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

(11) Publication number: **0 131 356**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **84303236.8**

(22) Date of filing: **11.05.84**

(51) Int. Cl.⁴: **E 01 B 31/12**
E 01 B 31/15

(30) Priority: **12.05.83 GB 8313101**

(43) Date of publication of application:
16.01.85 Bulletin 85/3

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

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(54) **Apparatus for removing material from a workpiece.**

(57) An endless band (1) of devices (2A and 2B, or 2E) which remove material from a workpiece is advanced lengthwise continuously in the same direction. These devices may be articulated (pins 3) and may have teeth (7) like file teeth. A working portion (1A) of the band is urged in one direction (downwardly, Figure 1) normal to the band by urging means (14A). There are preferably guide means (13) extending along the working portion of the band for preventing it from moving too far in the above-mentioned direction. The apparatus may include a chassis (28) having two projections (30, 31) for contacting the workpiece at locations at opposite ends of a path to be traversed by the material-removing devices. These devices remove material from the workpiece until its surface follows a desired path from immediately adjacent one of these locations to immediately adjacent the other one.

The apparatus may be used to smooth a welded joint between two lengths of railway rail.

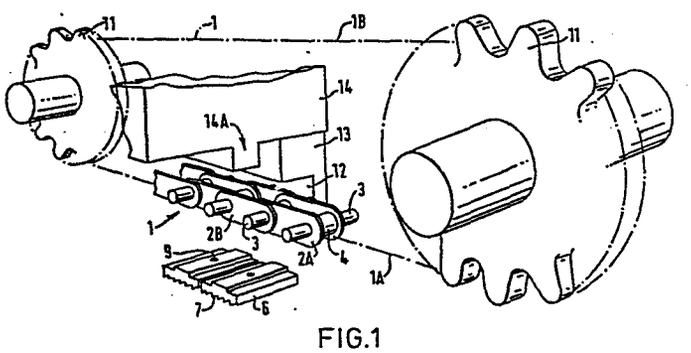


FIG.1

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Apparatus for removing material from a workpiece

According to the invention, there is provided apparatus for removing material from a workpiece, comprising an endless band incorporating material-removing means, advancing means for advancing the band lengthwise continuously in the same direction, and urging means extending along a working portion of the band for urging the material-removing means in one direction normal to said working portion of the band, in order to cause the material-removing means to remove material from a workpiece.

Preferably, the endless band, the advancing means and the urging means are supported on a chassis from which extend two spaced-apart projections which are intended to contact the workpiece at two locations at opposite ends of a path to be traversed by the material-removing means, the apparatus being such that material can be removed thereby from the workpiece until the surface of the workpiece follows a desired, for example straight, path from immediately adjacent one of said locations to immediately adjacent the other.

Preferably the apparatus further comprises guide means extending along said working portion of the band for preventing the material-removing means in said working portion from moving too far in said direction when they do not contact a workpiece.

The material-removing means may be abrasive material but in the examples described below it is elongate teeth, which may be similar in cross-section to teeth of a file, parallel to one another but not necessarily straight, with their length direction perpendicular to or inclined by less than 90° to the length direction of the band.

The apparatus may be used for removing surplus material from a wide range of workpieces, for example from a welded joint between plates on the side of a ship, and the material may be removed along straight or curved

lines. However, the examples described below are of a portable machine which can be carried along a railway track by two men and used to remove surplus material over a length of about 1 metre of rail including a welded joint between two lengths of rail, in order to ensure a smoother passage of train wheels over the joint. The guide means, if present in the apparatus, prevent the material-removing means from undesirably removing material from the rail when the working portion of the band is above the rail and gravity tends to cause it to sag and it is being driven by the advancing means. The sagging is countered by the guide means.

Examples in accordance with the invention are described below with reference to the accompanying drawings, in which:-

Figure 1 shows a diagrammatic perspective view of part of a machine for smoothing welded joints between lengths of railway rail,

Figure 2 shows a side view, partly in section, of one of many chain elements in the machine shown in Figure 1, with a cutting member attached to it,

Figure 3 shows a sectional view, taken along the line A-A in Figure 2, and shows the chain element and the cutting member together with urging means and guide means,

Figure 4 shows a perspective view illustrating an assembly of the chain elements and cutting members in the machine shown in Figure 1,

Figure 5 shows a perspective view of a modified form of chain,

Figure 6 shows the chain of Figure 5 together with urging means and guide means,

Figure 7 shows a perspective view of a cutting member which can replace the cutting members shown in Figures 1 to 6,

Figure 8 diagrammatically shows means for tensioning a chain, and

Figure 9 diagrammatically shows a chassis of the machine according to Figure 1.

