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(54) Loom with vertically mobile weft-carrier element for producing double-piece velvets, carpets and the like, including of very long pile.

(57) This loom for the double-piece production of velvets, carpets and the like, including long-pile production, is characterised by a weft-carrier element (G, T) arranged to traverse the various warp yarns (A,B,C,D) in accordance with the sequences established by the movement of heddles, at different levels (L', L") imposed cyclically on said weft-carrier element (G, T) by lifter means (Q) coordinated with the other means which implement the warp yarn traversing and heddle raising movements.

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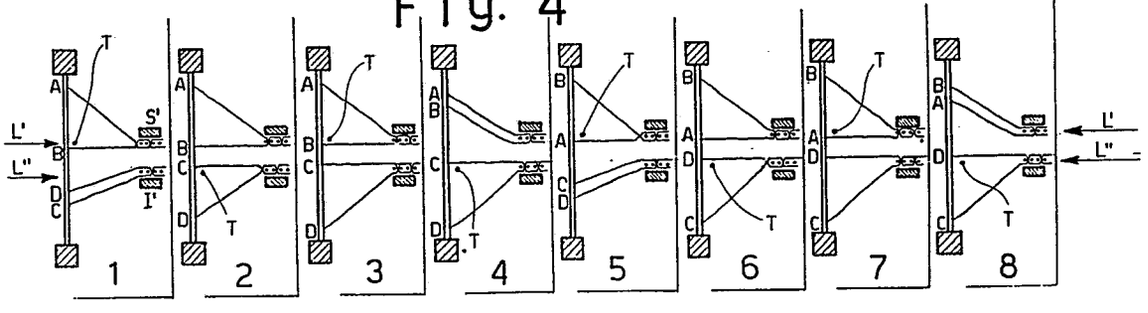
Fig. 4



LOOM WITH VERTICALLY MOBILE WEFT-CARRIER ELEMENT FOR PRODUCING DOUBLE-PIECE VELVETS, CARPETS AND THE LIKE, INCLUDING OF VERY LONG PILE

This invention relates to the field of looms and in particular to double-piece velvet looms provided with cam-controlled weft-carrier elements (eg shuttles) and heddles. In the known art, double-piece velvets are produced by joining together two superposed fabrics by means of binder interweaves which when cut produce that thick straight pile projecting from both sides of the previously joined fabrics which is characteristic of velvets.

This usual double-piece velvet construction can be indicated by the scheme of Figure 1. In this scheme, one fabric piece is formed from warp yarns B and A traversed by weft yarns I, III, V, VII, while the other fabric piece is formed from warp yarns D and C traversed by weft yarns II, IV, VI, VIII. In this scheme the fabric is shown in longitudinal section so that the weft yarns, which are perpendicular to the warp yarns, are represented by points (I, II, III, IV, V, VI, VII, VIII).

These two fabric pieces, with a weave usually known as GROSS are joined together by further yarns which for simplicity can be represented as the yarn U. The straight pile characteristic of velvets, carpets and other types of fabric is then formed by cutting the yarns U which join together the two pieces (ABI, III, V, VII, DCII, IV, VI, VII).

The weave used to form the two pieces can obviously be of other types (such as TAFFETA type), but this does not change the concept of two fabric pieces joined together by a further joining weave, to be cut in order to form the perpendicular pile surfaces. Currently (see Figure 2) such fabrics joined together and spaced apart by a distance dependent on the required length of projecting velvet pile, are formed from two separate series of warp yarns a', b' and d', c' into which normal weft carriers insert a weft yarn t operating at a fixed level 1, this then being secured to them by the shed formed by the cyclic movement of their heddles and then compacted by the operation of a usual reed.

This is shown by the sequence of Figure 2. This sequence shows the positions a, b, c, d assumed by the various heddles to cause the warp yarns a', b', c', d' to form the two fabric pieces with the profile shown diagrammatically in Figure 1, and which slide along the support beds S and I.

