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(71) Applicant: **Setmasters Limited**
Lymington, Hampshire SO41 8JD (GB)

(72) Inventor:
Van den Ouden, Jacob Wijbe
Highcliffe, Dorset BH23 4LB (GB)

(74) Representative:
Lomas, Geoffrey Michael et al
Barker, Brettell & Boutland,
Medina Chambers,
Town Quay
Southampton SO14 7AQ (GB)

Remarks:

Amended claims in accordance with Rule 86 (2)
EPC.

(54) Improvements in or relating to sheet and signature handling apparatus

(57) Figure 2 shows one of four signature dispensing stations 1 of a signature collator, provided with a common signature delivery conveyor 2 for receiving signatures simultaneously at each of the stations 1. Each of the dispensing stations 1 comprises a respective stack holder in the form of guide bars 4, 5 for a stack 6 of signatures.

The base of the stack 6 is supported firstly by a roller 7 extending across substantially the width of the stack, and by lips 8 projecting from the lower ends of bars 4, 5. The guide bars 4, 5 in conjunction with the roller 7 and lips 8 constitute a signature holder, the base of which is open between roller 7 and lips 8 so as to provide access for one of three suction means 11. In effect, the holder has a rectangular aperture in the base thereof defined between roller 7 and lip 8, for access of a suction means 11 and to enable the lowermost signature to be removed from the stack.

In operation a suction cup 16 is projected into engagement with the lower surface 21 of the bottom signature 20 in the stack 6, at a position closely spaced from lip 8. A compression spring, not shown, then helps to draw the suction cup 16 radially inwards relative to shaft 12, thereby causing the bottom edge of the lower signature 20 to be snapped clear of the lips 8. The shaft 12 is then caused to be indexed through 120°, vacuum is shut off to the suction cup 16, so allowing the signature 20 to fall onto the delivery conveyor 2.

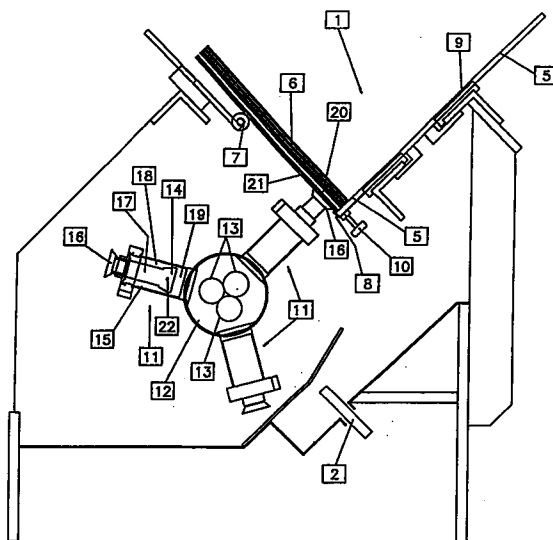


FIG. 2

EP 0 831 044 A1

Description

This invention relates to sheet and signature handling apparatus and particularly, but not exclusively, to signature-collating apparatus.

A signature is sometimes a single sheet of printed matter, but more usually is a folded single printed sheet. A plurality of signatures is assembled together, in the correct order, by a signature collator and is then bound and trimmed to produce a book.

A known kind of signature collator comprises a plurality of signature stack holders spaced-apart in line above a conveyor moving lengthwise of the line. Beneath each stack holder is located a respective rotary picker in the form of a continuously rotating gripper, which engages with the edge of the bottom of the stack to peel the lowermost signature from the stack, and on further rotation to deposit the signature on the conveyor. The conveyor delivers the signatures to a binding machine or stacking device.

A problem with such a signature collator is that damage can be caused to the signatures by the gripper unless the radial position of the blade is very carefully adjusted, and at high speeds damage is more likely to occur.

There is therefore a need for a signature collator which is capable of picking signatures from the bottom of a stack without damaging the signatures and which can operate at high speed if required.

The term signature will be used hereinafter to include a single sheet, which sheet is not necessarily intended for binding as a book.

According to the invention a signature handling apparatus comprises a stack holder adapted to hold a stack of signatures, the holder having an aperture in the base thereof which extends for substantially the full width or length of the base and adjacent to a side edge of the base, suction means adapted to engage with that portion of the underside of the lowermost signature that is exposed by the aperture, and to withdraw the lowermost signature from the stack through the aperture, and to deposit said signature on a delivery means.

The suction means is preferably carried by a rotary suction means carrier which is driven by drive means from a pick-up orientation in which the suction means first engages with said lowermost signature, to a deposit orientation in which said signature is released by the suction means.

The rotary carrier is preferably provided with a plurality of angularly spaced-apart suction means, and most preferably there are three suction means spaced-apart by 120°.

The drive means is preferably an indexing drive means, conveniently an indexing gearbox having a 3 to 1 ratio. The indexing drive means preferably provides smooth acceleration and deceleration.

Alternatively there are four suction means spaced-apart by 90°, and the drive means comprises an index-

ing gearbox having a 4 to 1 ratio.

It will be appreciated that an indexing gearbox having a 3 to 1 ratio may be converted to a 4 to 1 ratio by changing the belt link ratio to effect 4 stops.

Although indexing can be a relatively time consuming operation as compared with the continuous rotation of prior art gripper assemblies, this is compensated for in the inventive apparatus by the relatively short travel distance facilitated by the use of a plurality of angularly-spaced suction means.

The suction means preferably comprises a suction cup driven by a piston and cylinder assembly, the arrangement thereof being such that the suction cup is projected substantially radially of said rotary carrier to engage with said lowermost signature of the stack, and once a suction force with said underside of the lowermost signature has been established, the piston and cylinder assembly begins to withdraw the cup radially inwards of the carrier, to commence withdrawal of the signature from the stack.

The piston and cylinder assembly preferably provides an outer chamber disposed radially therebetween and an inner chamber disposed axially below the said piston, the said assembly comprising an axial passage extending through the suction cup, piston rod and piston and a vacuum connection is provided from the outer chamber to a vacuum/pressure supply tube, the arrangement being such that, in use, the suction cup is projected substantially radially outward when the outer chamber is subjected to a vacuum via the vacuum/pressure supply tube.

Preferably, in use, the vacuum/pressure supply tube provides, via the axial passage, the vacuum force with the underside of the lowermost signature.

The suction means preferably comprises a compression spring disposed within the cylinder and so arranged that, in use, the spring aids the withdrawal of the cup radially inwards.

The margin of that part of the lowermost signature exposed through the aperture is preferably supported by lip means, and the suction force is arranged to be sufficient to snap the margin past the lip means to enable withdrawal of the signature to commence on angular movement of the carrier from the pick-up orientation.

Roller means is preferably provided adjacent to the lip means to assist in guiding downward movement of said portion of the signature as the signature is released by the lip means. It is also preferable that resilient guide strips are provided to assist the said portion of the signature.

A rotary vacuum supply valve is preferably driven by said drive means associated with the rotary carrier, the supply valve controlling supply of vacuum to the respective suction means.

In a signature collator there is preferably a plurality of said signature handling apparatus arranged substantially in line, and comprising a common delivery means comprising a conveyor extending along the line for

receiving signatures from the plurality of stacks.

