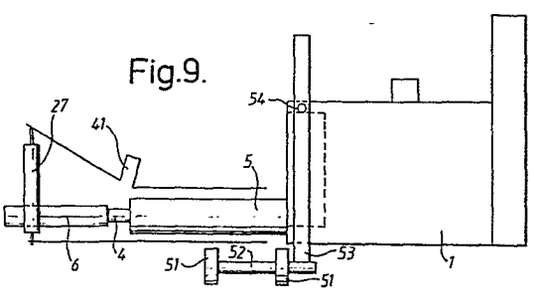
(54) Portable power saws and methods of inserting strip material into a wall.

(57) A portable power saw has a reciprocatory drive shaft 4 connected to a reciprocatory drive mechanism within a body 1. Guide rollers 27 mounted in front of and behind a blade 6 on the drive shaft 4 guide the saw along a workpiece. The rollers 27 are retractable such that the drive shaft 4, at the extremity of its stroke, may project beyond any other part of the saw. Rollers 51 which are preferably adjustable in position support the saw over the ground. A suction point 41 is provided for extracting debris.

The saw is particularly advantageous for use in cutting a groove in brick wells for the insertion of a strip material, such as a damp proof membrane.

Fig.9.



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PORTABLE POWER SAWS AND METHODS OF INSERTING STRIP MATERIAL INTO A WALL

This invention relates to portable power saws, and is concerned both with portable power saws incorporating an integral motor, and portable power saws having a connection point for an external motor drive. The invention is concerned particularly, although not exclusively, with portable power saws that are suitable for cutting a horizontal groove between courses of brickwork, for the installation of a waterproof membrane as a damp proof course.

There have been proposed a variety of different methods of installing a damp proof course in an existing building. Such methods have had varying degrees of success. However, perhaps the most effective damp proof course comprises that conventionally installed in new buildings, namely a waterproof membrane installed between courses of brickwork, during the erection of a building. Unfortunately, in the past, it has been found to be rather difficult to introduce such a membrane between courses of existing brickwork. This is largely due to the difficulty in successfully cutting out a horizontal groove between the courses of brickwork, into which groove the membrane may be introduced. It is known to use power saws to cut out such a groove, and these can be reasonably effective along straight walls. However, it has been found to be particularly troublesome to cut a groove in brickwork around corners, particularly inside corners.

Preferred embodiments of the present invention aim to provide portable power saws that are improved in this respect.

More generally, according to a first aspect of the present invention, there is provided a portable power saw

comprising a body (1), a reciprocatory drive mechanism (2) in the body, and an elongate reciprocable drive shaft (4) which is connected to said mechanism (2) and projects from said body (1) and is provided with means (23) for securing a saw blade thereto, characterised in that the drive shaft (4) may be so arranged that, at the extremity of its stroke, it projects beyond any other part of the saw, other than a saw blade secured to the drive shaft.

The provision of the elongate drive shaft can enhance considerably the manoeuvrability of the saw, such that it can be used readily to cut inside corners.

Preferably, the elongate drive shaft is mounted within an elongate shaft which is provided with bearing means for drive shaft. An Allen screw or the like may be provided on the shaft for securing a saw blade thereto.

The saw may be used with any suitable drive motor - e.g. an electric motor or a petrol motor. The motor may be integral with the saw, or separate thereform.

In an especially advantageous arrangement, the drive input point is an external connection point on said body, and said drive mechanism comprises a first shaft adapted to receive a rotary drive at said connection point, an eccentric mounted at one end of said first shaft, and said drive shaft drivingly connected to said eccentric such that rotary movement of said first shaft is converted to reciprocating movement of said drive shaft, in use. Both said first shaft and said drive shaft are preferably journalled in copper bushings.

In such an arrangement, the output shaft of a drive motor can be connected to said connection point directly. or via a rigid or flexible linkage. Where the drive motor

comprises an internal combustion engine, a belt drive, or other suitable drive that can provide slip, is advantageously provided between the output shaft of the motor and said drive shaft, to prevent possible damage to the motor, in the event of a saw blade jamming, in use.

Another preferred optional feature is the provision of guide means around or adjacent the drive shaft, to limit the depth of cut by abutting brickwork (for example) in use. The guide means is advantageously adjustable in position, to afford adjustment of the depth of cut, and is also preferably retractable, such that it does not cause an obstruction in corners, for example.

Another preferred feature is the provision of a suction pipe or the like adjacent the drive shaft or saw blade, in use, to suck debris clear of the work area. An especially advantageous arrangement combines the guide member mentioned above with the suction pipe, in the form of a shroud.

According to a second aspect of the present invention, there is provided a portable power saw comprising a body (1), a reciprocatory drive mechanism (2) in the body, a reciprocable drive shaft (4) which is connected to said mechanism and is provided with means (23) for securing a saw blade thereto, and guide means for guiding the saw along a workpiece, characterised in that said guide means comprises at least one roller (27) which is mounted in front of the saw blade in use.

According to a third aspect of the present invention, there is provided a portable power saw comprising a body (1), a reciprocatory drive mechanism (2) in the body, a reciprocable drive shaft (4) which is connected to said mechanism and is provided with means (23) for securing a saw blade thereto, and guide means for guiding the saw along a workpiece, characterised in that said guide means comprises a

retractable shroud (19) which is positioned around the saw blade in use and is provided with a suction point (41) for extracting debris from the shroud.

According to a fourth aspect of the present invention, there is provided a portable power saw comprising a body (1), a reciprocatory drive mechanism (2) in the body (1), and a reciprocatory drive shaft (4) which is connected to said mechanism (2) and is provided with means (23) for securing a saw blade thereto, characterised in that the saw is further provided with roller means (51) for supporting the saw on the ground and facilitating travel of the saw over the ground.

According to another aspect of the present invention, there is provided a method of inserting strip material into a wall, including the step of cutting a groove in the wall to accomodate the strip material, by means of a saw in accordance with any one of the foregoing aspects of the invention.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the diagrammatic drawings, in which:

Figure 1 is a side elevation of a portable power saw in accordance with the invention, with a saw blade fitted therein;

Figure 2 is an end elevation thereof;

Figure 3 is a longitudinal sectional view thereof;

Figure 4 is an end elevation of a variant thereof, with motor attached;

Figures 5 and 6 illustrate respective blade holders;

Figure 7 illustrates another saw in accordance with the invention, in side elevation;

Figure 8 is a detail view of part of the saw of Figure 7;

Figures 9 and 10 illustrate another saw in accordance with the invention, respectively in side elevation and plan view;

Figures 11 and 12 are respectively a longitudinal section and an end elevation of the saw of Figures 9 and 10;

Figures 13a to 13d illustrate respective saw blades for use in a saw in accordance with the invention;

Figure 14 illustrates a motor assembly for use with a saw in accordance with the invention;

Figure 15 illustrates a blade holder for use with the blades of Figures 13a to 13d;

Figure 16 illustrates a trestle support for use with a saw in accordance with the invention; and

Figure 17 illustrates a wedge for use in a method of installing a damp proof membrane in a brick wall.

In the figures, like reference numerals denote like or corresponding parts.

The portable power saw shown in Figures 1 to 3 comprises a main body 1 which houses a drive mechanism 2 between a drive input point 3 and an elongate reciprocable drive shaft 4. The drive shaft 4 is housed within an elongate shaft housing 5, and is provided at its outer end with a hole of square cross-section and means (such as an Allen screw, or the like - not shown) for securing a saw blade 6 therein. The blade 6 is a diamond tipped blade, suitable for cutting through stone, brick and/or mortar.

At one end of the housing 1, there is provided a handle 7, on which there is mounted an on-off switch 8 in the form of a spring-loaded button. The switch 8 is operable to switch the saw on and off, and is arranged in a fail-safe manner, such that the saw can be switched on only under positive pressure on the switch 8 by a user.