To totally understand the advantages of the present invention mention should firstly be made of the inherent properties of the machines which form said profile of Figure 1 by weft yarn operating at the fixed level 1 as shown in Figure 2.

The various positions a, b, c, d assumed by the warp yarns are determined by the movement of heddles controlled by their own cams (Figure 3) by way of idle levers. These levers are usually of the first class, so that when the cam tappet is lowered the heddle rises. For greater simplicity, the positions a, b, c, d will be identified hereinafter by the positions assumed by their operating heddles or will be identified by the heddles themselves.

On this basis, and with reference to Figures 2 and 3, the heddle a is associated with the cam a'', the heddle b is associated with the cam b'', the heddle c is associated with the cam c'' and the heddle d is associated with the cam d''.

Observing the representation of these cams in Figure 3, it can be seen that for clarity they are divided into eight 45° sectors to identify the angular positions $1'$, $2'$, $3'$, $4'$, $5'$, $6'$, $7'$, $8'$ which determine the weaving arrangements indicated in the various stages of Figure 2 by the same respective numbers ($1'$, $2'$, $3'$....).

For each of the angular positions $1'$, $2'$, $3'$ etc., Figure 2 shows the arrangement of the various heddles a, b, c, d relative to the reference position of the fabric support beds BS or BI, or relative to the fixed level 1 at which the weft yarn t is cyclically inserted.

It will be assumed that the various cams a'', b'', c'', d'' rotate anticlockwise in the direction of the arrow W so as to bring the points $1'$, $2'$, $3'$, $4'$ into successive contact with a tappet P.

With reference to the cam a'' which operates the heddle a indicated in Figure 2, in position $1'$ of Figure 3 the tappet P is in its lowest position so that as it is connected to the heddle a by idle levers, the heddle a is in its highest working position. This is the situation in stage $1'$ of the sequence of Figure 2. After the cam a'' has rotated through 45° in the direction W the tappet P is aligned with the line $2'$. Along this portion from $1'$ to $2'$ the cam contour S is concentric with its axis of rotation Z so that it does not lift the tappet P. It can in fact be seen that at stage $2'$ of Figure 2 the heddle position a has remained at the same level as in stage $1'$. This level remains constant through a further 45° rotation which moves the tappet into a position aligned with the line $3'$, and again through a further 45° rotation bringing the tappet P into alignment with the line $4'$ on the cam a''. In this respect, it can be seen from the corresponding sequences $1'$, $2'$, $3'$, $4'$ that the heddle position a has remained constant at its highest level.

As the cam a'' continues to rotate anticlockwise it brings its "ramp" R into contact with the tappet P to cause it to rise to maximum level, which is attained when the tappet is aligned with the line $5'$.

Observing stage 5′ of Figure 2 it can in fact be seen that the heddle a has moved into a lower position than the preceding and that this is the lowest position allowable by the shape of the cam a″. As the cam a″ rotate anticlockwise through a further 45° the tappet P comes into contact with its descending ramp Q so that when the tappet P is aligned with the line 6 the heddle position a is that shown in the corresponding stage 6′. From the cam contour it is clear that the position a in stage 6′ is the same as that in stages 1′, 2′, 3′ and 4′, ie the maximum lift position.

As the cam a″ further continues to rotates anticlockwise the tappet P comes into contact with the rising ramp L and then the descending ramp M to cause the heddle to move to correspond to the lines 7 and 8, which are the positions in stages 7′ and 8′ of Figure 2. The other cams b″, c″, d″ operate in the same manner as cam a″ to drive their heddles b, c, d into the positions indicated in the various stages 1′, 2′, 3′, 4′, 5′, 6′, 7′, 8′ of Figure 2, which have the same significance for these cams as that already described for the cam a″.

This sequential combined operation of the various heddles produces the two superposed fabric pieces which are joined together by other normal interweaves for the creation of the "double-piece" shown diagrammatically in Figure 1. In this process the weft yarn t is always handled at the same level 1, as indicated in the individual stages 1′, 2′, 3′... of Figure 2.