When the signature collator comprises a plurality of said rotary suction means carries, the carriers are preferably mounted on a common support shaft for rotation together.

In a preferred embodiment the support shaft is tubular and contains supply lines to the respective suction means from the rotary vacuum supply valve.

The rotary vacuum supply valve preferably comprises an outer stationary distributor body and an inner rotatable hub disposed co-axially therewithin in a close-fitting relationship, the outer stationary distributor body is formed with a vacuum port and a pressure inlet port and the inner rotatable hub comprises a plurality of angularly spaced axial bores each axial bore being adapted to be connected to a respective supply tube, the arrangement being such that, in use, rotation of the inner hub first brings each axial bore in turn into communication with the vacuum outlet and then with the pressure inlet.

It is preferable that the vacuum supply valve also comprises an annular distribution bush ring disposed co-axially between the rotatable hub and the outer distributor body, the bush ring being formed with a vacuum through-port and a pressure inlet through-port providing fluid communication between the axial bore and the distributor body vacuum and pressure inlet respectively when the axial bore is in register therewith. The annular bush ring is disposed in close-fitting relationship with both the distributor body and rotatable hub, the position of the bush ring being fixed relative to the outer distributor body.

There may be three equi-angularly spaced vacuum/pressure supply tubes, tappings being made to the supply tubes through apertures provided in the tubular support shaft.

Alternatively there are four equi-angularly spaced vacuum/pressure supply tubes.

The suction means are preferably arranged on the carrier in pairs, the suction means of each pair being spaced-apart in the axial direction of the rotary carrier for simultaneous engagement with the lowermost signature.

A signature collator in accordance with the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic side elevation of the collator,

Figures 2, 3 and 4 are vertical cross-sections through one of the signature dispensing stations of the collator of Figure 1 taken on the line A-A, and showing in sequence different stages of handling a signature,

Figure 5 is a radial view of one of the five rotary suction assemblies,

Figure 6a is a plan view of the stationary distributor body of the rotary vacuum supply valve,

Figure 6b is a vertical side view of the stationary distributor body,

Figure 6c is a cross-section through the stationary distributor body taken on the line B-B,

Figure 7a is a plan view of the rotatable hub,

Figure 7b is a vertical side view of the rotatable hub,

Figure 7c is a cross-section through the rotatable hub taken on the line C-C,

Figure 8a is a plan view of the annular distribution bush ring, and

Figure 8b is a vertical side view of the annular distribution bush ring,

Figure 1 shows four signature dispensing stations 1 of a collator which comprises a common signature delivery conveyor 2 for receiving signatures simultaneously at each of the stations 1, and feeding the signatures to a stacking assembly 3. Each of the dispensing stations 1 comprises a respective stack holder in the form of guide bars 4, 5 for a stack 6 of signatures, the guide bars 4, 5 extending at an angle of approximately 45° to the horizontal, opposed bars 4 being of L-section whereas intermediate bars 5 are flat strip.

The base of the stack is supported firstly by a roller 7 extending across substantially the width of the stack, and by lips 8 projecting from the lower end of bars 4, 5. The lips 8 take the form of a flange which projects beyond the upper surface 9 of the bar 5, the projection being controllable by the screws 10. Similar lips, not shown, are mounted on the vertical limbs of the L-section bars 4 and engage around the sides of the lowermost signature.

The guide bars 4, 5 in conjunction with the roller 7 and lips 8 constitute a signature holder, the base of the holder being open between roller 7 and lips 8 to provide access for the suction means 11 to be described. In effect, the holder has a rectangular aperture in the base thereof defined between roller 7 and lip 8, for access of the suction means and to enable the lowermost signature to be removed from the stack.

Figure 2 shows three equi-angularly spaced suction means 11 provided beneath each stack holder, the suction means 11 being mounted on a tubular shaft 12 rotatably mounted on a horizontal axis. Three parallel vacuum/pressure supply tubes 13 are mounted internally of the shaft 12 to provide manifolds for supplying vacuum to the suction means at the various dispensing stations.

Figure 5 shows that the suction means 11 are, in

fact, provided as three pairs of axially-spaced apart units 11, each pair being carried by a T-shaped arm 25 integral with an annular hub 26.

The hubs 26 are rigidly mounted on shaft 12.

Each suction means 11 is in the form of a piston 14 which is a loose fit in a cylinder 15, a suction cup 16 being carried by a piston rod 17. An axial passage, not shown, extends through the suction cup 16, piston rod 17 and piston 14. A vacuum connection, not shown, is provided from the outer chamber 18 to one of the vacuum pressure supply tubes 13.

When the associated supply tube 13 is subjected to vacuum, so as to apply vacuum to outer chamber 18, the piston 14 is driven outwards by the pressure difference between atmospheric pressure in inner chamber 19 and vacuum in chamber 18, thereby causing the piston rod 17 and suction cup 16 to be projected radially outwards from the shaft 12.

A vacuum supply valve, described later, times the supply of vacuum to chamber 18 so as to cause the suction cup 16 to be projected into engagement with the lower surface 21 of the bottom signature 20 in the stack 6, the suction cup contacting the lower signature 20 at a position closely spaced from lip 8. On contact of the cup with the bottom signature 20, the atmospheric supply to the passage through cup 16 is closed off, and by leakage of vacuum through a small hole 22 in the piston 14, the inner chamber 19 becomes subject to vacuum. This is the stage that has been reached in Figure 2. A compression spring, not shown, mounted on piston rod 17 then helps to draw the piston rod 17 radially inwards relative to shaft 12, thereby causing the bottom edge of the lower signature 20 to be snapped clear of the lip 8, and of the other lips not shown. The shaft 12 is then caused to be indexed through 120° by an indexing gearbox having a 3 to 1 ratio.

Figure 3 shows the suction means 11, which is in contact with the signature 20, in a substantially retracted position and the shaft 12 being rotated by the indexing gearbox.

In Figure 3 the lowermost signature 20 is shown being drawn from the stack as the cup 16 engaged therewith commences the indexing movement. The roller 7 facilitates the progressive withdrawal of the lowermost signature 20 from the stack 6.

Since an indexing gearbox is designed to provide a controlled acceleration and then deceleration to the indexing operation, the signature is subjected to controlled forces during withdrawal. A suitable gearbox is a cam roll unit comprising CAMCO RA series index drives, model numbers 400RA, 401RA, 512RA, 662RA.

Figure 4 shows the operative suction means 11 in a release position at which the vacuum supply valve is timed to shut off the vacuum to the operative suction means 11, so allowing the signature 20 to fall onto the delivery conveyor 2.

The rotary vacuum supply valve will now be described for use with a signature handling apparatus

comprising four suction means spaced-apart by 90°.

Figure 6a, 6b and 6c show the outer stationary distributor body 30 of the rotary vacuum supply valve. The distributor body 30 is a square block formed with a circular bore 32 extending axially through the centre of the body 30, and with a vacuum chamber 36 into which lead two outlet ports 38, 39, and a pressure inlet chamber 34 into which lead two inlet ports 40, 42, the chambers 34 and 36 breaking through the wall of bore 32, but being separated from each other by an arcuate land 30¹.