Referring firstly to Figures 1 to 4, the machine illustrated includes an endless band 1 in the form of a chain of devices 2A and 2B which alternate with one another along the chain and are articulated chain elements. Each chain element comprises two planar and parallel side parts 2C held together by a bridging piece 2D which is integral with the two side parts, the distance between the side parts 2C being less in the case of the chain elements 2A than it is in the case of the chain elements 2B. Each chain element 2A has its opposite extremities extending into the extremities of two adjoining chain elements 2B and pivotally connected thereto by pins 3 each of which extends through the two side parts 2C of two chain elements and extends at both ends beyond the chain elements. On each pin is mounted a roller 4 which can turn freely with respect to the pin.

Each bridging piece is formed with a hole 8 through which freely passes the shank of a screw 10 which is screwed into a hole 9 in a cutting member 6 which is formed with parallel teeth 7. The teeth have a length direction which is perpendicular to the length direction of the band and they are shaped rather like the teeth of a file. Figures 1 and 4 show two alternative forms for the rear face of the cutting member 6, opposite to the face formed with the teeth, the cutting member 6 shown in Figure 4 having a recess in its rear face into which a bridging piece 2D fits. Figure 7 shows a cutting member 6 with a similar recess in its rear face but here the teeth 7 have their length direction inclined by much less than 90°, in fact about 45°, to the length direction of the band and the cutting member 6 has the teeth over only a narrow central section, less than 1 cm. wide, of the front face of the cutting member.

The band passes around two sprocket wheels 11, at least one of which is driven manually or by a prime

mover. The teeth on the sprocket wheels project into the spaces between the side parts 2C of the chain elements and drive the band lengthwise, continuously in the same direction. The band has a working portion 1A which always advances in one direction and a return portion 1B which always travels in the opposite direction. Urging means in the form of a bar 14A, depending from a block 14, extend along the working portion 1A of the band and urge the chain elements therein, and therefore the cutting members 6 in the working portion 1A of the band, to move in one direction normal to the working portion of the band, i.e. vertically downwardly, considering Figure 1. For this purpose force is applied to the block 14, for example by a manually operated lever or hydraulically or by applied weights, or the weight of the block itself might suffice. This causes the bar 14A to press on the rollers 4 in the working portion of the band, which in turn causes the teeth 7 to remove surplus material from any workpiece which they encounter. On the under side of the bar there could be a strip which is replaced when worn.

As Figure 3 shows, the ends of the pins 3 project into grooves 12 in guide rails 13 which extend along the working portion 1A of the band. The arrangement may be such that when one of the cutting members 6 is running along a workpiece, in contact with a protrusion on it and removing surplus material from the protrusion, its associated pins 3 are not in contact with the guide rails but the pins associated with other cutting members 6, which are in the working portion 1A of the band but not in contact with the workpiece because the latter has no protrusion here, are in contact with the guide rails on the lower sides of the recesses 12. When the machine is lifted from the workpiece the ends of all the pins 3 in the working portion 1A of the band engage the guide rails, on the lower sides of the recesses 12. The guide rails, both when material is being removed from the

workpiece and when the machine is lifted from the workpiece, prevent the chain elements from moving too far in the direction in which they are urged by the bar 14A, i.e. vertically downwardly in the illustrated example, so as to cause the working portion of the band 1 to sag excessively. Where the pins 3 engage the guide rails there could be strips which are replaced when worn. Guide rails could guide the band 1 also in its return portion 1B.

When the machine is running, the shape of the lower face of the bar 14A and the shape of the guide rails on the lower sides of the recesses 12 determine the shape, for example planar, of the surface produced on the workpiece. The extent to which the lower face of the bar 14A is higher than the lower sides of the recesses 12 is critical and should be such as to enable the inclination of each device 2A and 2B in the working portion of the band, with respect to the direction in which the working portion of the band advances, to change periodically, producing a rippling effect. It appears to be advantageous to make the teeth 7 at the rear end of each cutting member 6 project further from the plane containing the axes of its two pins 3 than do the teeth 7 at the front end. It may also be advantageous to provide teeth on one of the longer vertical sides (considering Figure 3) of each cutting member 6.

Figure 8 illustrates an arrangement for tensioning the band. A movable block 20 supports a shaft 21 on which one of the pinions 11 is mounted and this block 20 is urged away from the other pinion 11 by dish springs 22 which act on a plate 23 which is fixed on one end of a rod 24 which passes freely through a fixed member 25 and has its other end fixed to the block 20.

If desired, the parallel teeth 7 could be formed on the bridging pieces 2D instead of on separate members 6 secured to the bridging pieces. Either way, considering Figure 2, there should be no teeth to the

left of the axis of the left-hand roller 4 or to the right of the axis of the right-hand roller 4, whereby as the chain elements run on and off the pinions 11 their consequent tilting does not result in the teeth carried by them cutting undesirably deeply into the workpiece. The teeth are preferably cleared of swarf in the return portion 1B of the band and preferably cutting oil is applied to them.