This usual production method has considerable drawbacks, including the following.

The cams must have very steep ramps. This prevents the use of high rotational speeds and therefore reduces the hourly quantity of fabric produced.

The sudden level variations required of the cams create very high tappet friction which increases the electrical power consumed by the loom.

The various heddles must undergo very wide-amplitude movements which at certain points become superposed on those of other heddles, so creating tangling problems between the various warp yarns.

The two fabric pieces tend to be pulled towards each other by the oblique pull of the warp yarns which are under tension, and this compromises the planarity of the fabric pieces themselves. The distance between the two fabric pieces depends on the amplitude of each heddle movement and is limited by the structural limits of the loom (operational speed, cam rigidity etc.), so hindering the creation of long-pile velvets or carpets.

An object of the present invention is to provide a loom for the double-piece production of velvets, carpets and the like in which the pile length of the velvet or the like does not depend on the amplitude of the heddle movement.

A further object is to provide a loom which operates under conditions which favour planarity of the fabric produced.

A further object is to provide a loom with a high production rate.

These and further objects will be apparent to the expert of the art on reading the following detailed description which relates to a loom for the double-piece production of velvets, carpets and the like, including long-pile production, characterised by a weft-carrier element arranged to traverse the various warp yarns, in accordance with sequences established by the movement of heddles, at different levels imposed cyclically on said weft-carrier element by lifter means coordinated with the other means which implement the warp yarn traversing and heddle raising movements. The operation of the invention is illustrated by way of non-limiting example on the accompanying drawing in which:

Figure 4 shows a sequence of operating stages of weave regulating heddles;

Figure 5 shows diagrammatically the contours of the operating cams for the aforesaid heddles.

With reference to Figure 4 it can be seen that the weft yarn T operates not at a single level 1 but at two different levels L′ and L″ which alternate with each other. In this respect, during stage 1 the weft yarn T is at its higher level, during stage 2 the weft yarn is at its lower level, and so on.

In Figure 4, which is shown similar to Figure 2 to facilitate comparison with the old method, the positions assumed by the heddles, or the positions of the same four warp yarns, are indicated by the letters A, B, C, D. The fabric support beds are indicated by the letters BS′ and BI′.

The various stages in the formation of the two fabric pieces are indicated by the numerals 1, 2, 3, 4, 5, 6, 7, 8.

These stages refer to those determined by the action of the specific cams A, B, C, D of Figure 5 on the various heddles during their anticlockwise rotation W′ to bring the tappet P′ to those points on their contour defined by the corresponding lines 1, 2, 3, 4, 5, 6, 7, 8 which divide the various cams A, B, C, D into 45° angular sectors.

The operation of the invention is the same as that already illustrated in describing the association of the sequences 1′, 2′, 3′, 4′, 5′... of Figure 2 with the corresponding sequences of the various cams a″, b″, c″, d″ of Figure 3 and relative to the four warp yarns a′, b′, c′, d′. From the aforesaid it is apparent that as the cams A, B, C, D needed to form the two fabric pieces use a double insertion level (L′, L″) for the weft, ramps of lesser inclination

are required. With reference to Figure 5 which is shown by way of example only, these ramps are traversed by means of 90° angular rotations instead of only the 45° rotations characteristic of the cams a″, b″, c″, d″ necessary for forming the two fabric pieces with a fixed weft level 1, although using the same weave relationship. If the same method is used for forming the binding interweave U for the two fabric pieces which generates the velvet pile, with the loom according to the invention it is possible to reduce all the aforesaid drawbacks of the old system, as the use of cams with less steep ramps allows considerable increase in the velvet production rate and a considerable reduction in the costs related to energy consumption and deterioration in the moving members. With this loom there is the advantage of producing the two anchoring fabrics AB, DC of Figure 1 in a manner which does not restrict the raising of the heddles to their distance apart, so that velvets with practically any pile length can be produced.