Figure 7a, 7b and 7c show the inner rotatable hub 50 which is also a part of the rotary vacuum supply valve. The hub 50 comprises a cylindrical tube connector 52 formed internally with four axial bores 56, disposed radially within the hub at substantially 90° spacing. The bores 56 extend from the open end 54 through substantially the length of the hub. The open end of the bores 56 are each adapted to receive a respective one of the supply tubes 13. In the half of the hub furthest from the open end 54 there is provided first, second, third and fourth radial through-ports 57 disposed angularly around the circumference of the hub at substantially 90° spacings and such that they provide fluid communication respectively with the axial bores 56. At substantially halfway along the length of the hub there is disposed an external annular ring 58.

Figures 8a and 8b show the distributor bush 60 which is a further part of the rotary vacuum supply valve. The bush 60 comprises an annular ring 62 comprising a vacuum through-port 64 and a pressure inlet through-port 66.

When the various parts of the rotary vacuum supply valve are assembled the bush 60 is disposed co-axially within the bore 32 such that the vacuum through-port 64 aligns with the vacuum chamber 36, and the pressure inlet through port 66 aligns with the pressure inlet chamber 34. The inner rotatable hub 50 is disposed co-axially within the bush 60 in a close-fitting relationship and the annular ring 58 abuts the outer surface of the distributor body 30. A housing closure plate, not shown, is secured to the left hand end, in figure 6b, of the housing, to close chambers 34 and 36.

The hub 50 is disposed within the bush 60 such that when the hub is rotated the first, second, third and fourth through ports 57 each come into register in turn with the vacuum outlet through port 64 and subsequently with the pressure inlet through port 66.

In use the hub 50 is rotated by the shaft 12 which is rotated by the indexing gear box. As the hub 50 rotates, each of the bores 56 is connected in turn with the vacuum chamber 36, so providing a vacuum condition to the respective suction cup supply tube 13, and subsequently with the inlet pressure, so providing a pressurised condition to the respective suction cup supply tube 13.

Claims

1. A signature handling apparatus comprising a stack holder adapted to hold a stack of signatures (6), characterised in that the holder (4, 5, 7, 8) has an aperture in the base thereof which extends for substantially the full width or length of the base and adjacent to a side edge of the base, and suction means (11) adapted to engage with that portion of the underside of the lowermost signature (20) that is exposed by the aperture, to withdraw the lowermost signature (20) from the stack through the aperture, and to deposit said signature on a delivery means (2). 5
2. Apparatus as claimed in claim 1, wherein the suction means (11) is carried by a rotary suction means carrier which is driven by drive means from a pick-up orientation in which the suction means first engages with said lowermost signature (20), to a deposit orientation in which said signature is released by the suction means (11). 10
3. Apparatus as claimed in claim 2, wherein the rotary suction means carrier is provided with a plurality of angularly spaced-apart suction means. 15
4. Apparatus as claimed in claim 3, wherein three suction means (11) are provided, angularly spaced-apart by 120°. 20
5. Apparatus as claimed in claim 2, 3 or 4, wherein said drive means comprise indexing drive means. 25
6. Apparatus as claimed in claim 5, wherein said indexing drive means comprise an indexing gearbox. 30
7. Apparatus as claimed in claim 6, wherein said indexing gearbox has a 3 to 1 ratio. 35
8. Apparatus as claimed in claim 3 wherein four suction means (11) are provided, angularly spaced-apart by 90°. 40
9. Apparatus as claimed in claim 3 wherein said drive means comprise an indexing gearbox having a 4 to 1 ratio. 45
10. Apparatus as claimed in any one of claims 1 to 9, wherein the suction means (11) comprise a suction cup (16) driven by a piston rod (17) piston (14) and cylinder (15) assembly, the suction cup (16) projecting substantially radially of said rotary suction means carrier so as to engage with said lowermost signature (20) of the stack (6) and, once a suction force with said underside of the lowermost signature (20) has been established, the piston rod (17), piston (14) and cylinder (15) assembly is operable to withdraw the cup (16) radially inwards of the suction means carrier, in order to commence withdrawal of the signature (20) from the stack (6). 50
11. Apparatus as claimed in claim 10 wherein the piston rod (17), piston (14) and the cylinder (15) assembly provides an outer chamber (18) disposed radially between said piston rod (17) and cylinder (15) and an inner chamber (19) disposed axially below the said piston rod (17) and piston (14), the said piston rod (17), piston (14) and cylinder (15) assembly comprises an axial passage extending through the suction cup (16), piston rod (17) and piston (14) and a vacuum connection is provided from the outer chamber (18) to the vacuum/pressure supply tube (13), the arrangement being such that, in use, the suction cup (16) is projected substantially radially outward when the outer chamber (18) is subjected to a vacuum via the vacuum/pressure supply tube (13). 55
12. Apparatus as claimed in claim 11 wherein the suction force with said underside of the lowermost signature (20) is provided by the vacuum/pressure supply tube (13) via the axial passage through the suction cup (16).
13. Apparatus as claimed in claim 12 wherein the suction means (11) comprises a compression spring providing a means to aid the withdrawal of the cup (16) radially inwards.
14. Apparatus as claimed in any one of claims 1 to 13, wherein the margin of that part of the lowermost signature (20) exposed through said aperture is supportable by lip means (8), the suction force being sufficient to snap said margin past the lip means (8) so as to enable withdrawal of the signature (20).
15. Apparatus as claimed in any one of claims 9 to 14, provided with roller means adjacent to the lip means so as to assist in guiding downward movement of said portion of the underside (21) of the signature (20) as the signature is released from the lip means (8).
16. Apparatus as claimed in any one of claims 2 to 15, provided with a rotary vacuum supply valve (30, 50, 60) driven by said drive means, the supply valve (30, 50, 60) being operable to control supply of vacuum to the suction means.
17. A signature collator comprising a plurality of signature handling apparatus, each as claimed in any one of claims 1 to 16, arranged substantially in line, and a conveyor (2) extending along the line, opera-

ble to receive signatures from said plurality.

18. A signature collator as claimed in claim 17, provided with a plurality of said rotary suction means carriers, mounted on a common support shaft for rotation together. 5
19. A signature collator as claimed in claim 18 wherein the common support shaft (12) is tubular and contains supply lines to the respective suction means from a rotary vacuum supply valve, the supply lines being in the form of equi-angularly spaced vacuum/pressure supply tubes (13), tappings being made to the supply tubes through apertures provided in the tubular support shaft (12). 10 15
20. A signature collator as claimed in claim 17, 18 or 19 wherein pairs of said suction means (11) are mounted on each rotary suction means carriers, the suction means (11) of each pair being spaced-apart in the axial direction of said rotary suction means carrier for simultaneous engagement with the lowermost signature (20). 20
21. A signature collator as claimed in claim 17, or any of claims 18 to 20 as appended to claim 17, in which the rotary vacuum supply valve comprises an outer stationary distributor body and an inner rotatable hub disposed co-axially therewithin in a close-fitting relationship, the outer stationary distributor body is formed with a vacuum outlet port and a pressure inlet port and the inner rotatable hub comprises a plurality of angularly spaced axial bores each axial bore being adapted to be connected to a respective supply tube, the arrangement being such that, in use, rotation of the inner hub first brings each axial bore in turn into communication with the vacuum outlet and then with the pressure inlet. 25 30 35 40

Amended claims in accordance with Rule 86(2) EPC.

