

12

EUROPEAN PATENT APPLICATION

21 Application number: 80302461.1

51 Int. Cl.³: **B 21 B 43/02**

22 Date of filing: 21.07.80

30 Priority: 23.07.79 GB 7925567

43 Date of publication of application:
28.01.81 Bulletin 81/4

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

71 Applicant: **DAVY-LOEWY LIMITED**
Prince Of Wales Road
Sheffield S9 4EX Yorkshire(GB)

72 Inventor: **Swift, Coiin**
50, Falcon Way
Dinnington, Sheffield S31 7NY Yorkshire(GB)

74 Representative: **Kirk, Geoffrey Thomas et al,**
BATCHELLOR, KIRK & EYLES 2 Pear Tree Court
Farringdon Road
London EC1R 0DS(GB)

54 **Turn-over cooling bank.**

57 A cooling bed for metal stock, which also turns the stock as it progresses along the bank, has sets of carrier (1) and pick-up racks (7). Each set of racks is reciprocated both horizontally and vertically and an adjustment means is provided for adjusting the horizontal stroke of one set of racks. The adjustment means includes a shaft (15), an inner member (43) eccentrically secured to the shaft (15), an outer member (45) eccentrically secured to the inner member (43) and means for connecting the members (43, 45) together at selected relative angular positions.

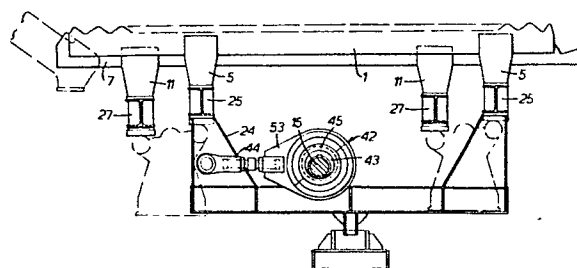


Fig. 7.

-1-

TURN-OVER COOLING BANK

This invention relates to a turn-over cooling bank for metal stock. During the manufacture of metal stock, particularly that having a square or rectangular cross section, it is hot rolled or continuously cast and then cut
5 to length. The stock is then allowed to cool on a cooling bank during which time it is displaced intermittently along the length of the bank. It is also desirable to rotate the stock as it moves along the bank so that it cools more uniformly and thereby avoids distortion of the stock.

10 Turn-over cooling banks are known which comprise sets of carrier racks and pick-up racks, each arranged to have a reciprocating motion in both the horizontal and vertical planes, such that the resultant movement of the racks is substantially elliptical. The relative movement of
15 the sets of racks is such that the stock, introduced to the input end of the bank, is disposed in a number of steps to the output end of the bank and the stock is slowly rotated as it progresses across the bank. The movement of the sets of racks is fixed and the bank is suitable for transporting
20 stock of particular cross-sectional dimensions.

It is an object of the present invention to provide a cooling bank of this type which can accommodate stock of a wide range of cross-sectional dimensions.

According to the present invention, a turn-over
25 cooling bank for metal stock comprises:-
(a) a carrier rack having a notched support surface arranged substantially horizontal,
(b) a pick-up rack having a notched support surface arranged substantially horizontal and substantially
30 parallel to the carrier rack,
(c) means for providing a first one of the racks with a reciprocating horizontal travel of a fixed stroke,
(d) means for providing the other rack with a

-2-

reciprocating horizontal travel with a fixed but adjustable stroke which is substantially 180° out of phase with the first of said racks,

(e) means for providing both racks with a reciprocating vertical travel of a fixed stroke with the two racks being moved simultaneously 180° out of phase with each other,

the horizontal and vertical movement of each rack being such that it moves along an elliptical path and stock lying on the racks is rotated as it is moved along the bank, characterised in that the means for providing said other rack with a reciprocating horizontal travel includes

- (1) a rotatable drive shaft,
- (2) an inner member rigidly secured to the drive shaft and eccentrically mounted with respect thereto,
- (3) an outer member eccentrically mounted on the inner member and rotatable with respect to the inner member, and
- (4) means for rigidly connecting the inner and outer members together at a selected one of a number of angular positions of the outer member with respect to the inner member whereby the stroke of the horizontal travel of the said other rack is adjustable between predetermined limits.

In a preferred embodiment, it is the carrier rack which is provided with a horizontal travel which is adjustable between predetermined limits.

In use, the stock is picked up at the entrance end of the bank on the notched support surface of the pick-up rack, moved forward, and deposited on the notched support surface of the carrier rack. The stock is then moved forward by the carrier rack and deposited on the support surface of the pick-up rack. This motion continues to move the stock progressively to the exit end of the bank. The notches on the two racks are so shaped that, each time the stock is deposited onto the pick-up rack, it is turned about an axis parallel to its length. The angle through which the stock is turned is usually 90° . If the bank is to

-3-

accommodate stock of differing cross-sectional dimensions, then it is necessary to be able to adjust the amount of forward travel of the stock as it is moved by the carrier rack and deposited on to the pick-up rack. This is to make
5 sure that the stock is deposited on the correct part of the notched support surface of the pick-up rack so that the stock turns over through the correct angle without excessive sticking and bumping which would damage the stock and the support surface of the racks.