Advantageously, it is possible to produce velvets or carpets with a pile much longer than that allowed by the old system, as the transverse components due to the considerable oblique pull of the warp yarns which tend to pull the anchoring fabrics together are eliminated, as is the formation of creases in them which deprive the product of its precious homogeneous form.

The practical implementation of the cyclic raising of the weft does not pose special problems. It can be done in various ways, all accessible to any expert of the art. By way of example, the following method is shown schematically in Figure 6. A weft pusher rod E (associated with a weft pulling rod F provided with grippers for gripping the yarn) is driven reciprocatingly along G transverse to the direction of advancement and in the plane of the fabrics by the action of a cam H. The movement G can also be obtained indirectly, for example by using a drive pinion on a rack rigid with said rod. The alternating movement of the drive pinion can be obtained by association with the usual cams (H). This entire transverse control mechanism for the weft can itself be cyclically raised along N by the aid of vertical guides M and a further cam Q synchronized with all other cams of the loom.

Claims

1. A loom for the double-piece production of velvets, carpets and the like, including long-pile production, characterised by a weft-carrier element (G, T) arranged to traverse the various advancing warp yarns (A, B, C, D) of the two fabric pieces joined by the velvet formation yarn (U), in accordance with sequences established by the movement of heddles, at different levels (L′, L″) imposed cyclically on said weft-carrier element (G, T) by lifter means (Q) (Figure 6).

2. A loom for the double-piece production of velvets, carpets and the like, including long-pile production, as claimed in the preceding claim, characterised in that the warp yarns forming an individual fabric piece undergo movements which do not interfere with the warp yarns of the other fabric piece.

3. A loom as claimed in the preceding claims, characterised by heddle control cams in which the ramps connecting the specific levels extend over wider angles than those of cams associated with looms having a fixed weft working level.

4. A loom as claimed in the preceding claims, characterised by means for cyclically raising the working level of the weft-carrier rod, these means being based on the coordinated operation of cams cooperating with other cams for controlling its horizontal cyclic travel, which is obtained by the engagement of tappet-operated pinions with a rack.