In Figure 4, there is shown an alternative arrangement for two handles 9, which are carried on members 10 which are bolted to the housing 1, between ribs 11 formed thereon. In Figure 4, there is shown an electric motor 12, having an output shaft 13 connected directly to the drive mechanism 2, at the drive input point 3.

As may be seen in Figure 2, the drive mechanism 2 comprises a first input shaft 14, which is arranged to be coupled to the output shaft of a drive motor, via the external connection point 3. The input shaft 14 is mounted for rotational movement about its longitudinal axis, in

a copper bush 15 and ball bearing 20. At the lower end of the shaft 14 (as seen in Figure 2), there is provided an eccentric 20, which in turn is coupled to the drive shaft 4, such that rotary movement of the input shaft 14 is converted to a reciprocating movement of the drive shaft 4. The drive shaft 4 is journalled in copper bushes 16 and 17. A removable inspection cover 18 is provided on the body 1, to afford access to the drive mechanism 2 and the drive shaft 4.

Referring again to Figure 1, there is advantageously provided around the shaft housing 5 a clear plastics shroud 19. The shroud 19 is generally cylindrical around the shaft housing 5, but projects upwardly (as seen in Figure 1) in the manner of a fishtail. The shroud 19 can be secured around the shaft casing 5 in any desired position, and may be fully retracted or removed therefrom, if desired.

The purpose of the shroud 19 is twofold. Firstly, it serves as a guide member to limit the depth of cut of the saw blade 6, by abutting against the brickwork, for example, in use. When it is desired to cut into a corner, for example, the shroud 19 can be retracted towards the housing 1, so that it does not affect manoeuvrability of the saw.

The second function of the shroud 19 is to remove dust and debris from the vicinity of the saw blade 6, in use. To this end, the shroud 19 has an open mouth towards the saw blade 9, and suction means for creating reduced pressure within the shroud 19, thereby to suck-in dust and debris, which is then carried away to a suitable container. The shroud 19 is conveniently made of clear plastics, such that it does not affect visibility of the work area. However, it could be of any other suitable material, such as metal. For example, it

could be formed of a main tubular metal body, having an upwardly projecting clear plastics portion as the fishtail.

Any suitable drive motor may be used to drive the input shaft 14 via the connection point 3. For example, an electric motor may be secured to the housing 1, as shown in Figure 4. As an alternative, a petrol-driven internal combustion engine may be used. In such a case, it is desirable to provide a belt drive (or other suitable linkage affording slip) between the internal combustion engine and the drive shaft 4 and/or saw blades 6, to prevent possible damage to the engine, in the event of the saw blade 6 jamming. Instead of mounting a drive motor directly onto the housing 1, a flexible drive linkage, for example, may be provided between the external connection point 3 and the motor.

It may be appreciated that the illustrated saws may be particularly useful in cutting a groove in a wall, preparatory to inserting strip material such as a waterproof membrane therein, to afford or replace a damp proof course. Due to the design of the saws, and in particular to the provision of the elongate projecting drive shaft 4, it is possible to manoeuvre the saw to cut a groove even in internal corners. In this respect, the illustrated saws afford a most important advantage over previously proposed devices, as they make possible for the first time the ready insertion of a waterproof membrane in an existing wall.

As an alternative to the belt drive option mentioned above, a clutch mechanism may be provided between a drive motor (e.g. an internal combustion engine) and the drive shaft 4, to limit torque transfer therebetween.

As an alternative to forming the drive shaft 4 directly with a square hole, or alternative means, for

receiving the blade 6, a blade holder may be secured as a separate unit to the end of the drive shaft 4. Such an arrangement is illustrated in Figure 5, where the respective end of the drive shaft 4 is provided with a threaded portion 21, which engages in a corresponding threaded portion 22 of a blade holder 23. The blade holder 23 defines a hole 24 of square cross-section to receive the blade 6. An Allen screw 25 screw-threadedly engages in a respective aperture through the blade holder 23, and serves to secure a blade 6 in position, in the aperture 24.

Figure 6 illustrates an optional modification, which is particularly useful for cutting a groove below ground level. In Figure 6, there is provided a blade holder 23 corresponding to that shown in Figure 5. However, instead of being secured directly to the drive shaft 4, the blade holder 23 screw-threadedly engages a free end of a generally Z-shaped link member 26. The other end of the link member 26, engages a respective square aperture, either directly in the end of the drive shaft 4, or in another blade holder such as 23 secured thereto.

It may readily be appreciated that, in use of the arrangement illustrated in Figure 6, a groove may be cut below ground level, without the need for a large amount of excavation. All that is required is to carry out minor excavation, sufficient to permit the passage of the link member 26.

Figures 7 and 8 show a modification of the portable power saw 1, in which improved means are provided for guiding the saw with respect to a brick wall, in use. To this end, a pair of rollers is mounted at the free end of the shroud 19, one roller 27 at each side of the shroud 19. The rollers are mounted on adjustable mounting plates 29, which are secured to the shroud 19 by means of screws 28, and are so arranged as to provide adjustment of the positions of the rollers 27 upwardly and downwardly. Positioned below the rollers 27 is a mounting 30 for a spring-loaded bearing 31 which is adapted to engage the ground, thereby to support the weight of the portable saw, in use. As an alternative to the spring-loaded bearing 31, there may be provided a further roller 32, which is secured to the mounting 30, and is adapted to bear the weight of the power saw, in use. Further shown in Figure 7 is an adjustable handle 33 which passes around the full circumference of the shroud 19, and a vacuum connection point 41, for the removal of debris in use of the saw.

In another variation shown in Figures 9 and 10, guide rollers, 27 (which may be of steel or rubber), are again provided for guiding the saw along brickwork, for example, in use. However, in this variant, means for supporting the power saw on the ground comprises a pair of rubber rollers 51 (alternatively, bearings may be used) mounted on an axle 52 which is provided at the bottom of a shaft 53. The shaft 53 is secured to a respective side of the housing 1 by any suitable means, such that the vertical position of the shaft 53 with respect to the housing 1 may be adjusted. Thus, with the rubber rollers 51 engaging the ground, the height of the power saw in use may be correspondingly adjusted. In this example, an adjusting screw 54 is provided for securing the shaft 53 in any desired position. A shaft 53 with a respective pair of rollers 51 is provided at each of two opposite sides of the housing 1.

As may be seen in Figure 10, there is provided a bearing 55 for guiding the saw blade 6, in use. The bearing 55 is mounted on a member 56 which in turn is mounted on a steel shaft 58. A spring 57 mounted on the shaft 58 serves to urge the member 56 and the guide bearing 55 outwardly, but the bearing 55 is retractable against the spring bias. Thus, in use, the guide bearing 55 bears against the rear side of the blade 6, to urge the blade 6 in a forward cutting direction, thus substantially preventing any tendency for the blade 6 to wander. Figure 10 also shows a handle 59 secured to one side of the shroud 19. The handle 59 may either have a shape as shown, or may be of mushroom shape, or the like.

Figures 11 and 12 show some modifications to the arrangement as illustrated in Figure 3. In Figure 11, the input shaft 14 is provided with splines, or the like, to afford a sliding connection fit with a drive shaft connected thereto. The input shaft 14 is journalled in bushes 60, and a large bearing 61. The drive shaft 4 is journalled in linear bearings 62 and 63, and a felt washer 64 is provided at the drive end of the drive shaft 4 to prevent ingress of dirt, etc., within the housing 1.

As may be seen in Figure 12, the switch 8' is secured to the underside of the handle 7 and acts as a "deadmans switch", which must be depressed to cause operation of the saw.