10 In order that the invention may be more readily understood it will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a side elevation of part of the turn-over cooling bank,

15 Figure 2 is a side elevation of a further part of the turn-over cooling bank,

Figure 3 is a plan of the part of the bank shown in Figure 2,

20 Figure 4 is a plan of the drive arrangement for the cooling bank,

Figure 5 is a plan of part of the drive arrangement of the carrier racks,

Figure 6 is a side elevation of the double eccentric device shown in Figure 5, and

25 Figure 7 is a side elevation of part of the drive arrangement for the carrier racks.

Referring to the figures, a turn-over cooling bank for metal stock, generally of square cross-section and say 100-160 mm length of side, includes a plurality of carrier
30 racks 1, of which one is shown in the figures. These racks are of elongate form with a notched upper support surface 3. The racks are arranged in parallel, side-by-side, spaced apart relation and each rack has a number of downwardly extending brackets 5 spaced apart along its length. The
35 corresponding brackets of all the carrier racks are

-4-

connected to transverse beams 25. As shown in Figure 7, the transverse beams 25 are connected together by underslung tie beams 24. A plurality of pick-up racks 7, of which one is shown in the figures, are arranged in parallel, side-by-side, spaced apart relation and are interdigitated with the carrier racks 1. These racks have a notched upper support surface 9 and each rack has a number of downwardly extending brackets 11 spaced apart along its length and the corresponding brackets of these racks are connected by transverse beams 27. The beams 27 are connected together by underslung tie beams 26.

Referring particularly to Figures 2 and 3, the beams 25, 27 are arranged in pairs in side-by-side relation and beneath each beam there is a roller track 25A, 27A respectively. Each pair of beams is supported on a rocker unit 29, consisting of a fixed pedestal 31 having a pair of rocker plates 33 pivotally mounted thereon, and connected together by two pins each carrying a roller 35. One roller engages the underside of the track 27A beneath the beam 27 and the other roller engages the underside of the track 25A beneath the beam 25. A mechanism, to be described in more detail later, is employed to rock the plates 33 relative to the fixed pedestal 31 to reciprocate the rollers 35 in a vertical direction with the rollers being out of phase, that is, as one roller is raised, the other is lowered. The movement of the rollers causes the carrier racks to be reciprocated up and down 180° out of phase with the up and down movement of the pick-up racks.

The reciprocating movement of the rollers 35 is brought about by a drive means which includes a rotatable shaft 15, mounted substantially horizontally in fixed bearings 17. An eccentric 41 is mounted on the shaft 15 and a lift arm 39 is mounted on the eccentric. The lift arm is connected by respective links 37 to pivots on the plates 33. As the shaft is rotated, the eccentric causes the links 37

-5-

to reciprocate substantially horizontally and to pivot the rocker plates 33 with respect to the pedestals 31.

Referring again to Figure 1, a mechanism is shown for causing all of the racks 7 to be moved together in a horizontal direction. The mechanism includes an eccentric 19, mounted on the rotatable shaft 15, and an arm 21 engages with the eccentric. A link 23 connects the arm 21 to a part of the tie beam 26 which is positioned beneath one of the transverse beams 27. Rotation of the shaft causes the framework, including the tie beam 26 and transverse beams 27, to reciprocate in a substantially horizontal direction with a fixed stroke. Since the racks 7 are rigidly secured to the beams 27, the racks 7 also reciprocate in a horizontal direction with a fixed stroke. The horizontal reciprocation of the beam 27 is arranged such that, throughout the horizontal reciprocation, the tracks 27A remain in contact with the rollers 35. The pick-up racks 7 are thus subjected to both vertical and horizontal reciprocatory movement simultaneously and, consequently, the actual movement of the racks 7 is along an elliptical path. The stroke, both the vertical and the horizontal movements applied to the pick-up racks, is fixed and, consequently, the shape of the elliptical path is fixed.

Referring to Figure 7 again. a mechanism is shown for providing horizontal reciprocatory movement to the carrier racks 1. A double eccentric device, indicated generally by reference 42, is mounted on the shaft 15 and is connected by a link 44 to part of the tie 24, which is positioned beneath one of the beams 25. On rotation of the shaft, a reciprocatory horizontal movement is provided to the beams 25 and, consequently, to the carrier racks 1. This reciprocatory horizontal movement supplied to the carrier racks is of a fixed stroke but this stroke can be adjusted.