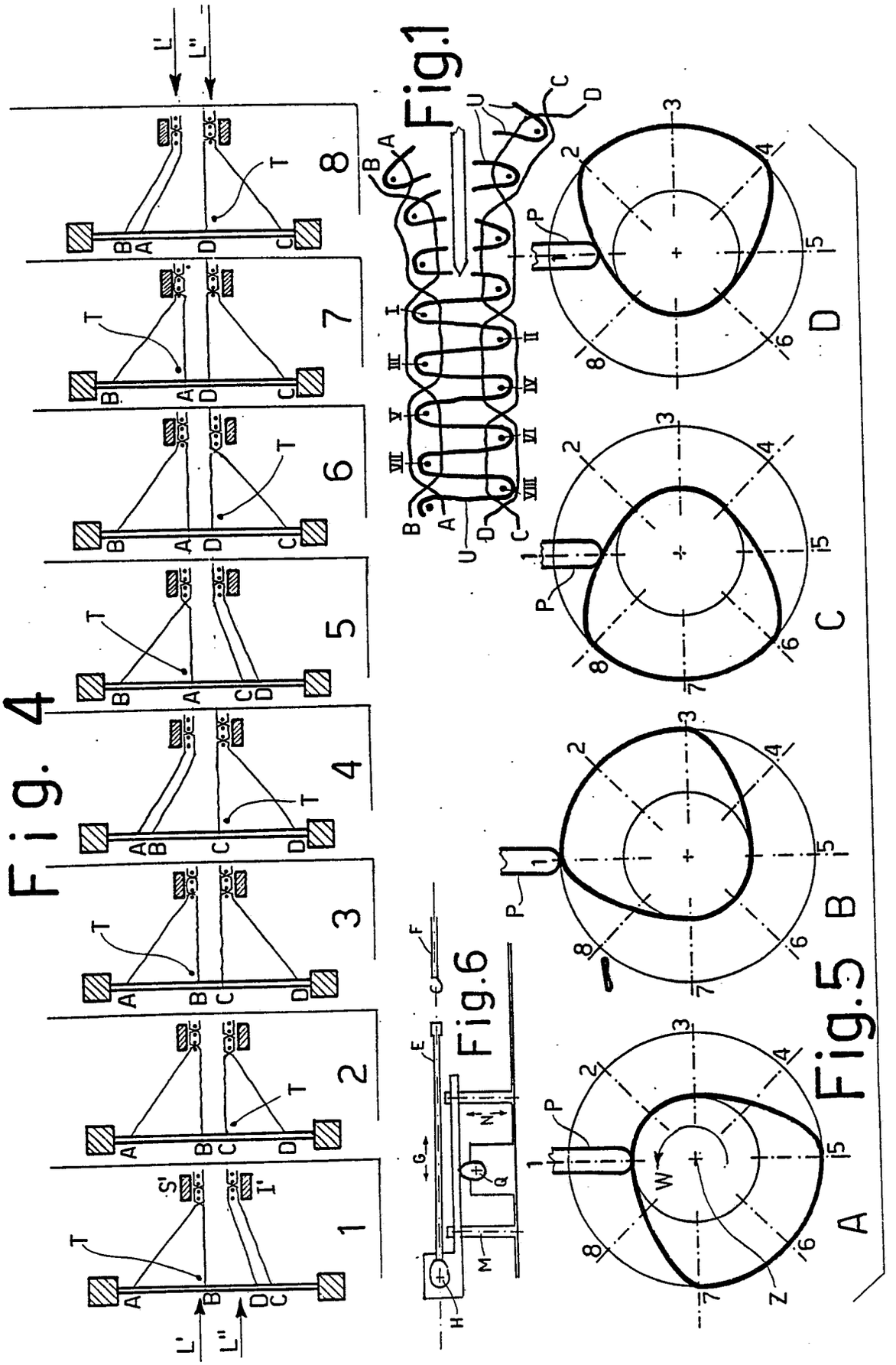


Fig. 4
Fig.1
Fig.6
Fig.5 A
Fig.5 B
Fig.5 C
Fig.5 D
L'
L"
T
S'
I'
A
B
C
D
U
P
W
Z
E
F
G
H
M
N
Q