1. A signature handling apparatus comprising a stack holder adapted to hold a stack of signatures (6), the holder (4, 5, 7, 8) housing an aperture in the base thereof which extends for substantially the full width or length of the base and adjacent to a side edge of the base, and suction means (11) adapted to engage with that portion of the underside of the lowermost signature (20) that is exposed by the aperture, to withdraw the lowermost signature (20) from the stack through the aperture, and to deposit said signature on a delivery means (2), characterised in that the suction means (11) comprise a suction cup (16) driven by a piston rod (17) piston (14) and cylinder (15) assembly, the suction cup (16) projecting substantially radially of said rotary suc- 45 50 55

tion means carrier so as to engage with said lowermost signature (20) of the stack (6) and, once a suction force with said underside of the lowermost signature (20) has been established, the piston rod (17), piston (14) and cylinder (15) assembly is operable to withdraw the cup (16) radially inwards of the suction means carrier, in order to commence withdrawal of the signature (20) from the stack (6).

2. Apparatus as claimed in claim 1, wherein the piston rod (17), piston (14) and the cylinder (15) assembly provides an outer chamber (18) disposed radially between said piston rod (17) and cylinder (15) and an inner chamber (19) disposed axially below the said piston rod (17) and piston (14), the said piston rod (17), piston (14) and cylinder (15) assembly comprises an axial passage extending through the suction cup (16), piston rod (17) and piston (14) and a vacuum connection is provided from the outer chamber (18) to the vacuum/pressure supply tube (13), the arrangement being such that, in use, the suction cup (16) is projected substantially radially outward when the outer chamber (18) is subjected to a vacuum via the vacuum/pressure supply tube (13).

3. Apparatus as claimed in claim 2 wherein the suction force with said underside of the lowermost signature (20) is provided by the vacuum/pressure supply tube (13) via the axial passage through the suction cup (16).

4. Apparatus as claimed in claim 1, 2 or 3, wherein the suction means (11) comprises a compression spring providing a means to aid the withdrawal of the cup (16) radially inwards.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the margin of that part of the lowermost signature (20) exposed through said aperture is supportable by lip means (8), the suction force being sufficient to snap said margin past the lip means (8) so as to enable withdrawal of the signature (20).

6. Apparatus as claimed in any one of claims 1 to 5, wherein the suction means (11) is carried by a rotary suction means carrier (26) which is driven by drive means (12) from a pick-up orientation in which the suction means first engages with said lowermost signature (20), to a deposit orientation in which said signature is released by the suction means (11).

7. Apparatus as claimed in claim 6, wherein the rotary suction means carrier is provided with a plurality of angularly spaced-apart suction means.

8. Apparatus as claimed in claim 7, wherein three suction means (11) are provided, angularly spaced-apart by 120°.

9. Apparatus as claimed in claim 6, 7 or 8, wherein said drive means comprise indexing drive means. 5

10. Apparatus as claimed in claim 9, wherein said indexing drive means comprise an indexing gearbox. 10

11. Apparatus as claimed in claim 10, wherein said indexing gearbox has a 3 to 1 ratio.

12. Apparatus as claimed in claim 6, wherein four suction means (11) are provided, angularly spaced-apart by 90°. 15

13. Apparatus as claimed in claim 6, wherein said drive means comprise an indexing gearbox having a 4 to 1 ratio. 20

14. Apparatus as claimed in any one of claims 5 to 13, provided with roller means (7) adjacent to the lip means (8) so as to assist in guiding downward movement of said portion of the underside (21) of the signature (20) as the signature is released from the lip means (8). 25

15. Apparatus as claimed in any one of claims 6 to 14, provided with a rotary vacuum supply valve (30, 50, 60) driven by said drive means (12), the supply valve (30, 50, 60) being operable to control supply of vacuum to the suction means (11). 30

16. A signature collator comprising a plurality of signature handling apparatus, each as claimed in any one of claims 1 to 15, arranged substantially in line, and a conveyor (2) extending along the line, operable to receive signatures from said plurality. 35 40

17. A signature collator as claimed in claim 16, provided with a plurality of said rotary suction means carriers, mounted on a common support shaft for rotation together. 45

18. A signature collator as claimed in claim 16, wherein the common support shaft (12) is tubular and contains supply lines to the respective suction means from a rotary vacuum supply valve, the supply lines being in the form of equi-angularly spaced vacuum/pressure supply tubes (13), tapplings being made to the supply tubes through apertures provided in the tubular support shaft (12). 50 55

19. A signature collator as claimed in claim 16, 17 or 18, wherein pairs of said suction means (11) are mounted on each rotary suction means carriers, the

suction means (11) of each pair being spaced-apart in the axial direction of said rotary suction means carrier for simultaneous engagement with the lowermost signature (20).

20. A signature collator as claimed in claim 16, or any of claims 17 to 19 as appended to claim 16, in which the rotary vacuum supply valve comprises an outer stationary distributor body and an inner rotatable hub disposed co-axially therewithin in a close-fitting relationship, the outer stationary distributor body is formed with a vacuum outlet port and a pressure inlet port and the inner rotatable hub comprises a plurality of angularly spaced axial bores each axial bore being adapted to be connected to a respective supply tube, the arrangement being such that, in use, rotation of the inner hub first brings each axial bore in turn into communication with the vacuum outlet and then with the pressure inlet.