Referring particularly to Figures 5 and 6, the

-6-

drive means for providing the horizontal reciprocatory movement includes an inner member 43 rigidly and eccentrically mounted on the shaft 15. In the arrangement shown, the member 43 is offset by 35 mm with respect to the axis of rotation of the shaft 15. A second member 45 is eccentrically mounted on the member 43 and is rotatable with respect thereto. In the arrangement shown, the offset between the members 43 and 45 is 10 mm. The member 45 has a flange 47 which fits over one edge of the member 43. This edge of the member is apertured and similar apertures 49 are provided in the flange 47. By rotating the member 45 with respect to the member 43, the relative offset between the two members can be adjusted between $35 + 10$ equals 45 mm and $35 - 10$ equals 25 mm. When the required offset has been obtained, the two members are connected together by means of bolts (not shown) which pass through the apertures 49 into the apertures in the member 43. A roller race 51 surrounds the member 45 and the eccentric movement of the member 45 is transmitted by the race 51 to an arm 53 which, in turn, transmits the movement to the transverse beams 25 supporting the carrier racks by way of the link 44 and the toe 24.

For a product of given cross-sectional dimensions, the eccentric members 43, 45 are adjusted to cause the stock, lowered by the carrier racks on to the pick-up racks, to engage the required part of the notches on the pick-up racks for the stock to be turned, without excessive sliding. If stock of different cross-sectional dimensions is to be cooled on the bank, then the eccentrics have to be adjusted to ensure that the stock is placed on the pick-up racks at such as position and at such an entry angle that the stock is turned without excessive sliding. The two eccentric members 43, 45 can be adjusted between positions which give different amounts of offset and also between positions which give the same amount of offset but different entry angles for the stock as it is placed on the pick-up racks. This

-7-

facility enables the best entry angle to be chosen to ensure that the stock rotates through the required angle each time it is placed on the pick-up racks, even though the stock has differing cross-sectional dimensions.

5 The pitch of the notches on the pick-up racks and the carrier racks, and both the vertical and horizontal displacement of the racks, are all dependent on the range of products to be transported along the cooling bank.

 The pitch of the notches on the racks is roughly
10 fixed as being equal to the distance across the diagonals of the maximum stock to be transported plus approximately 50 mm to maintain this as a maximum gap so as not to restrict air flow for cooling purposes. The fixing of the vertical and horizontal movements required is rather more difficult but
15 basically consists of adding the notch height of the pick-up rack to the notch height of the carrier rack and then adding 20 mm for additional clearance. Having fixed the vertical height of each ellipse in this way and the relative distance between the two racks, the ideal width of the ellipse for
20 the maximum size stock can be established, as can the ideal width for the minimum size stock. Obviously a compromise has to be made between these sizes for the width of the ellipse, but the compromise chosen is dependent on the relative sizes of the products which are to be carried on
25 the bank. The in-built adjustment which is permitted on a bank constructed in accordance with the present invention enables the bank to be used for a wide range of product sizes.

 Although in this specification the carrier racks
30 have been described as having the adjustable horizontal stroke, they could be provided with a fixed horizontal stroke and the pick-up racks could be provided with an adjustable horizontal stroke. As a further option, both sets of racks could be provided with an adjustable
35 horizontal stroke.

-8-

Claims:

1. A turn-over cooling bank for metal stock comprises

- (a) a carrier rack having a notched support surface arranged substantially horizontal,
- (b) a pick-up rack having a notched support surface arranged substantially horizontal and substantially parallel to the carrier rack,
- (c) means for providing a first one of the racks with a reciprocating horizontal travel of a fixed stroke,
- (d) means for providing the other rack with a reciprocating horizontal travel with a fixed but adjustable stroke which is substantially 180° out of phase with the first of said racks,

(e) means for providing both racks with a reciprocating vertical travel of a fixed stroke with the two racks being moved simultaneously 180° out of phase with each other,

the horizontal and vertical movement of each rack being such that it moves along an elliptical path and stock lying on the racks is rotated as it is moved along the bank,

characterised in that the means for providing said other rack with a reciprocating horizontal travel includes

- (1) a rotatable drive shaft,
- (2) an inner member rigidly secured to the drive shaft and eccentrically mounted with respect thereto,
- (3) an outer member eccentrically mounted on the inner member and rotatable with respect to the inner member, and
- (4) means for rigidly connecting the inner and outer members together at a selected one of a number of angular positions of the outer member with respect to the inner member whereby the stroke of the horizontal travel of the said other rack is adjustable between predetermined limits.

2. A turn-over cooling bank as claimed in claim 1, characterised in that the outer member has a flange which

-9-

overlies part of the edge of the inner member, said flange and said overlaid part of the inner member being provided with apertures which are alignable at said angular positions and bolts passing through said aligned apertures to secure the inner and outer members together.

3. A turn-over cooling bank as claimed in claim 1 or 2, characterised in that said outer member carries a roller race supporting an arm connected to said other rack.