It is to be appreciated that, in the illustrated saws, both the shroud 19 and the rollers 27 are so mounted as to be retractable. They are retractable to the extent that the end of the drive shaft 4, at the extremity of its stroke, may project beyond any other part of the saw (other, of course, than the saw blade 6 secured to the drive shaft 4).

This may not be readily apparent from certain of the figures, which are essentially of a diagrammatic nature. This is important in affording manoeuvrability of the saw around an inside corner.

As a variant of the arrangement illustrated in Figures 9 and 10, each roller 27 may be mounted on its own side plate, which in turn is adjustably mounted (e.g. on the elongate shaft housing 5) so that it may be retracted or extended to a desired position, and then secured in place (e.g. by a hand operated clamping arrangement). There may be provided a detachable base plate which, for example, may simply clip onto the underside of the side plates upon which the rollers 27 are mounted, to form a shroud in which debris may collect. It may not be essential to provide a top to the shroud, and in one arrangement, there may be provided a suction nozzle which is disposed adjacent the cutting blade 6. The suction nozzle may also be adjustable in position, in a similar manner to the side plates upon which the guide rollers 27 are mounted.

With reference to Figure 9, a preferred arrangement may be such that the rollers 51 may be retracted on the shaft 53 to such a position that the cutting blade 6 is substantially at ground level. (The drive shaft 4 and blades 6 would have to be somewhat lower in position than illustrated in Figure 9).

Particularly when cutting along a mortar joint between courses of brickwork, it is important that the saw blade 6 travels in a substantially uniform horizontal path. To this end, therefore, the saw illustrated in Figures 9 and 10 may with advantage be provided with a spirit level, or the like, for indicating the level of the saw. For example, there may be provided one level extending transversely of the

axis of the drive shaft 4, and another level extending substantially parallel thereto. Alternatively, a single "dome" level may be provided, for indicating any deviation from the horizontal plane.

If desired, the shafts 53 may be provided with means for accommodating irregularities in the ground. For example, they may be provided with a telescopic arrangement including springs and/or fluid dampers, to compensate for and/or smooth out the effects of irregularities in the ground surface.

Figures 13a to 13d show respective alternative blades for use with the illustrated saws. The blade shown in Figure 13a has a rounded tip 66, and is formed with serrated cutting edges 65 along both sides, so that it may cut in either direction. The blades shown in Figures 13b and 13c each have a single serrated cutting edge 65, and a pointed tip 66. The rake of the tip 66 in Figure 13c is greater than that shown in Figure 13b. In Figure 13d, the cutting blade has a convex serrated cutting edge 65, and a straight tip 66.

All of the blades shown in Figures 13a to 13d may be of steel, coated with tungsten carbide or diamond granules. In an especially advantageous method of manufacture, tungsten carbide granules are plasma welded on to a steel blade surface.

Each of the blades shown in Figures 13a to 13d is formed at its inner end with a locating aperture 70, and with screw-thread serrations 70, at each side of the blade. The blades are adapted to be secured in position by means of a blade holder as illustrated in Figure 14, where the end of the drive shaft 4 is shaped to form a portion 81 of semi-circular cross-section, having an

upstanding projection 80. A clamping member 68 is formed with a shape complementary to that of the portion 81, over which it is designed to fit, and is also of semi-circular cross-section. Both the portion 81 and the clamping member 68 are provided with matching external screw-threads. A securing ring 69 is freely mounted on the drive shaft 4, and is provided with internal screw-threads.

In use, both the securing ring 69 and the clamping member 68 are moved away from the portion 81, and one of the blades shown in Figures 13a to 13d is placed thereon, with the projection 80 registering with the location aperture 70. The clamping member 68 is then placed on top of the blade, such that the external screw portions on all of the clamping member 68, the portion 81, and the blade therebetween, are in register. The securing ring 69 is then engaged with the external screw-threads, and tightened-up until the blade is held firmly in position between the clamping member 68 and the portion 81.

In practice, it may be possible to dispense with the projection 80 and location aperture 70, the screw-threaded portions 71 on the blade being brought automatically into register with those on the clamping member 68 and the portion 81, upon tightening of the securing ring 69. If desired, the securing ring 69 may be provided with an Allen screw or the like, to positively locate it in a clamping position on the drive shaft 4.

The design and manufacture of the cutting blades may be in themselves novel.

Figure 15 illustrates diagrammatically a trolley on which there may be mounted the prime power units for the power saw. The illustrated trolley has a handle 35 provided with plastic grips 34 and a base 43 which is supported on rubber tyred wheels 36. A foot having a rubber tip is provided for supporting the trolley in a stationary position. An electric cable holder 39 is provided at the side of the trolley. An electrically driven vacuum unit 42, is mounted on a round steel plate 40, which in turn is secured to the base 43 of the trolley. An electrically driven motor 44 is secured to the trolley base 43, by means of a swivel stand 45. In use drive is transferred between the electric motor 44 and the portable power saw by means of a flexible drive shaft.

An an alternative to an electric motor, the portable power saw may be driven by compressed air motor or any other suitable alternative means. Preferably, means is provided for varying the speed of the motor 44, or for alternatively varying the speed of the respective saw blade.

Figure 16 illustrates a portable platform 74, mounted on supports 72. The platform 74 is made of wood, aluminium or any other suitable material. Each support 72 comprises a main body 75 which is telescopically adjustable in height, and may, for example, be formed with a series of holes 75 for the insertion of pins to secure the support 72 at a desired height. Telescopic legs 73 extend from each support 72. Means is preferably provided for positively locating the platform 74 upon the supports 72.

The platform 74 is particularly advantageous to assist easy operation of the illustrated power saws when working at heights above ground level and/or where the ground

is uneven. The telescopic nature of the supports 72 and their legs 73 enables the platform 74 to be disposed in a substantially horizontal position, even on sloping ground, for example. The power saw illustrated in Figure 9 may then readily be run along the platform 74, supported on its rollers 51.

Figure 17 illustrates a wedge 77 of chisel-shape, which may be of plastics, aluminium or any other suitable material. In a preferred use of the illustrated saws, an horizontal groove is cut in the mortar joint between two adjacent courses of brickwork, for the insertion of a waterproof membrane, to form a damp proof course. Wedges 77 are placed in the groove at regular intervals, as it is being formed. The wedges then afford a temporary support for the brickwork, and may be readily removed as the waterproof membrane is subsequently inserted into the groove.

By way of example, the wedges 77 may be sufficiently long to extend across a full width of a brick (e.g. two inches), and may be of approximately 2mm thickness. They may be positioned at a frequency of two wedges 77 per 9 inch brick. The provision and use of wedges such as 77 may be particularly important in methods in accordance with the invention, in that they may prevent damage to a wall (e.g. by cracking), and may permit the insertion of a waterproof membrane in a particularly simple manner.

Although the illustrated saws are primarily intended for the sawing of masonry, it is to be appreciated that, with appropriate choice of blade, they may be used for cutting other materials, such as metal, wood and plastics, for example.

CLAIMS:

1. A portable power saw comprising a body (1), a reciprocatory drive mechanism (2) in the body, and an elongate reciprocable body shaft (4) which is connected to said mechansim (2) and projects from said body (1) and is provided with means (23) for securing a saw blade thereto, characterised in that the drive shaft (4) may be so arranged that, at the extremity of its stroke, it projects beyond any other part of the saw, other than a saw blade secured to the drive shaft.

2. A portable power saw according to Claim 1, wherein the drive shaft (4) is mounted within an elongate housing (5) which is provided with bearing means for the drive shaft.

3. A portable power saw according to Claim 1 or 2, including guide means for guiding the saw along a workpiece and/or over the ground.

4. A portable power saw according to Claim 3, wherein said guide means comprises at least one roller mounted in front of the blade in such a manner that it may be retracted behind the end of the drive shaft at the extremity of its stroke.