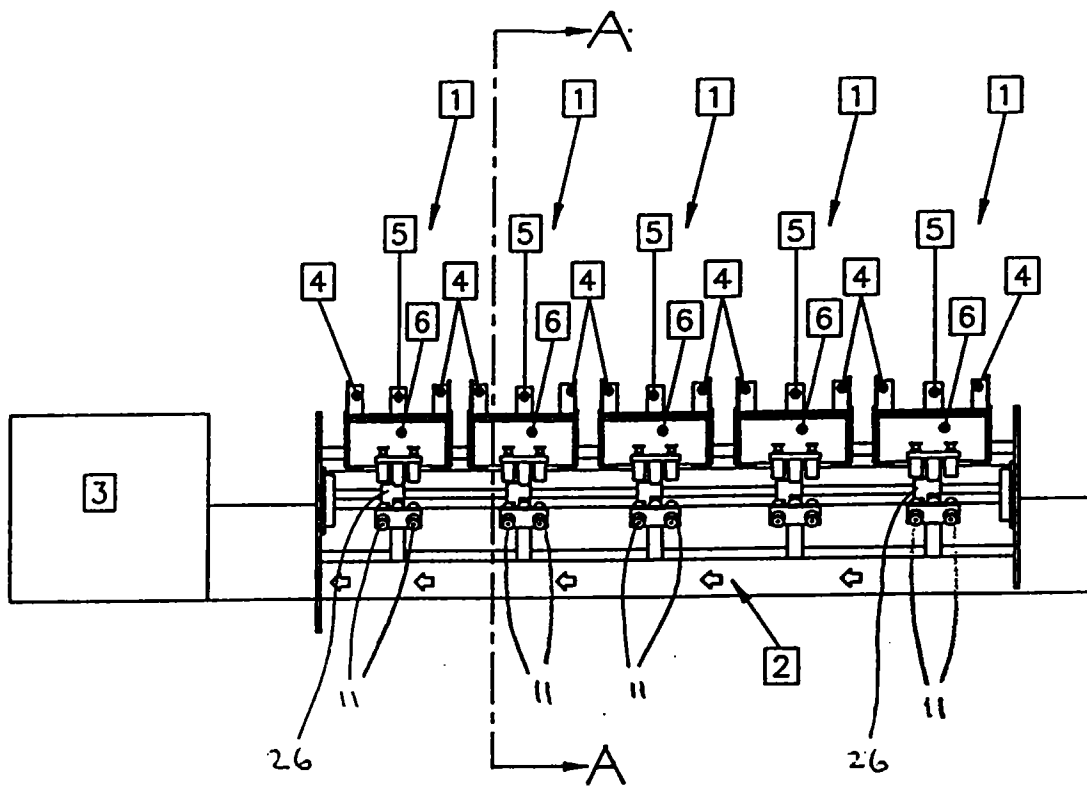


FIG 1

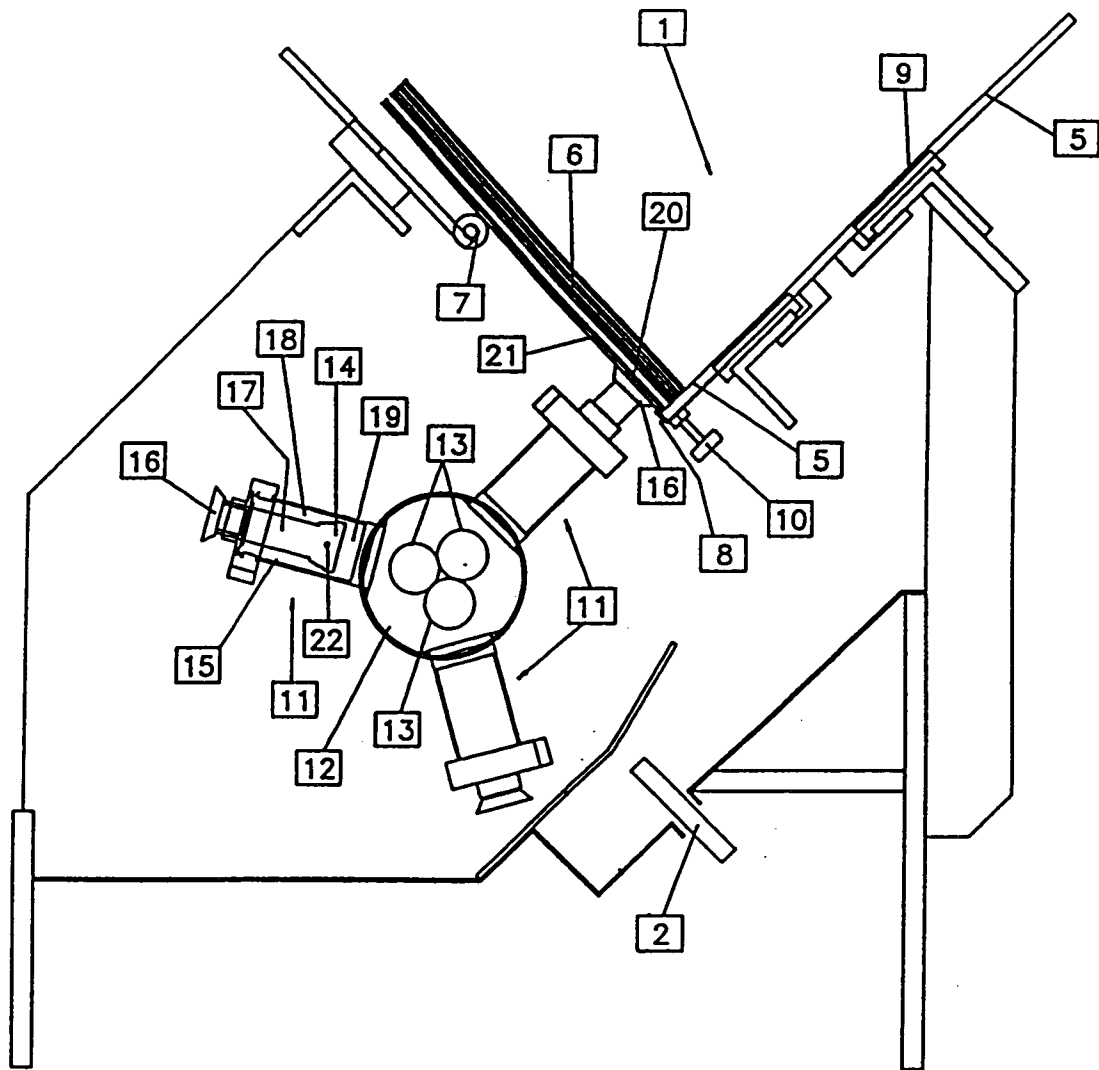


FIG. 2

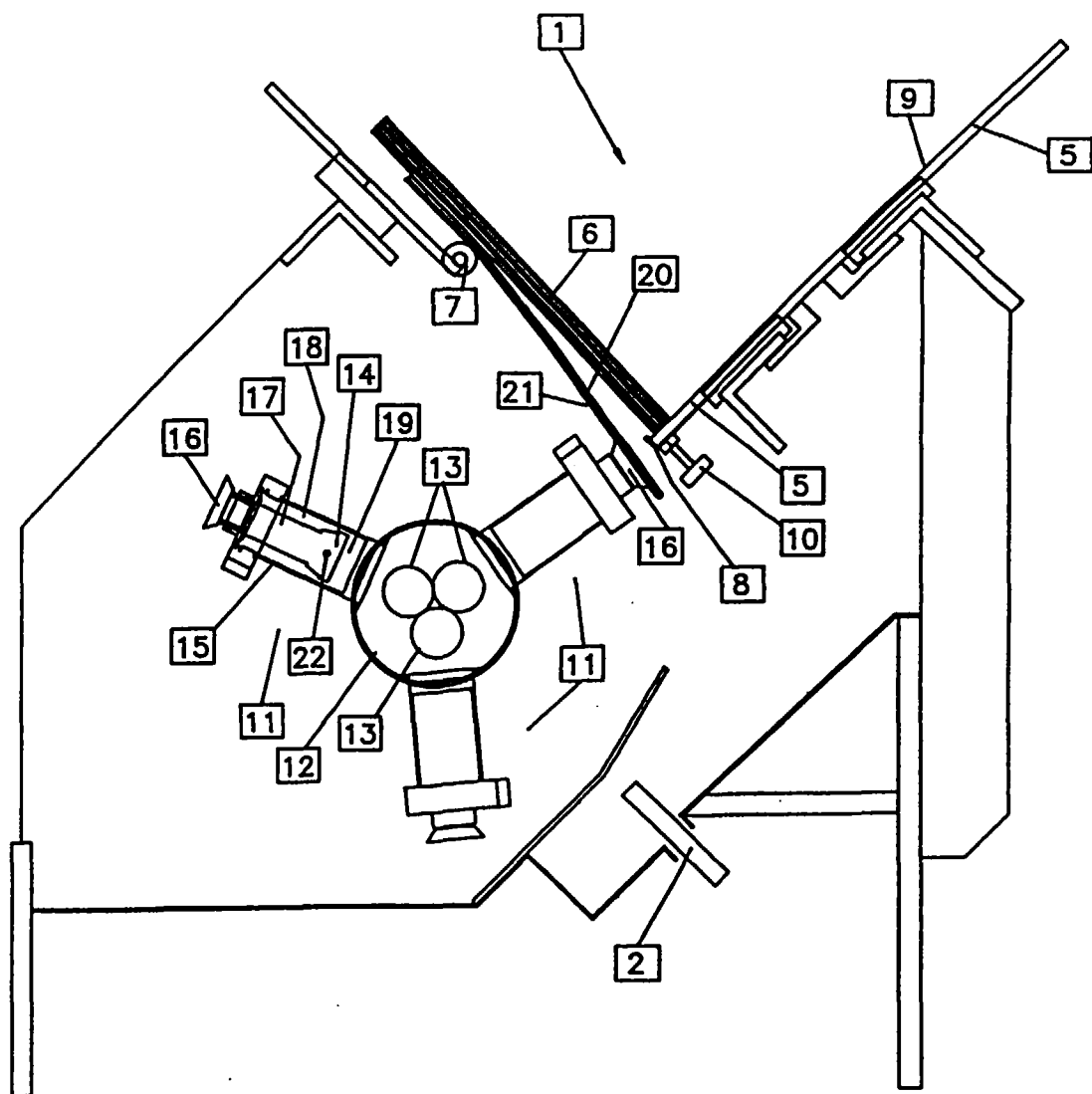


FIG. 3

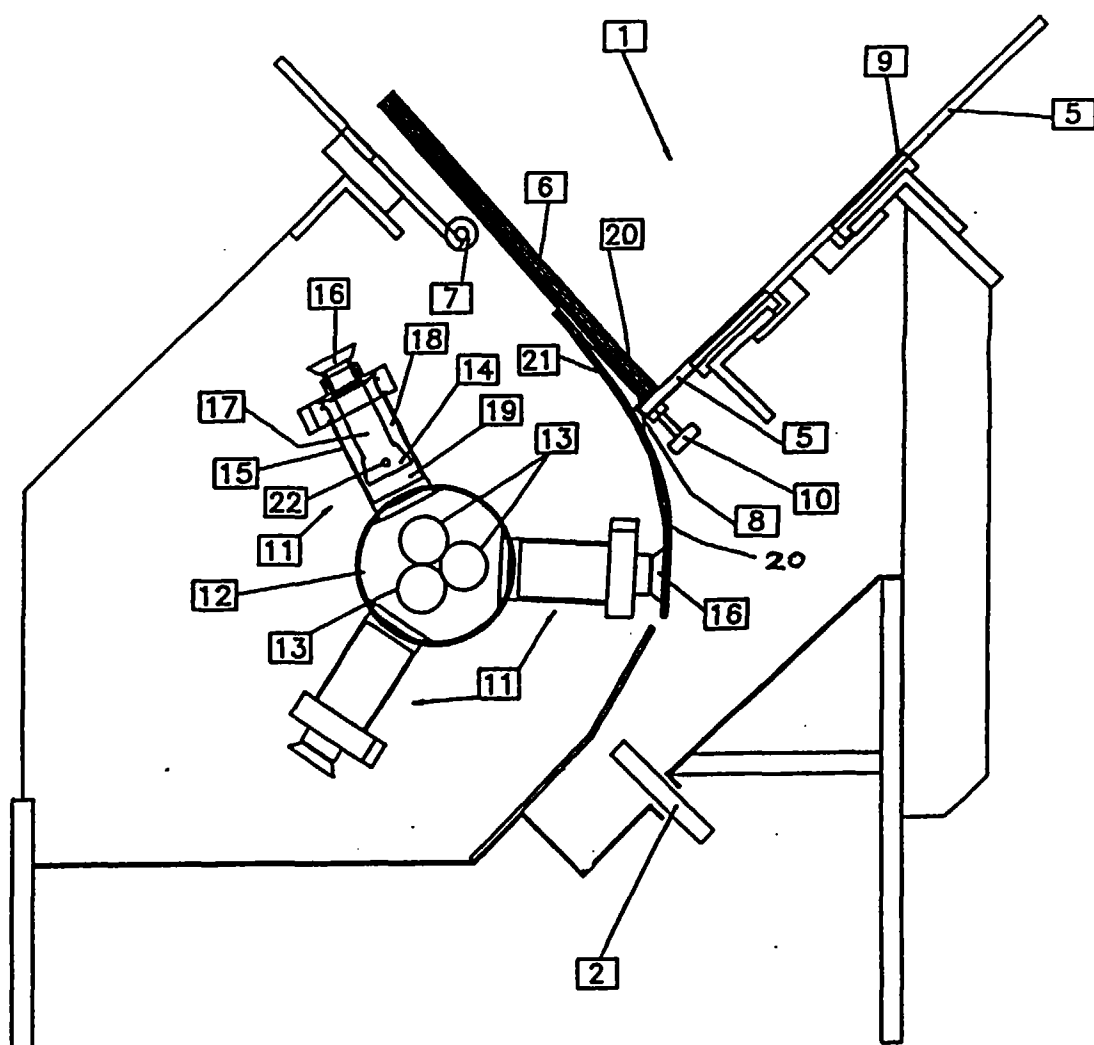


FIG. 4

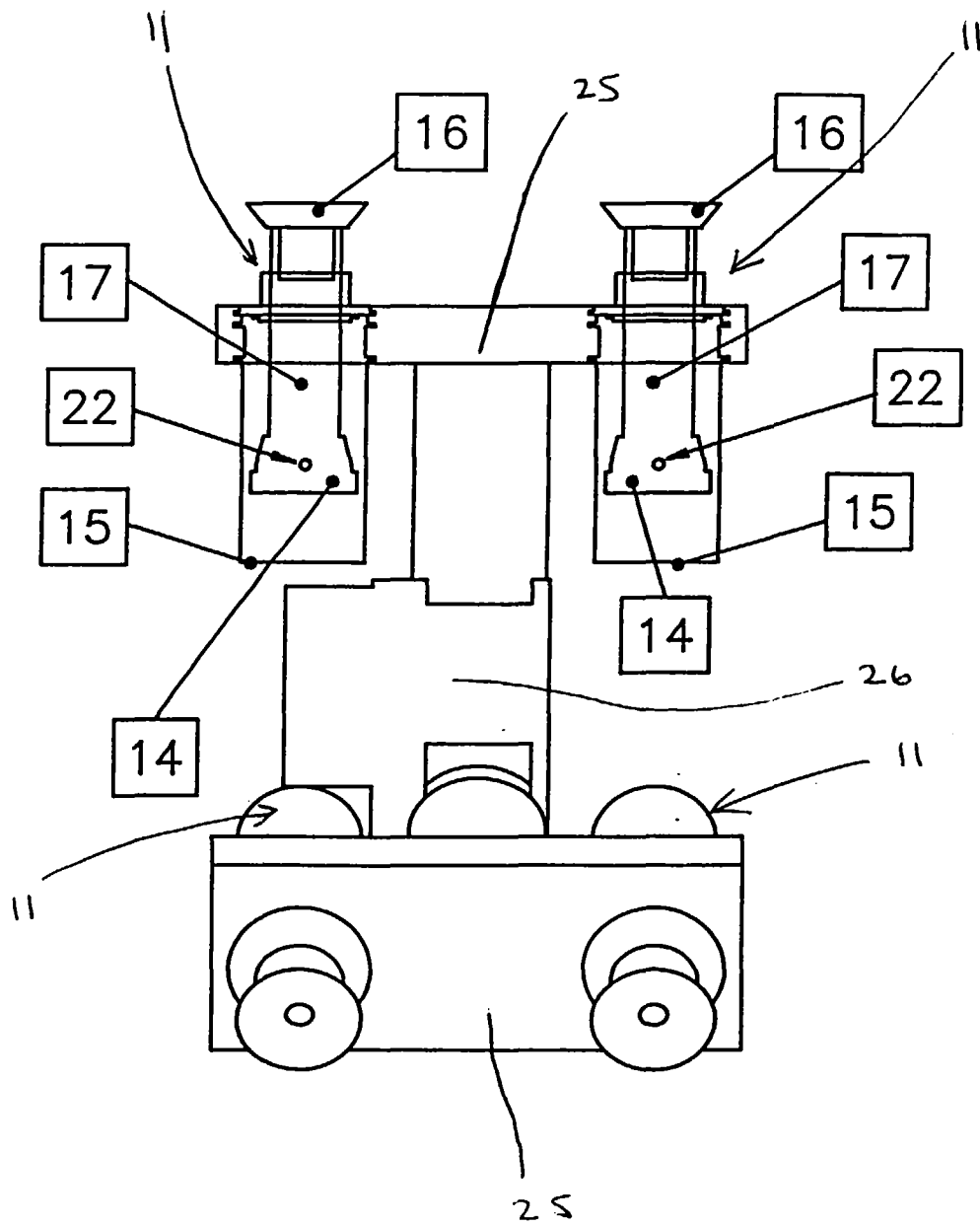


FIG. 5

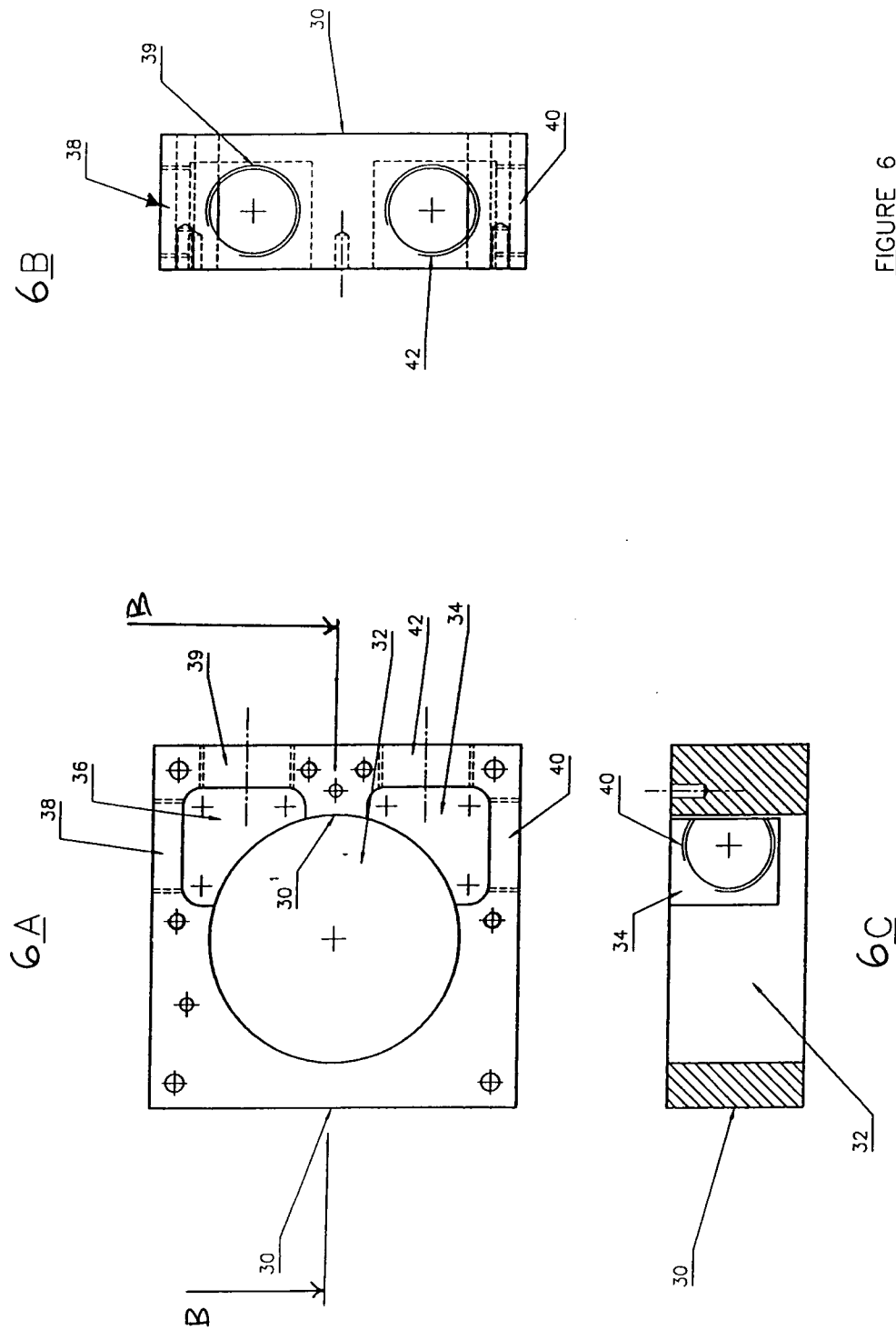


FIGURE 6

DISTRIBUTOR BODY
MATERIAL: AL. ALLOY
FINISH: CLEAN