4. A turn-over cooling bank as claimed in any preceding claim, characterised in that there are a plurality of carrier racks and a plurality of pick-up racks, the racks being arranged in spaced-apart interdigitated relation and the carrier racks being connected together for simultaneous movement of the pick-up racks being connected together for simultaneous movement.

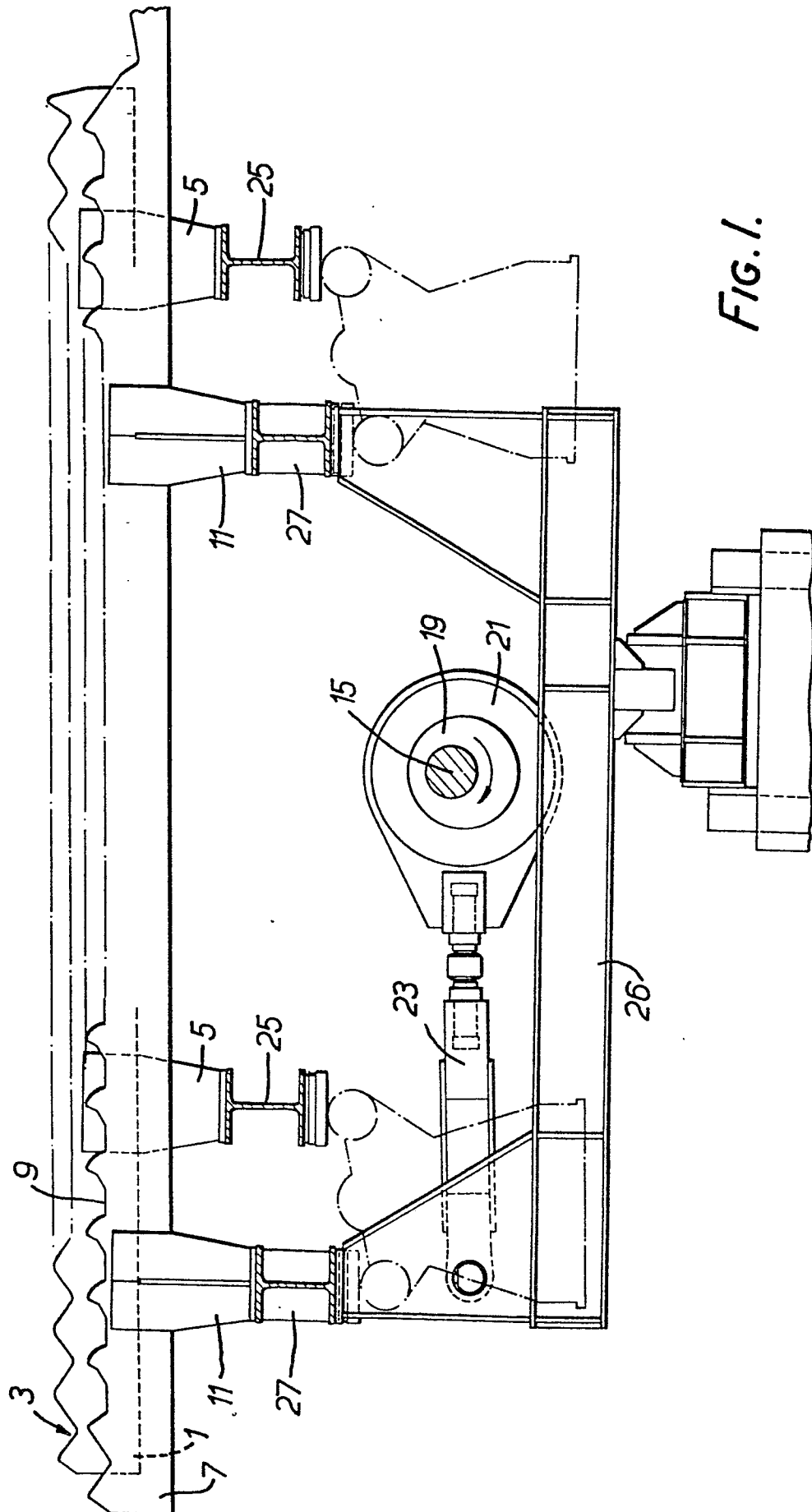


FIG. 1.