Figure 9 shows diagrammatically a chassis 28 on which all the parts shown in Figures 1 to 4 are supported, the chassis having carrying handles 29 at opposite ends and two rotund and possibly hemispherical projections 30 and 31 near opposite ends, as near to each other as possible having regard to the fact that they must not be engaged by the teeth 7.

In the case where a welded joint between two lengths of railway rail is to be smoothed, the lower face of the bar 14A is planar and so are the surfaces of the guide rails 13 on the lower sides of the recesses 12. The machine shown in Figures 1 to 4, or, preferably, incorporating the cutting member shown in Figure 7, is lowered by two men, with the band 1 already running, until the projection 30 contacts the surface of one of the lengths of rail. The projection 31 cannot immediately contact the other length of rail because an upward protrusion on the rail at the joint prevents this. The teeth 7 remove surplus material from a limited part of the rail cross-section, until the projection 31 contacts the other length of rail, leaving a planar facet along the line 32, about a metre long and preferably less than 1 cm. wide, partly on one of the lengths of rail and partly on the other length, from immediately adjacent the location where the projection 30 contacts the rail to immediately adjacent the location where the projection 31 contacts the rail. Then the chassis is turned, by means not shown, about the rail and the operation is repeated, the teeth 7 now removing

surplus material from an adjacent limited part of the rail cross-section, leaving a similar second planar facet adjoining the first. In this way, several, preferably at least ten, planar facets are formed, on those parts of the rail which will be in contact with train wheels, and the profile of these parts of the rail at opposite ends of the working portion of the band 1 will approximate to the curved profiles of the rail at the locations engaged by the projections 30 and 31, with the result that there is a smooth transition from one length of rail to the other.

The illustrated machine can also be used to remove other high spots on rails but is not intended to be used to re-profile the whole of any length of rail.

Figures 5 and 6 show part of a band 1 comprising a series of chain elements 2E each of which is a member formed with a tooth 16 on one side, to engage the teeth of the pinions 11 in order to drive the band, and teeth 7 on the opposite side to cut the workpiece, although these teeth could be on a detachable cutting member as shown in any of Figures 1, 4 and 7. Link members 17 are each pivotally connected by pins 3 to two adjacent chain elements 2E, the ends of the pins 3 projecting beyond the link members to engage guide rails 13 to prevent sagging of the chain. The members 2E are urged towards the workpiece by force applied to a block 14 having two projections 14B depending from it and extending along the entire working portion 1A of the band, these projections engaging the link members 17.

CLAIMS

1. Apparatus for removing material from a workpiece, comprising an endless band incorporating material-removing means, advancing means for advancing the band lengthwise continuously in the same direction, and urging means extending along a working portion of the band for urging the material-removing means in one direction normal to said working portion of the band, in order to cause the material-removing means to remove material from a workpiece.

2. Apparatus according to claim 1 in which the endless band, the advancing means and the urging means are supported on a chassis from which extend two spaced-apart projections which are intended to contact the workpiece at two locations at opposite ends of a path to be traversed by the material-removing means, the apparatus being such that material can be removed thereby from the workpiece until the surface of the workpiece follows a desired path from immediately adjacent one of said locations to immediately adjacent the other.

3. Apparatus according to claim 1 or 2 and further comprising guide means extending along said working portion of the band for preventing the material-removing means in said working portion from moving too far in said direction.

4. Apparatus according to any preceding claim in which the material-removing means are elongate cutting teeth parallel to one another.

5. Apparatus according to any preceding claim in which the band comprises articulated devices which incorporate the material-removing means.

6. Apparatus according to claim 5 in which the band comprises chain elements, each pivotally connected near one extremity to one adjoining chain element and near an opposite extremity to another adjoining chain element and the chain elements are engaged by toothed members at least one of which is driven to move the band lengthwise.

7. Apparatus according to claims 3 and 6 in which the chain elements are pivotally connected by pins each of which has two projecting portions, one at each end, which project beyond the chain elements and engage said guide means.

8. Apparatus according to claim 5 in which the band comprises a series of toothed members and the material-removing means are fixed thereto or form part thereof, there being link members each of which is pivotally connected to two adjacent toothed members whereby a chain is formed, the teeth on the toothed members engaging driving means for moving the band lengthwise.

9. Apparatus according to claims 3 and 8 in which the pivotal connections between the link members and the toothed members are effected by pins which project outwardly beyond the link members and engage said guide means.

10. Apparatus according to any preceding claim comprising a rotatable member around which the band passes as it advances and means for imparting a translatory movement to said rotatable member in order to tension the band.