5. A portable power saw according to Claim 3 or 4, wherein said guide means comprises at least one roller adjustably mounted on the body to support the same on the ground, the roller preferably being retractable to a position in which the body may be supported on the ground with a blade secured to the drive shaft positioned substantially at ground level.

6. A portable power saw according to any preceding claim, including a suction point which is provided adjacent a blade in use, the suction point optionally forming part of a roller assembly for guiding the saw along a workpiece.

7. A portable power saw according to any preceding claim, including indicator means for indicating the orientation of the saw in use.

8. A portable power saw according to any preceding claim being adapted to cut through masonry.

9. A portable power saw according to Claim 8, including a saw blade having a form as depicted with reference to any one of Figures 13a to 13d.

10. A portable power saw according to any preceding claim, provided with a drive input point for connecting an external drive to said mechanism.

11. A portable power saw according to Claim 10, including a motor mounted on a wheeled support and provided with a flexible drive connector to said drive input point.

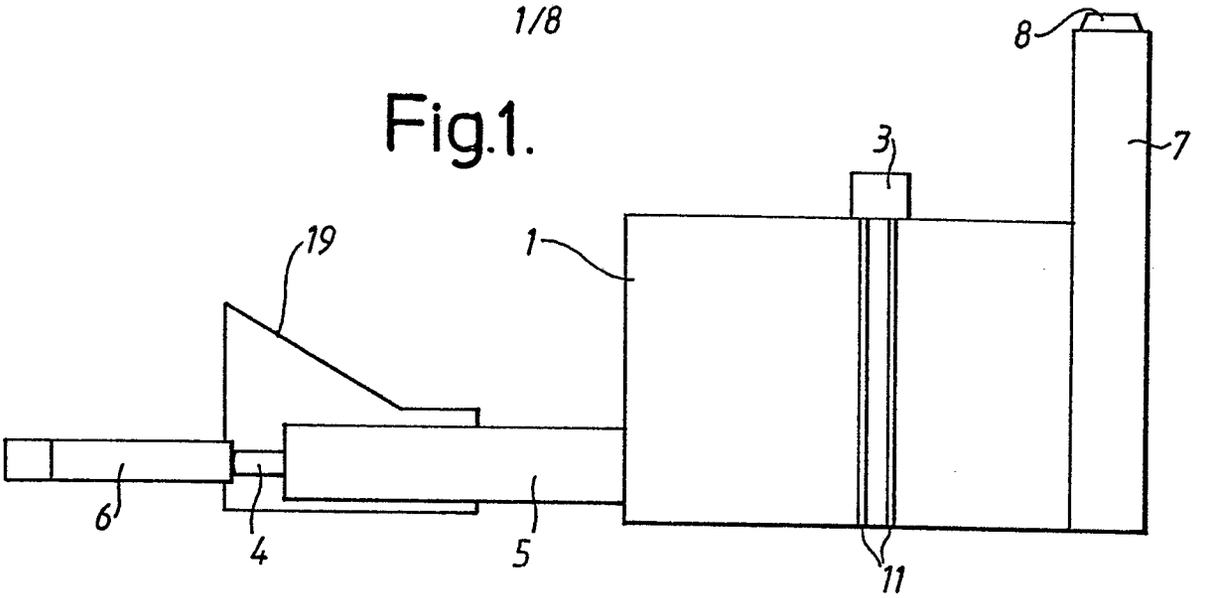
12. A portable power saw comprising a body (1), a reciprocatory drive mechansim (2) in the body, a reciporcable drive shaft (4) which is connected to said mechanism and is provided with means (23) for securing a saw blade thereto, and guide means for guiding the saw along a workpiece, characterised in that said guide means comprises at least one roller (27) which is mounted in front of the saw blade in use.

13. A portable power saw comprising a body (1), a reciprocatory drive mechanism (2) in the body, a reciprocable drive shaft (4) which is connected to said mechanism and is provided with means (23) for securing a saw blade thereto, and guide means for guiding the saw along a workpiece, characterised in that said guide means comprises a retractable shroud (19) which is positioned around the saw blade in use and is provided with a suction point (4) for extracting debris from the shroud.

14. A portable power saw comprising a body (1), a reciprocatory drive mechanism (2) in the body (1), and a reciprocable drive shaft (4) which is connected to said mechanism (2) and is provided with means (23) for securing a saw blade thereto, characterised in that the saw is further provided with roller means (51) for supporting the saw on the ground and facilitating travel of the saw over the ground.

15. A method of inserting strip material into a wall, including the step of cutting a groove in the wall to accommodate the strip material, characterised in that the groove is cut by means of a saw according to any one of the preceding claims.

Fig.1.



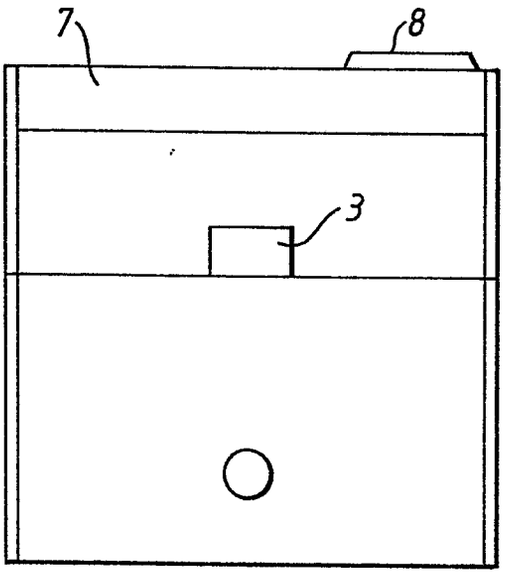


Fig.2.

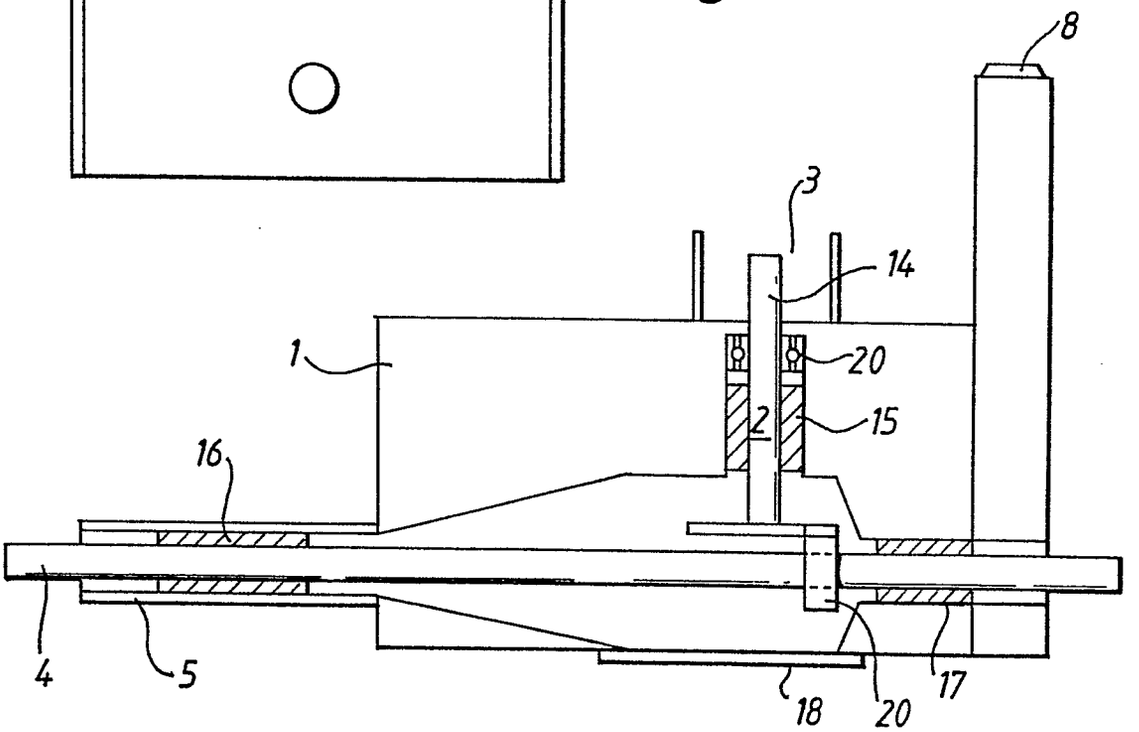


Fig.3.