2/7

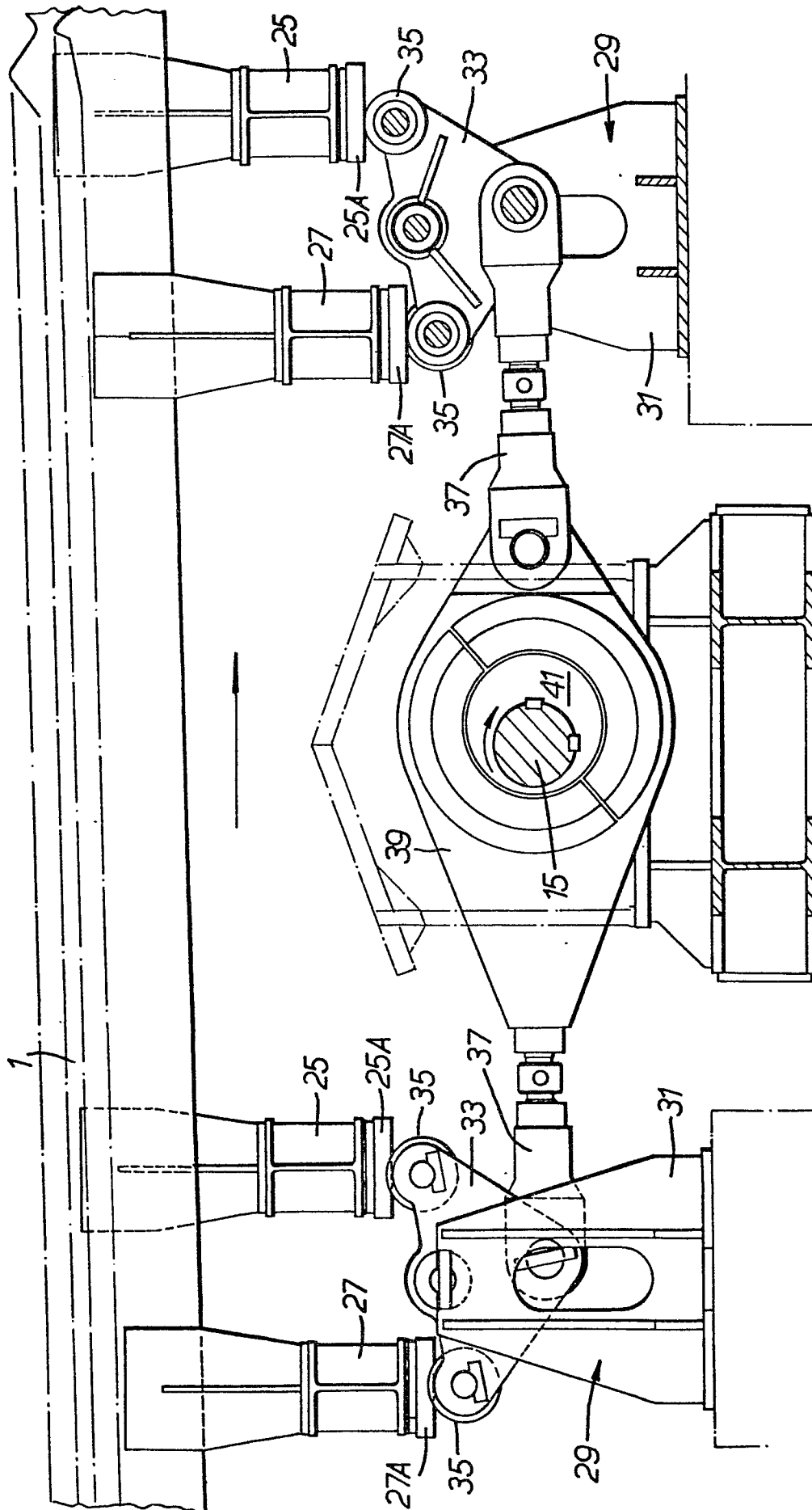


FIG. 2.