F:\DRAWINGS\SIGCOL\DEV\96108

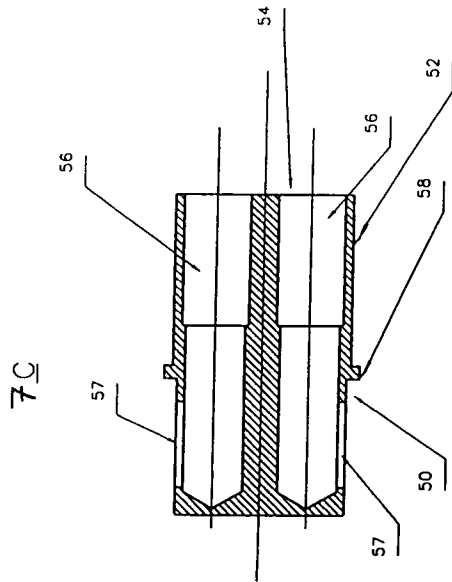
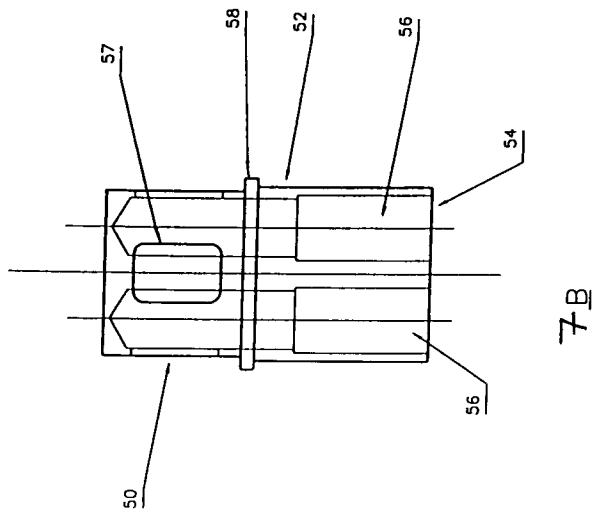
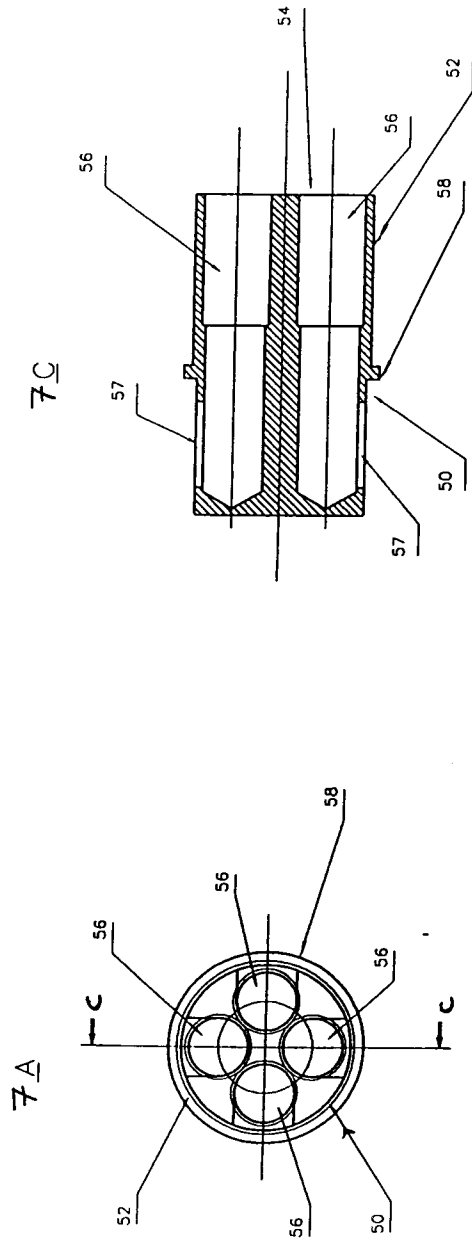


FIGURE 7
HUB
MATERIAL: STEEL
FINISH: CLEAN

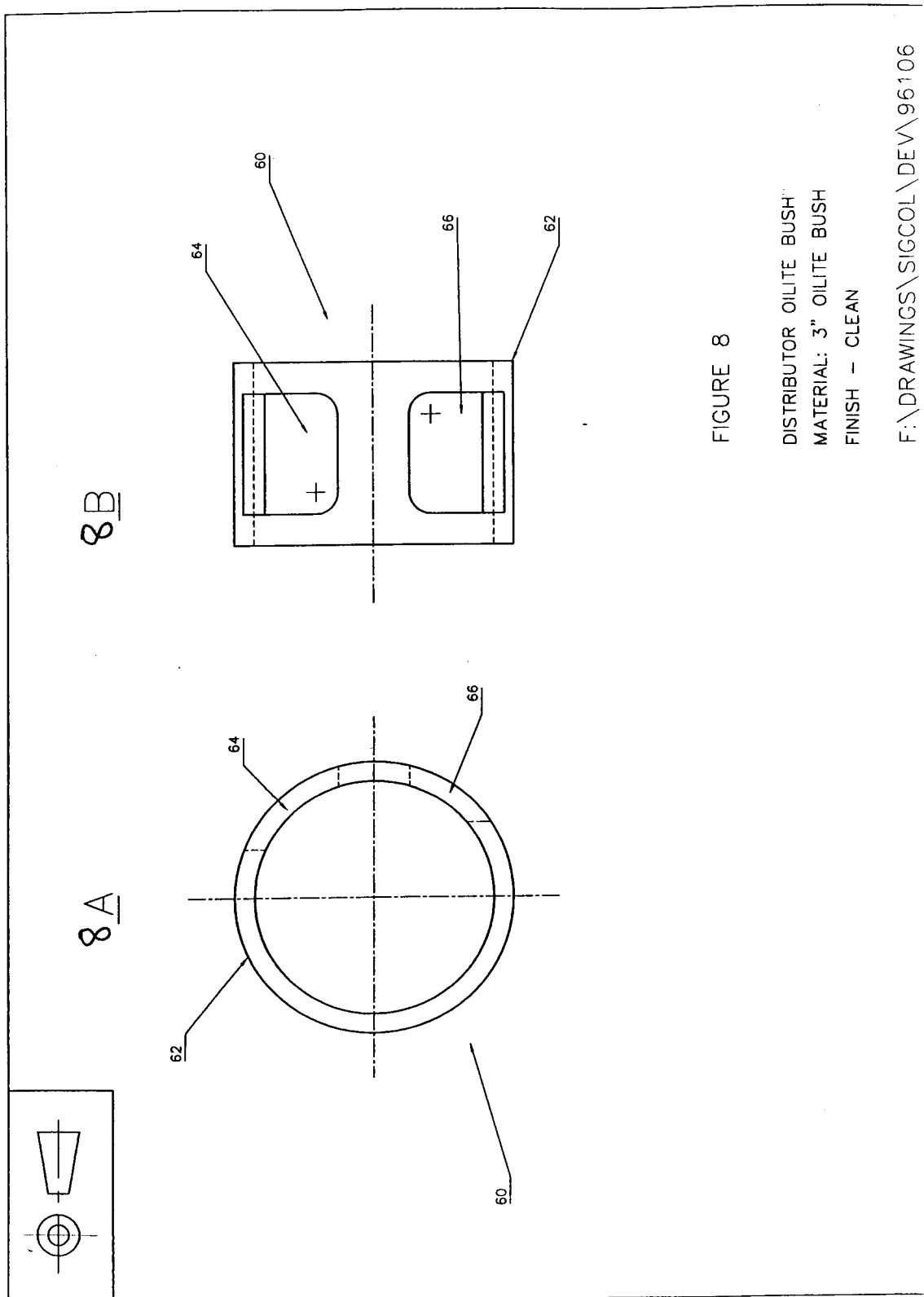


FIGURE 8

DISTRIBUTOR OILITE BUSH
MATERIAL: 3" OILITE BUSH
FINISH - CLEAN

F:\DRAWINGS\SIGCOL\DEV\96106



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 6918

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.6)
X	US 4 350 466 A (BAHR ET EL) * the whole document *	1-3,5,8, 14,16	B65H3/08 B65H3/42 B65H39/043
X	EP 0 543 472 A (HORIZON INTERNATIONAL INC.) * the whole document *	1,2,14, 17	
X	US 5 078 669 A (DIETRICH ET AL) * the whole document *	1-4,14	
X	US 4 588 179 A (T. GUTIERREZ) * the whole document *	1,17,18	
A	DE 25 47 132 A (H.J. LANGEN & SONS LTD.) * page 6, last paragraph - page 11; figures *	5-7,9	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 March 1997	Examiner Raven, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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