11. Apparatus according to any preceding claim in which there are means for turning the band around the workpiece so that the apparatus can remove material from the latter along a plurality of parallel paths and produce a plurality of planar facets on the workpiece, approximating to a curved surface.

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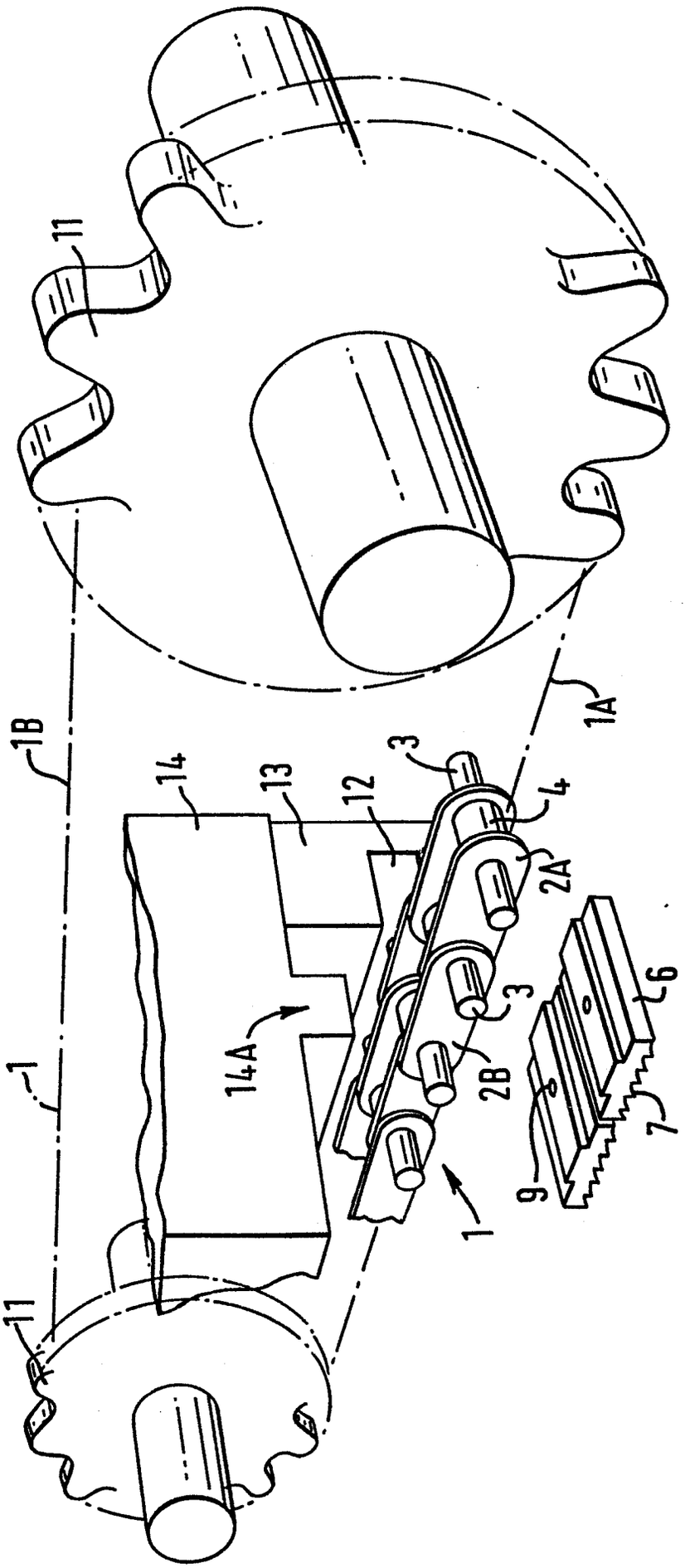