3/7

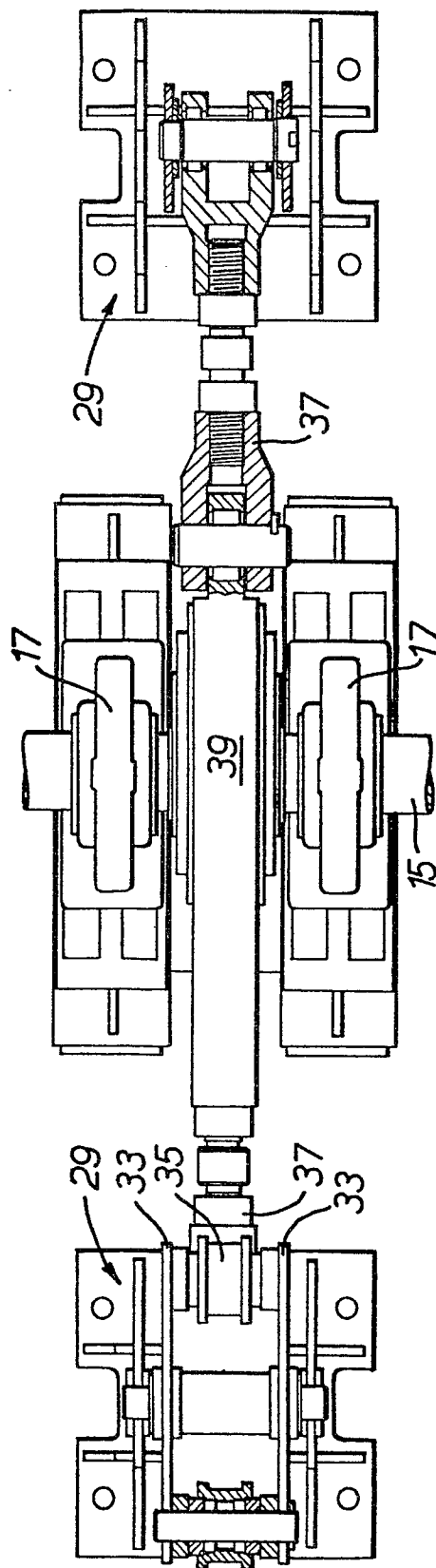


FIG. 3.

4/7

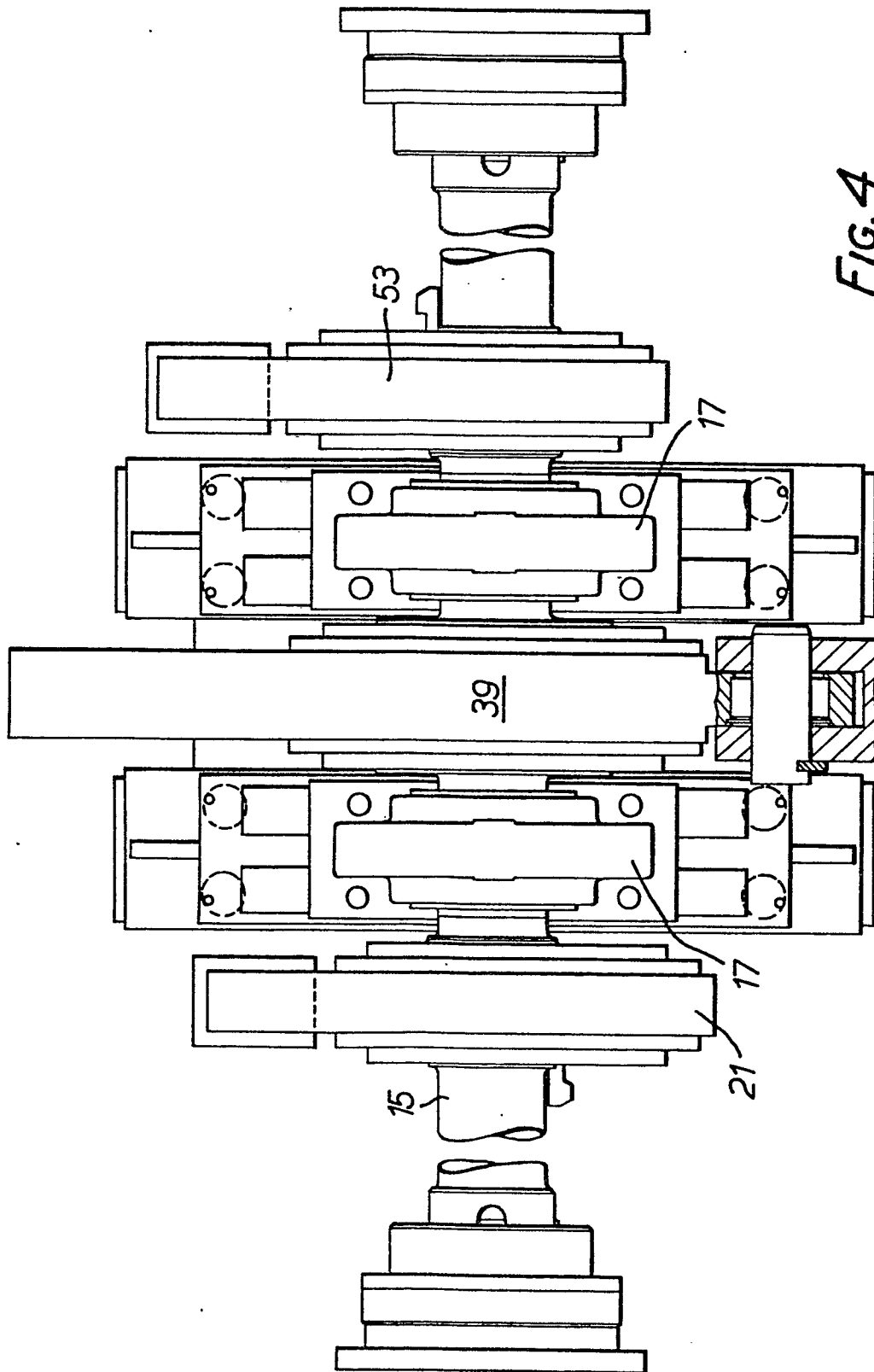


FIG. 4.