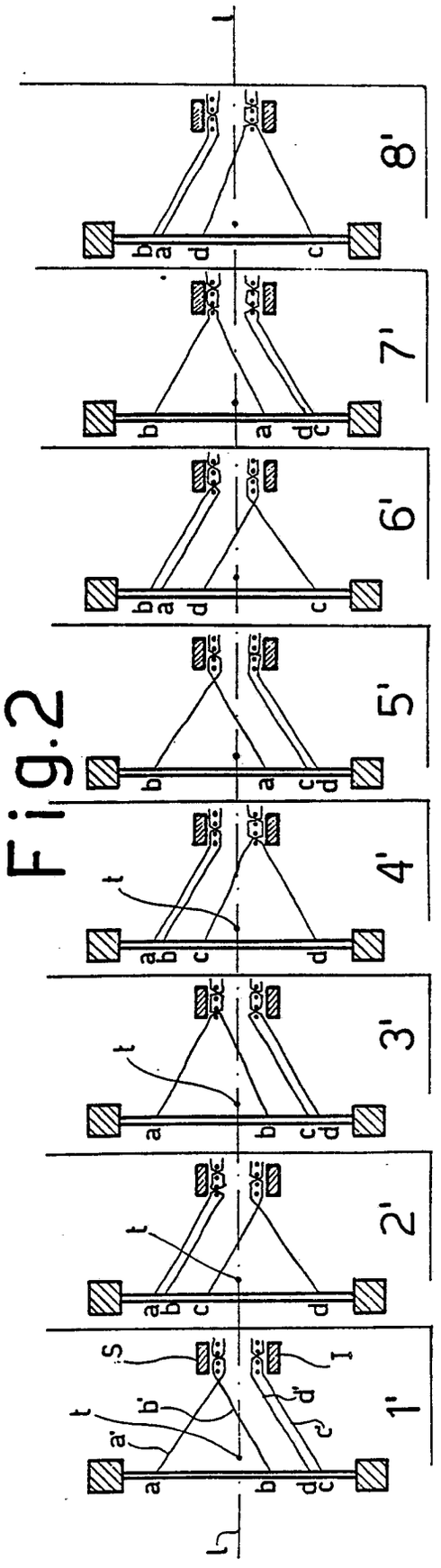


Fig.2
8'
7'
6'
5'
4'
3'
2'
1'
a
b
c
d
t
S
I
a'
b'
d'

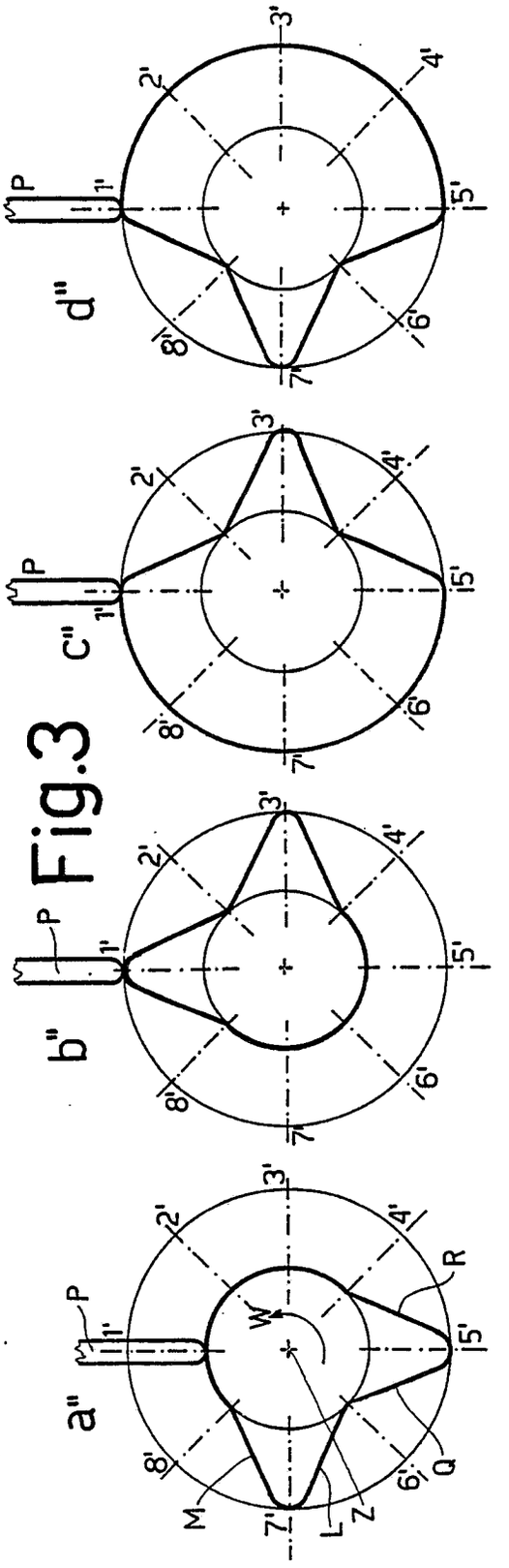


Fig.3
a"
b"
c"
d"
P
1'
2'
3'
4'
5'
6'
7'
8'
R
Q
W
M
L
Z

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 11 6629

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)
A	FR-A-2 545 509 (S.A.C.M.) * Page 1, lines 7-29; figures 1,2 *	1,2	D 03 D 39/16
A	FR-A-2 163 524 (GUSKEN)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.3)
			D 03 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05-06-1989	BOUTELEGIER C.H.H.

CATEGORY OF CITED DOCUMENTS

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