FIG.1

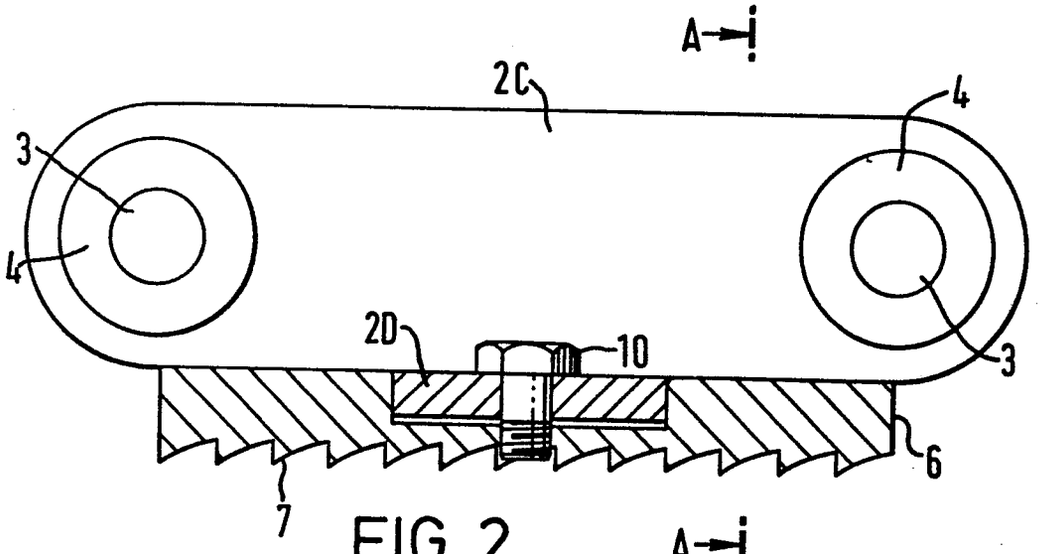


FIG. 2

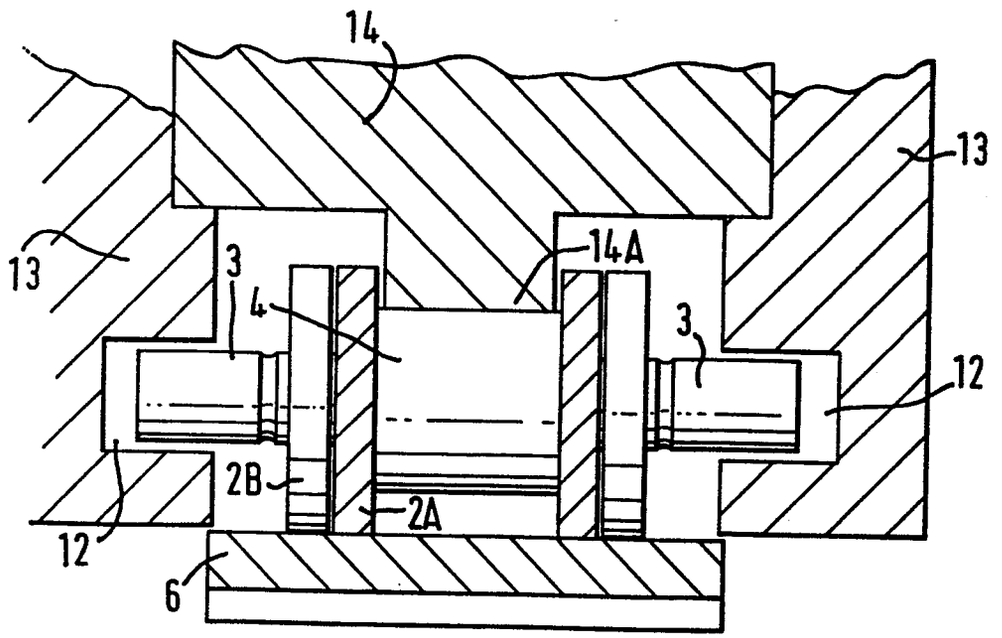


FIG. 3