5/7

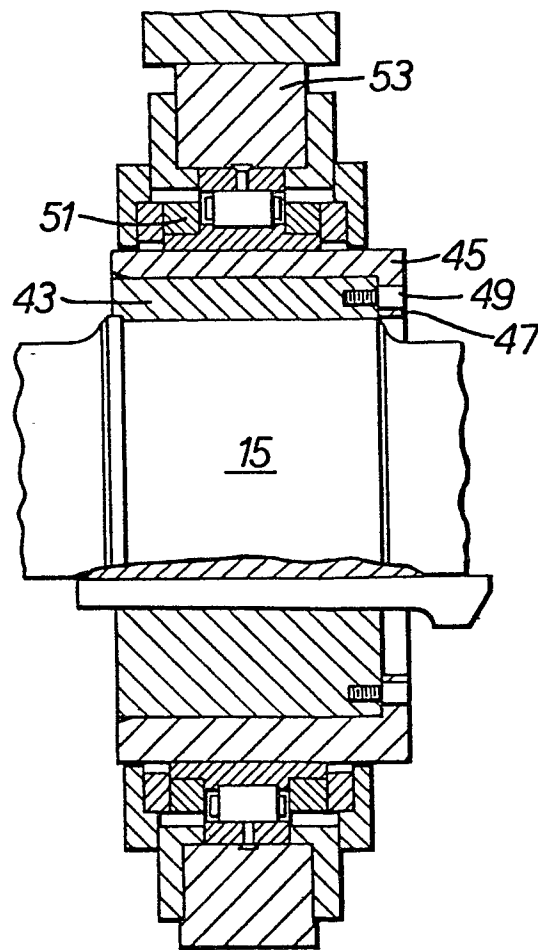


FIG. 5.

6/7

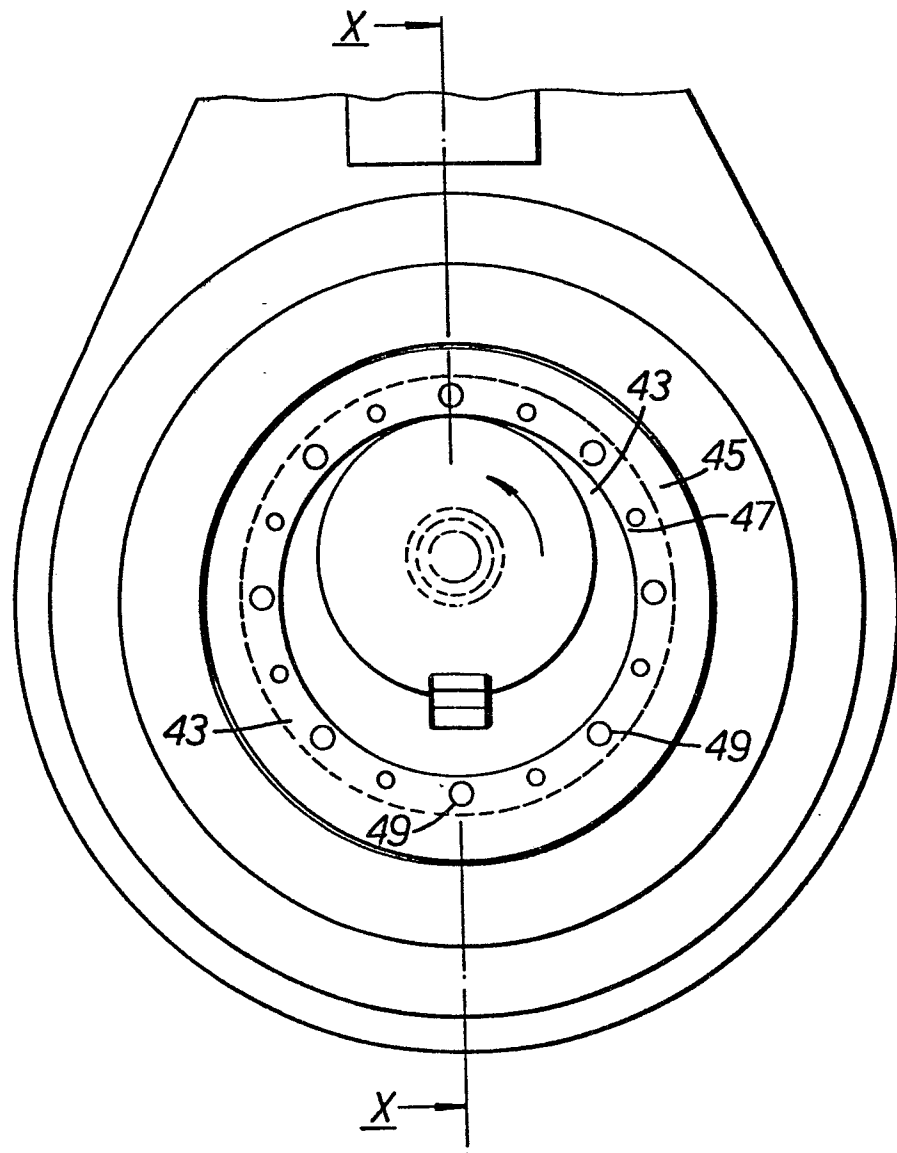


FIG. 6.