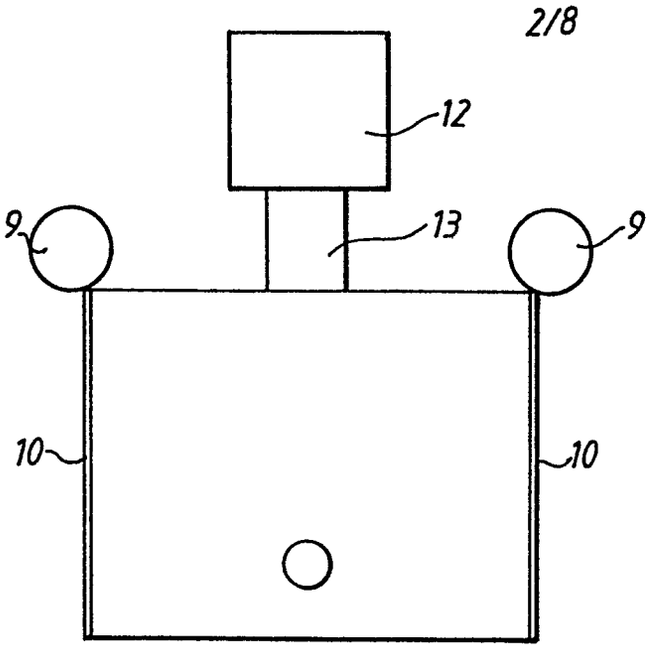


Fig.4.

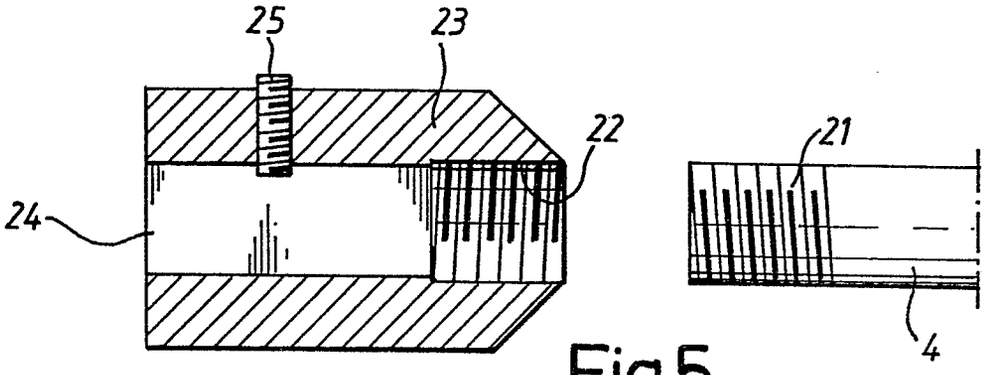


Fig.5.

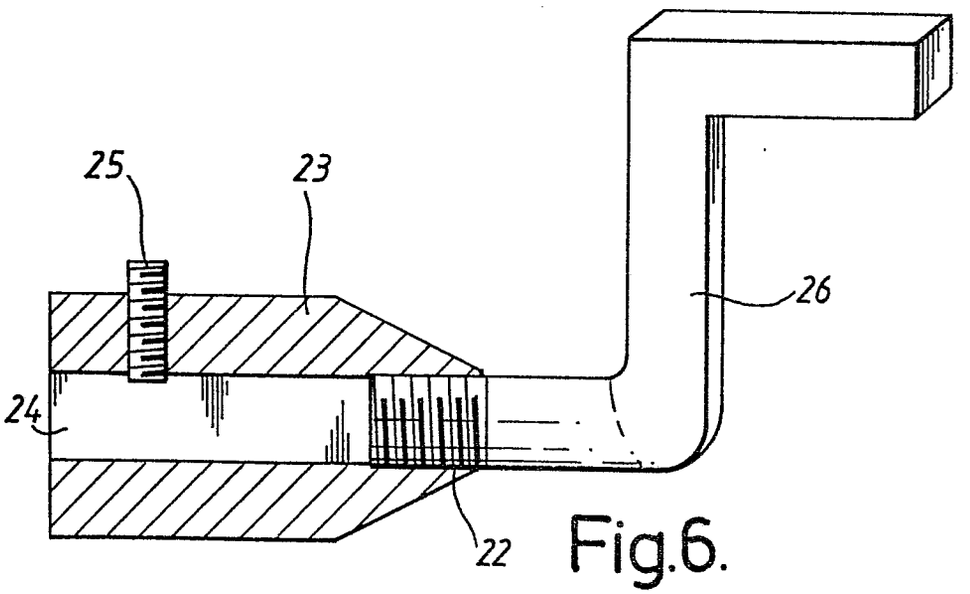


Fig.6.