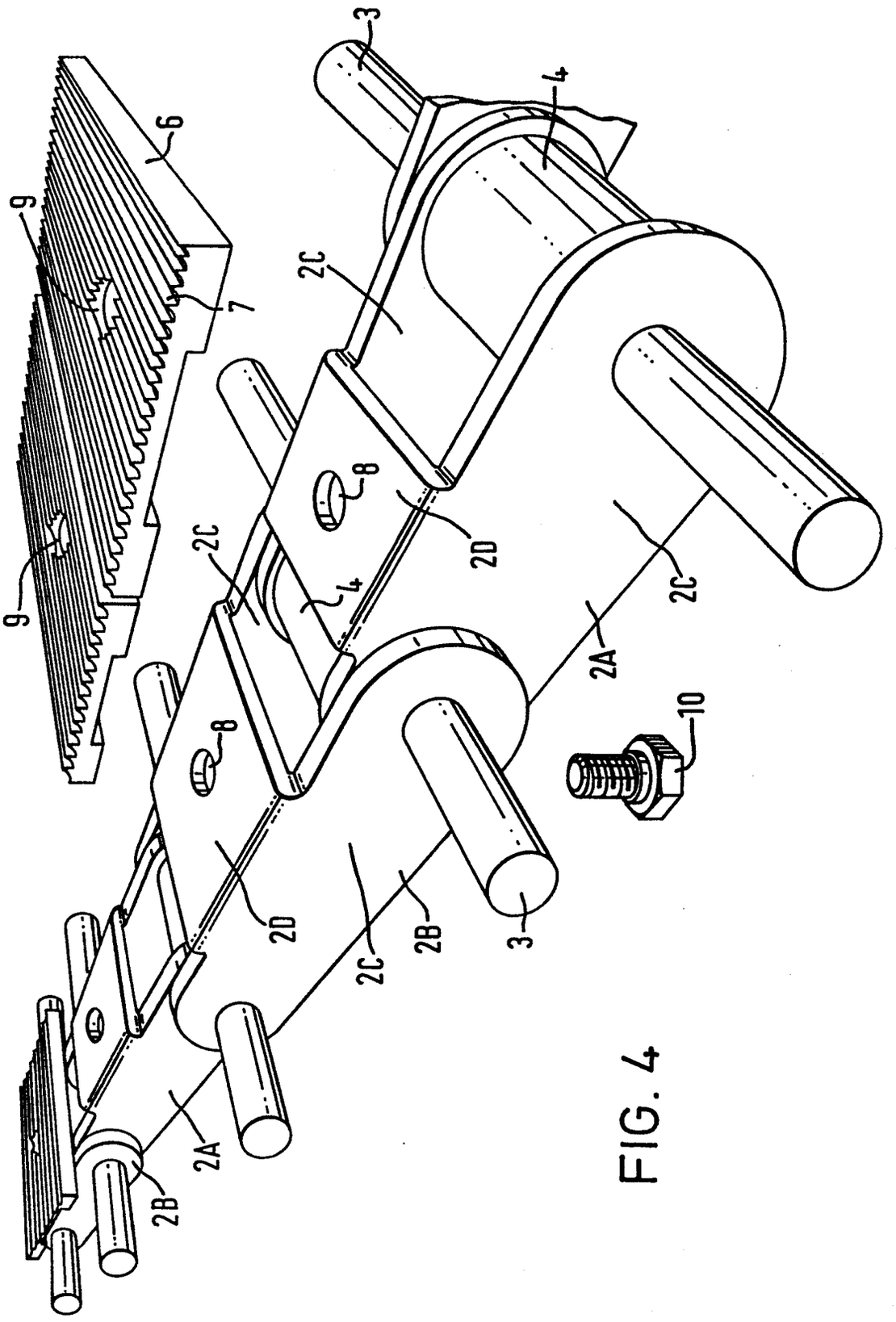


FIG. 4

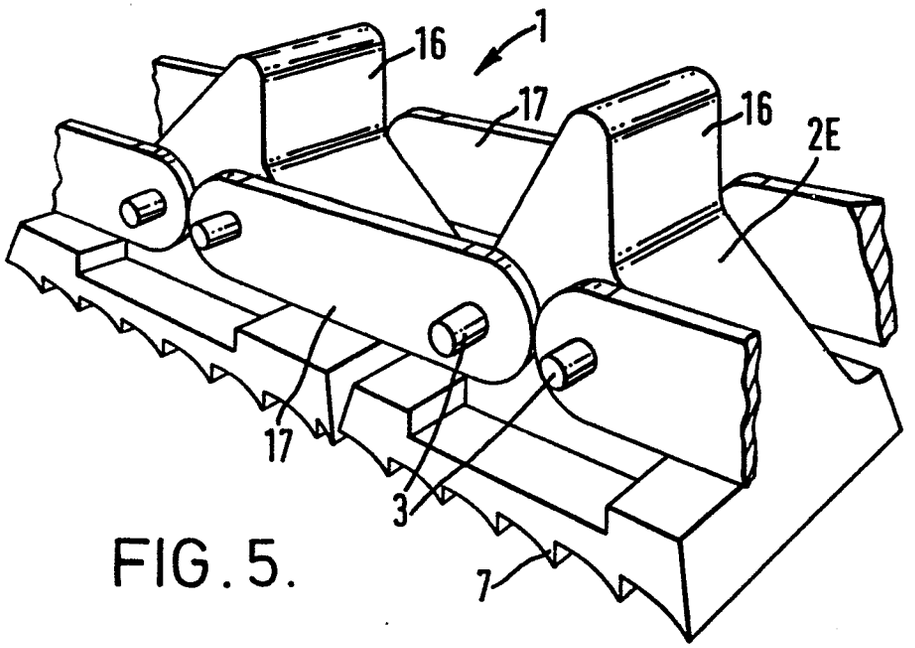


FIG. 5.