7/7

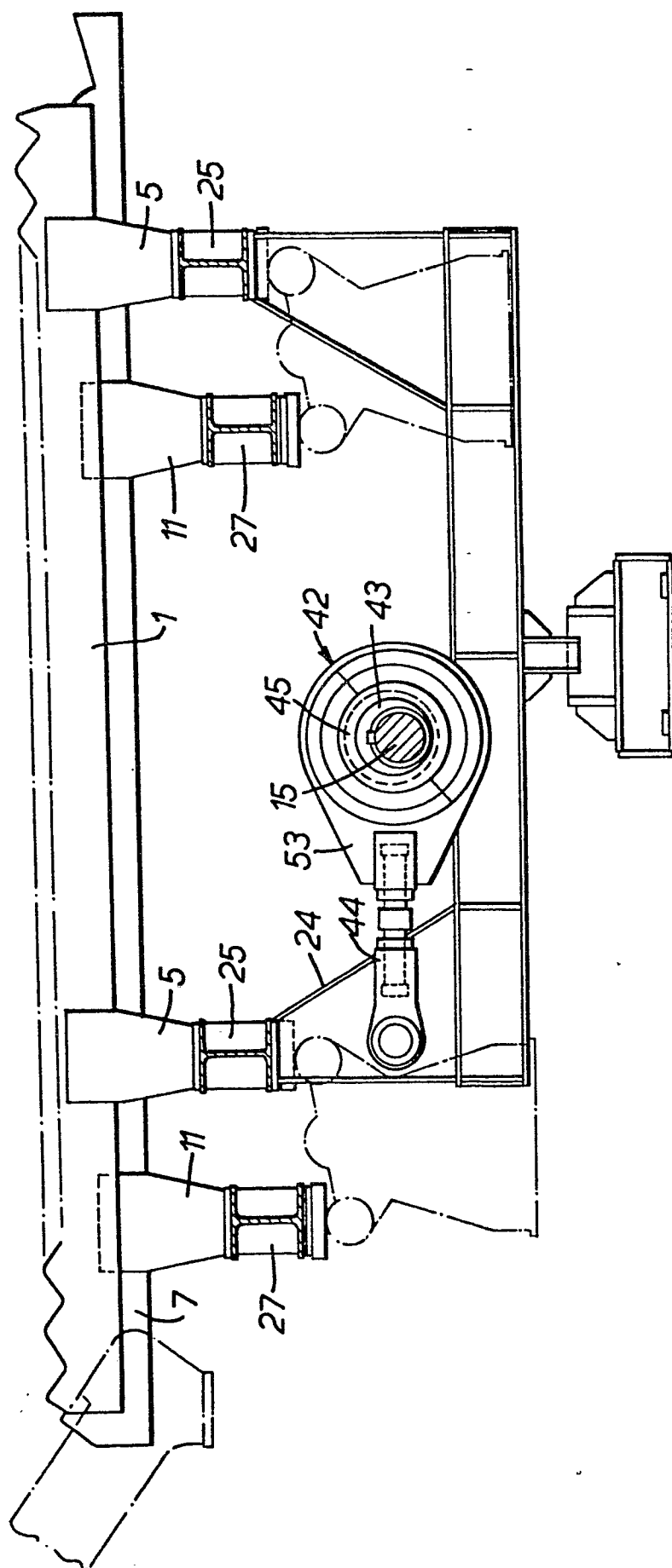


FIG. 7.

0023147



European Patent
Office

EUROPEAN SEARCH REPORT

Application number
EP 80 30 2461

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>DE - A - 1 427 897 (HOESTEMBERGHE)</u> * Page 3; claims 1-3; figure 10 * --	1,3,4	B 21 B 43/02
	<u>BE - A - 502 916 (MOELLER)</u> * Page 3, lines 9-30; figures 1-4 * --	1	
	<u>GB - A - 661 337 (MOELLER)</u> * Claim 1; figures 1-2 * & BE - A - 490 372 --	2	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
	<u>FR - A - 2 255 113 (MANNESMANN)</u> * Claims 1,3 * --	1,4	B 21 B B 65 G
A	<u>FR - A - 2 300 631 (DEMAG)</u> * Page 1, lines 18-25; claim 1; figure 2 * --	1,3,4	
A	<u>FR - A - 497 042 (SOC. ETUDES)</u> * Figure 1 * ----	1,4	CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
☒ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	27-10-1980	VERMEESCH	