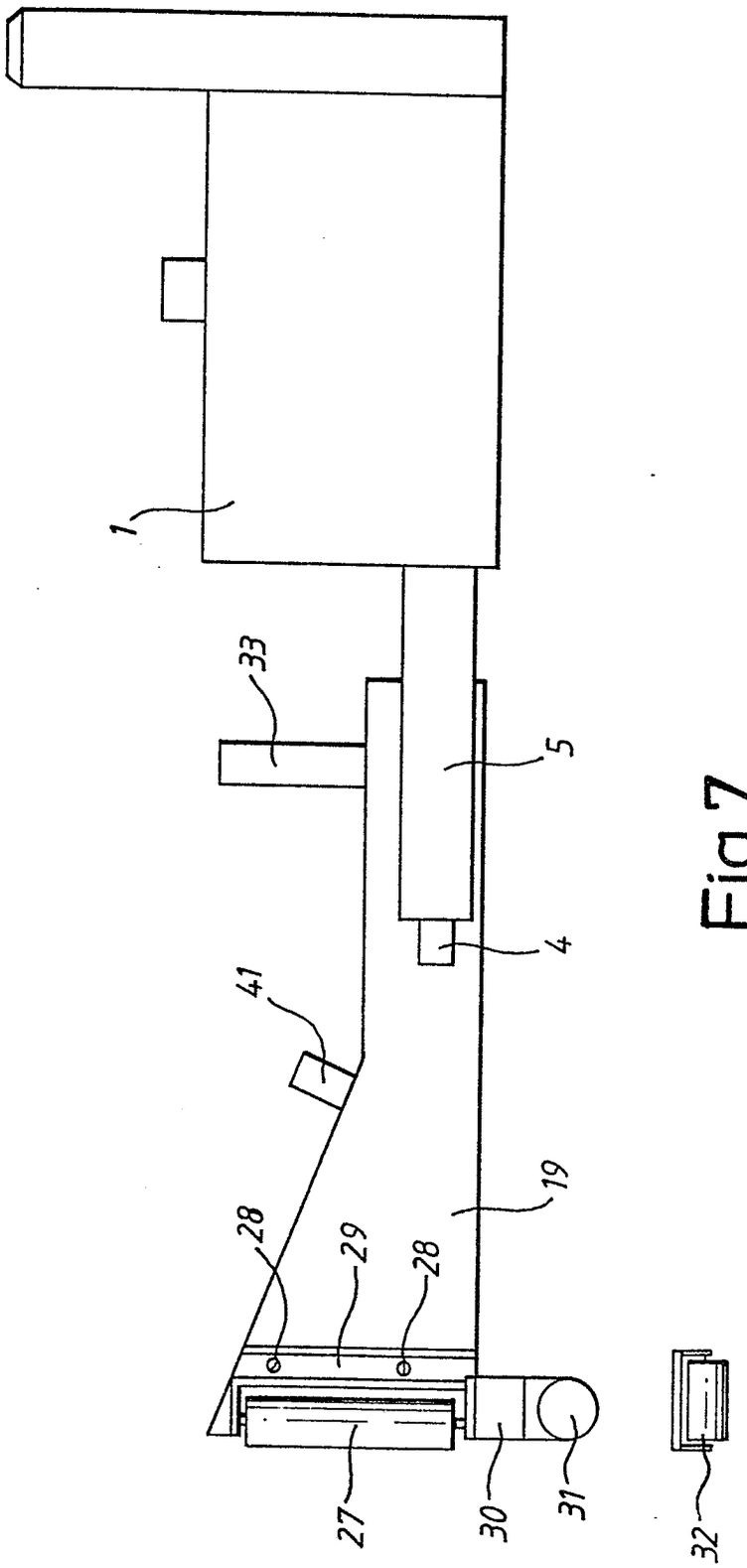


Fig.7.

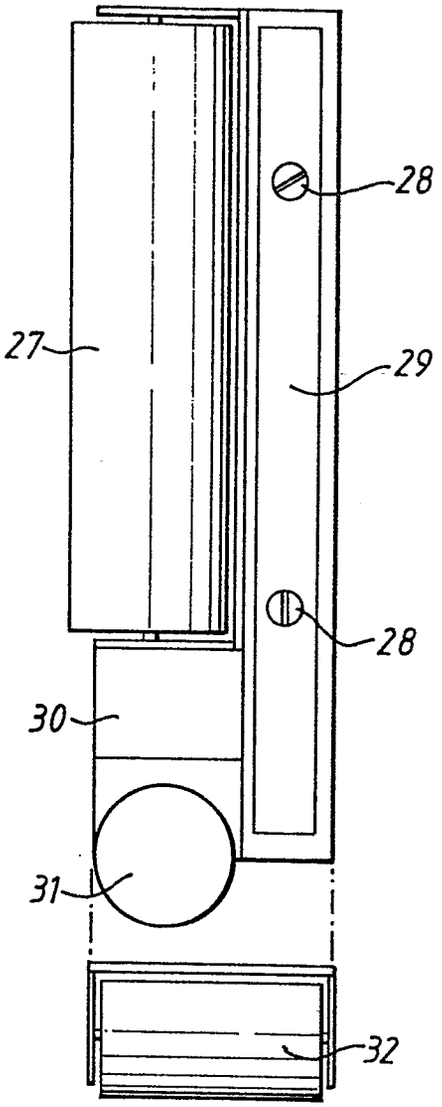


Fig.8.

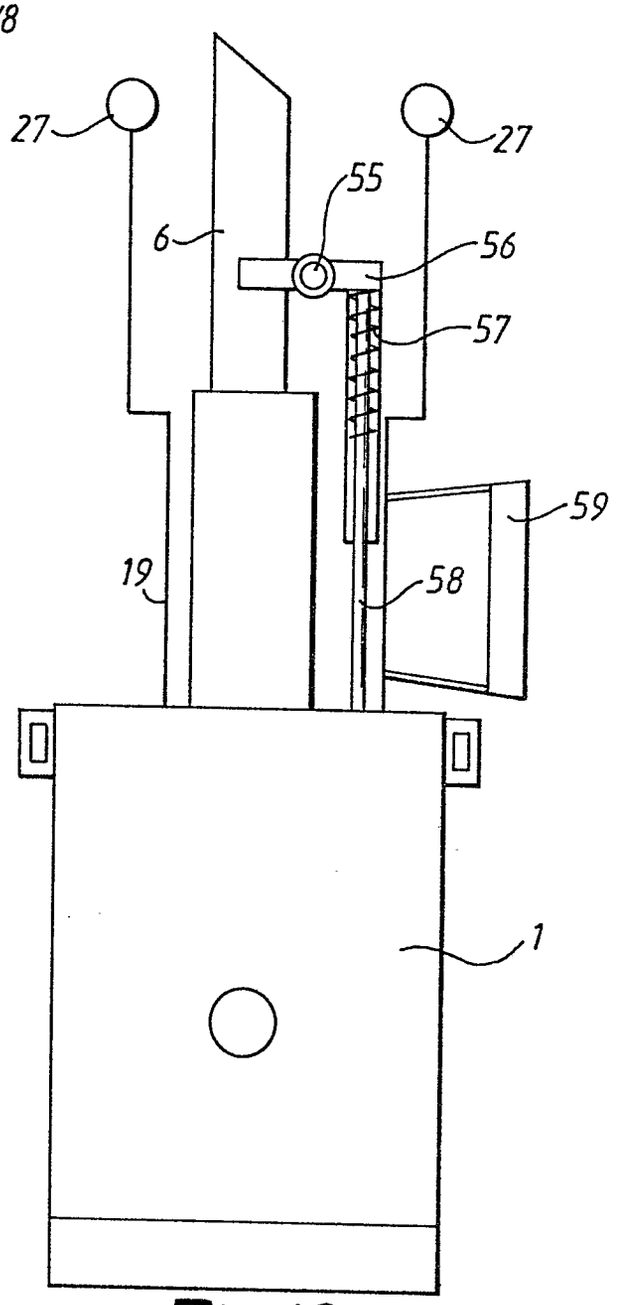
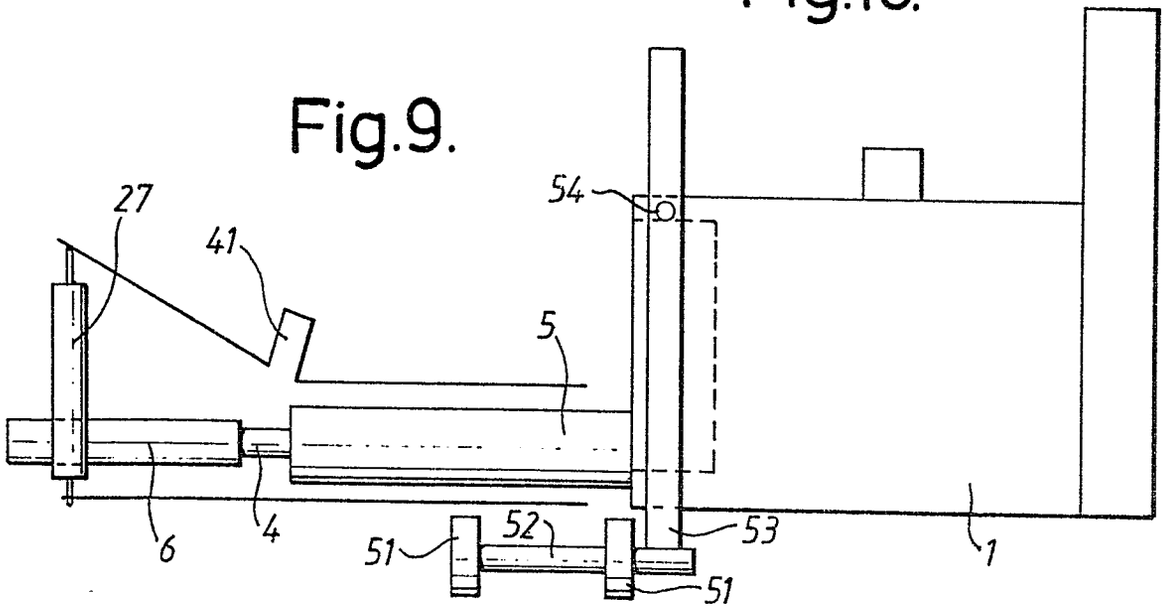
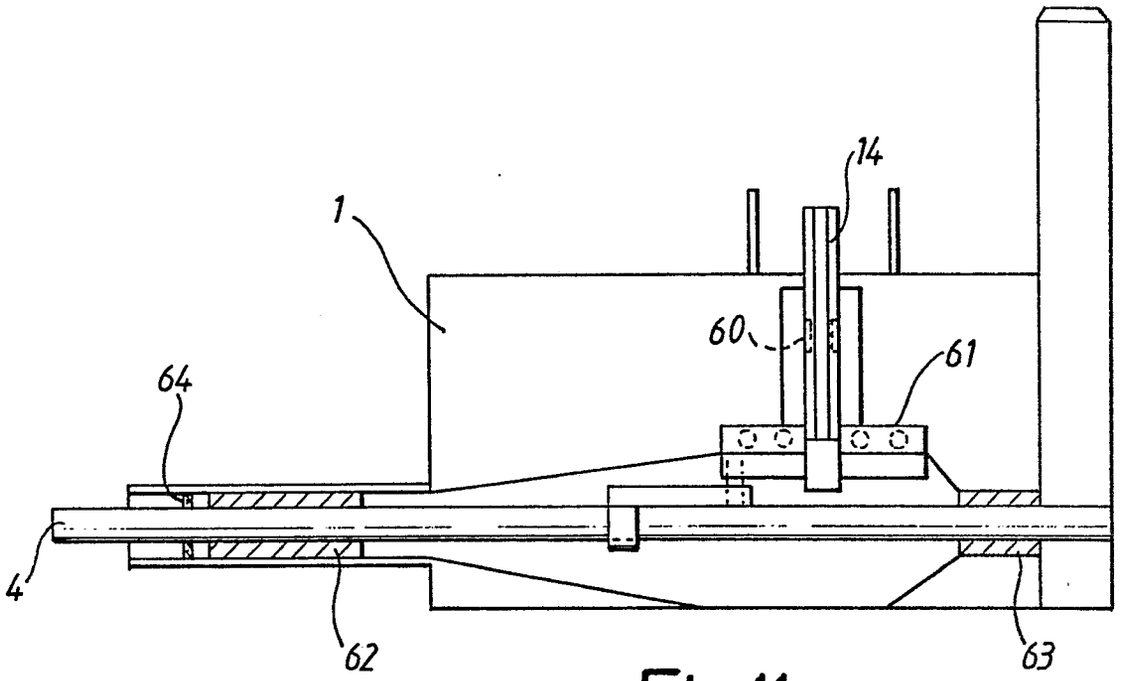