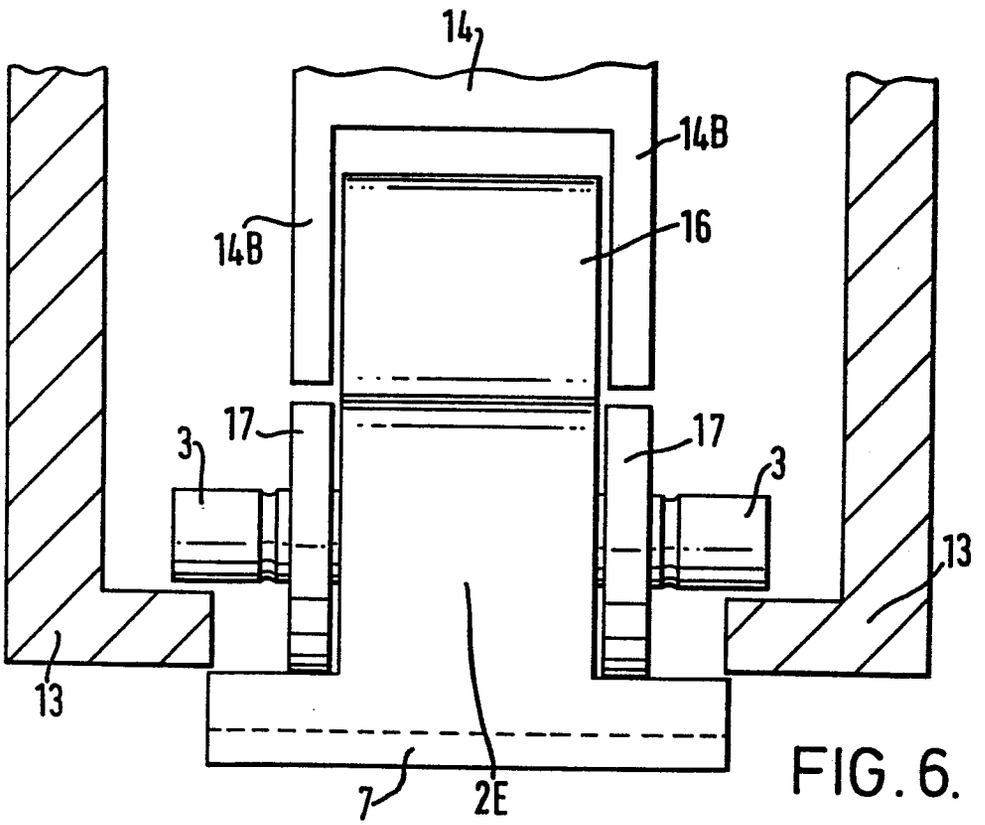


FIG. 6.

FIG. 7.

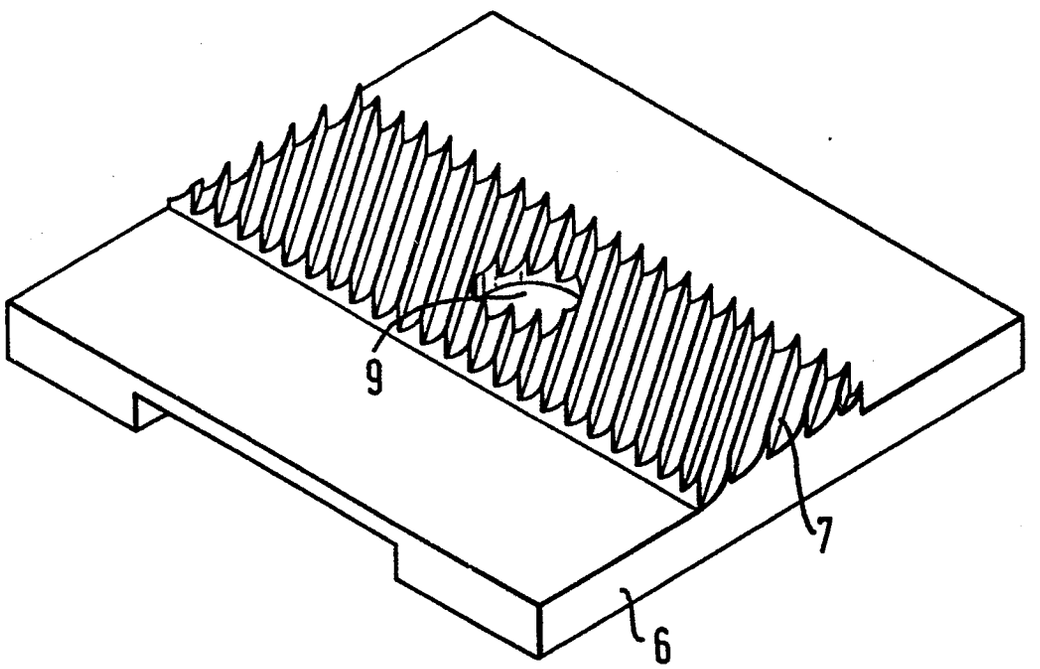
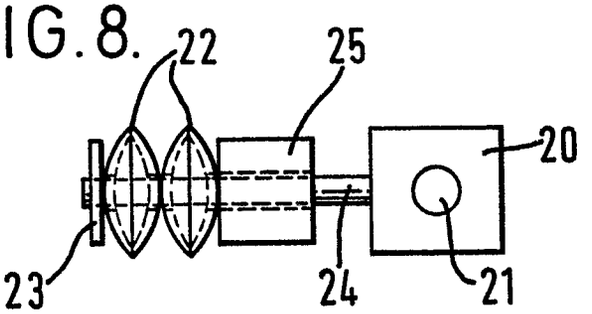


FIG. 8.