Fig.10.

Fig.9.





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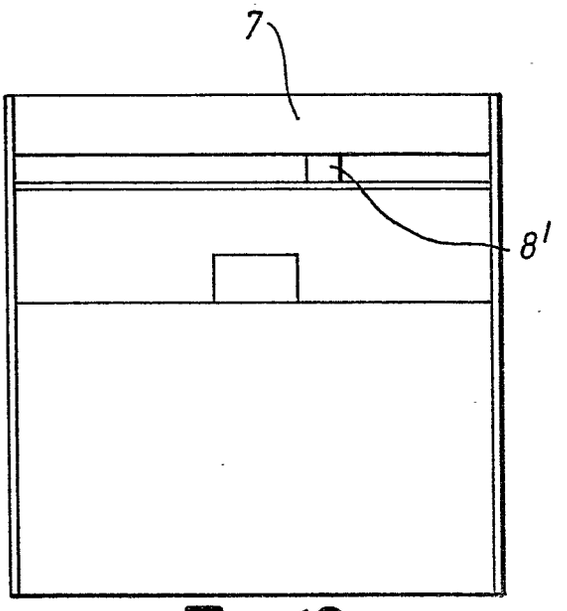

Fig.12.

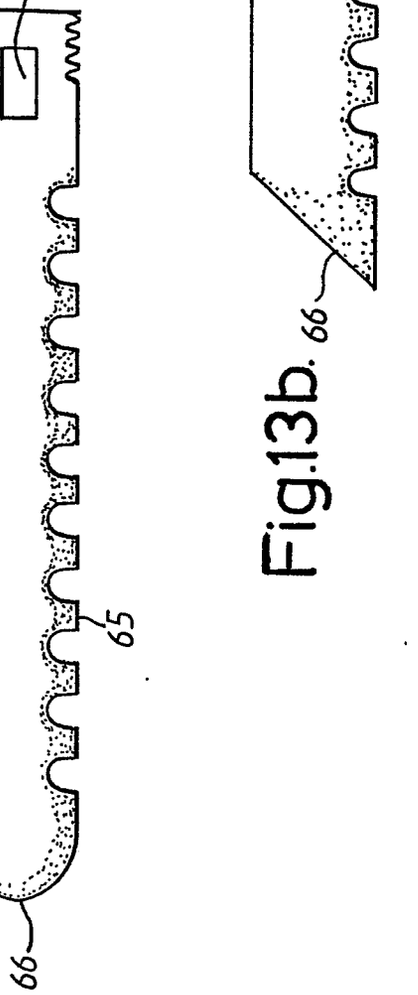

Fig.13a.

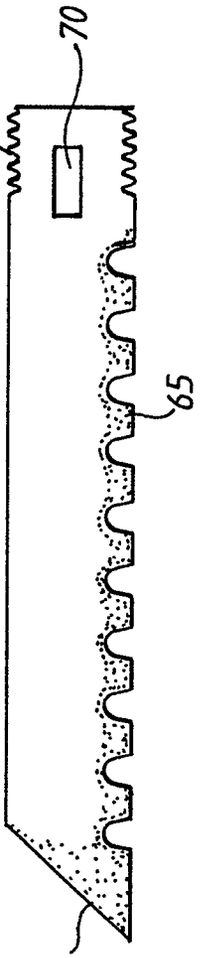

Fig.13b.

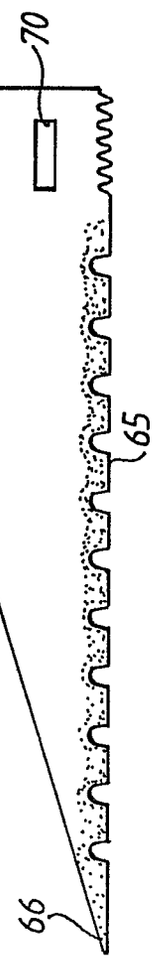

Fig.13c.

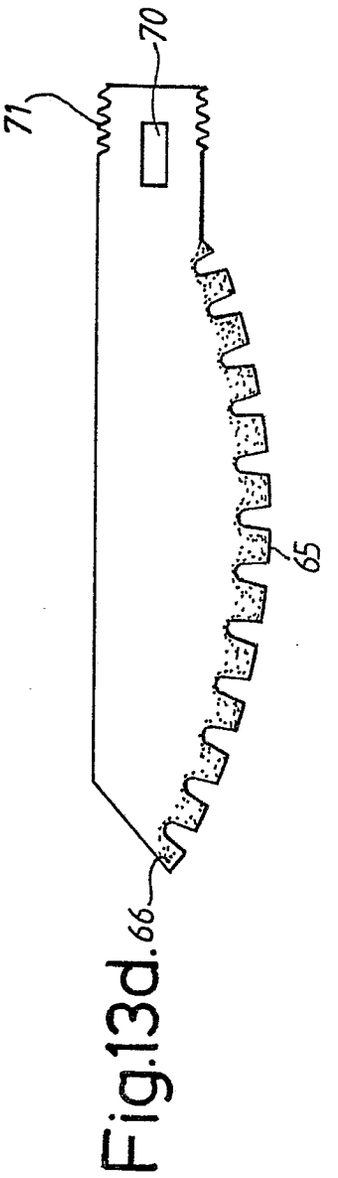

Fig.13d.