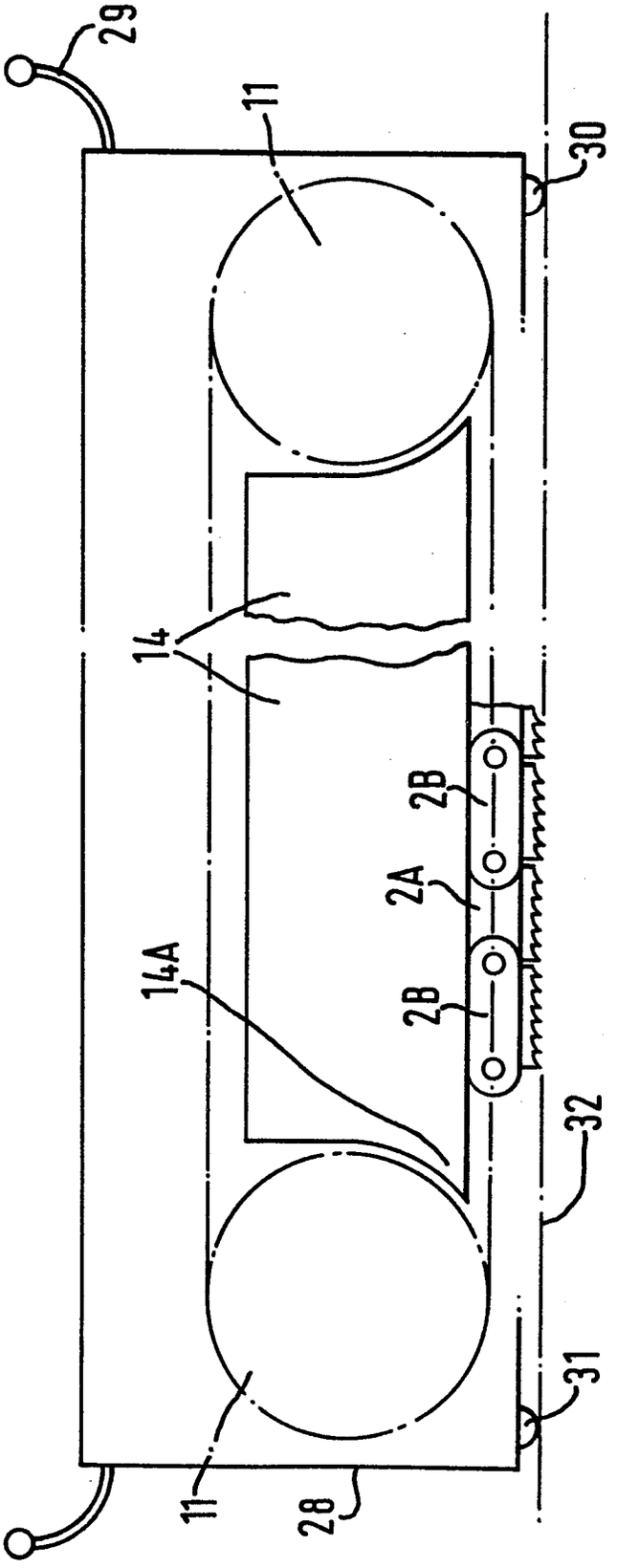


FIG. 9.

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EUROPEAN SEARCH REPORT

0131356
Application number

EP 84 30 3236

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-2 114 454 (PERAZZOLI) * Page 1, right-hand column, line 21 - page 2, right-hand column, line 36; figures 1-4 *	1-3,5-7,10	E 01 B 31/12 E 01 B 31/15
X	DE-C- 600 356 (RèGGEBERG) * Complete document *	1,2,4-7	
X	DD-A- 135 632 (F. PLASSER BAHNBAUMASCHINEN-INDUSTRIEGESELLSCHAFT MBH) * Page 22, last paragraph - page 23; figure 6 *	1	
A	DE-C- 168 741 (MELAUN) * Complete document *	11	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

E 01 B 31/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	13-07-1984	PAETZEL H-J

CATEGORY OF CITED DOCUMENTS

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