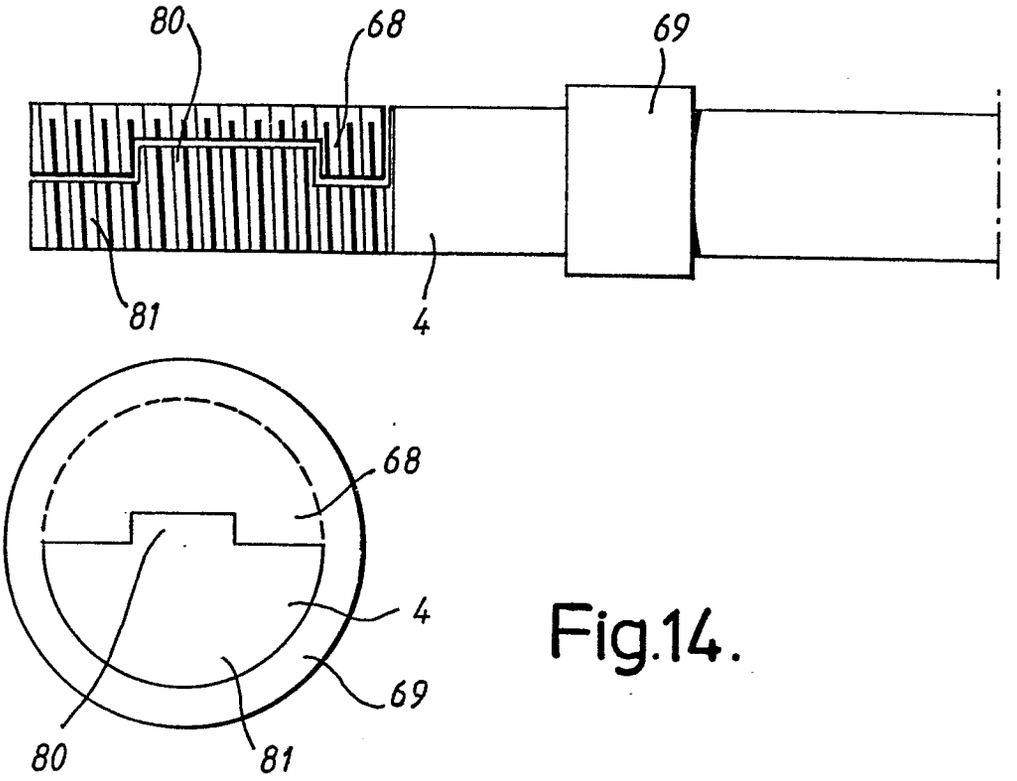
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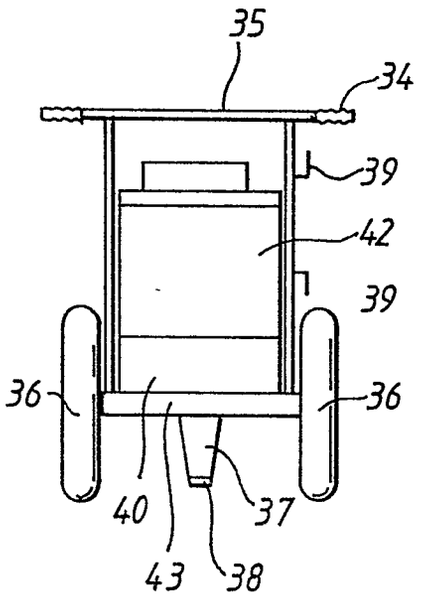
Fig.14.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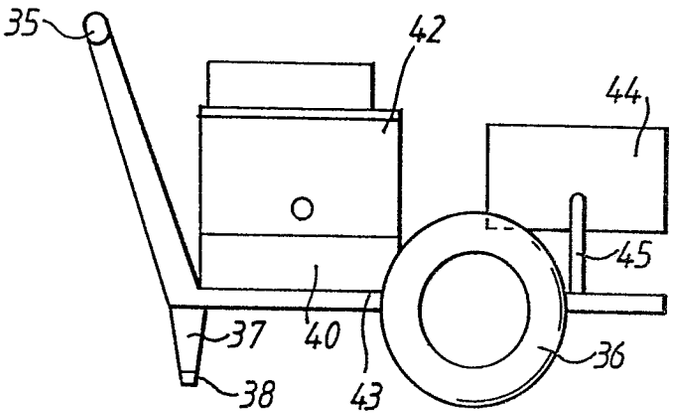
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Fig.15.

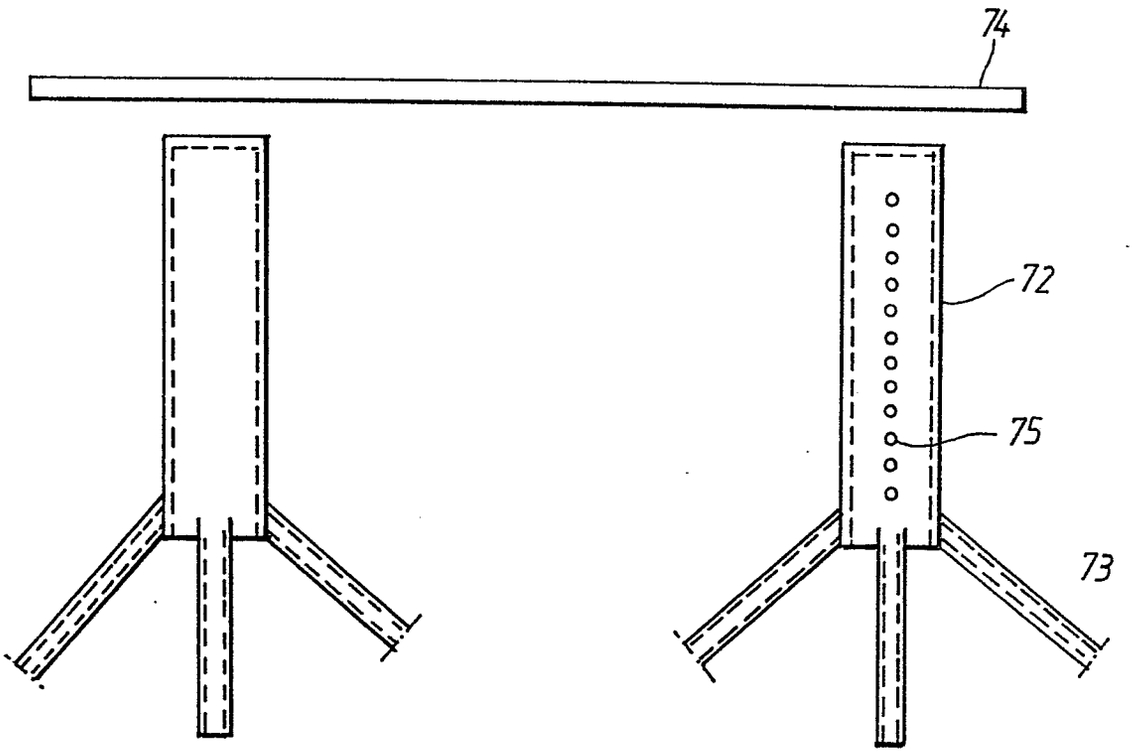

Fig.16.

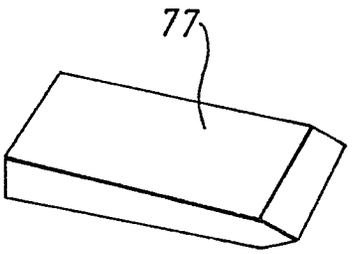

Fig.17.