



AU9342939

(12) PATENT ABRIDGMENT (11) Document No. AU-B-42939/93
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 668184

- (54) Title
DEVICE FOR PLASTICISING THERMOPLASTIC MATERIAL
- International Patent Classification(s)
(51)⁵ **B02C 004/08 B02C 018/14 B29B 007/48 B29B 017/00**
B29C 047/10
- (21) Application No. : **42939/93** (22) Application Date : **08.06.93**
- (87) PCT Publication Number : **WO93/25312**
- (30) Priority Data
- (31) Number (32) Date (33) Country
1212/92 12.06.92 AT AUSTRIA
- (43) Publication Date : **04.01.94**
- (44) Publication Date of Accepted Application : **26.04.96**
- (71) Applicant(s)
GEORG WENDELIN; HELMUTH SCHULZ; HELMUT BACHER
- (72) Inventor(s)
HELMUT BACHER; HELMUTH SCHULZ; GEORG WENDELIN
- (74) Attorney or Agent
KELVIN LORD & COMPANY , 4 Douro Place, WEST PERTH WA 6005
- (56) Prior Art Documents
WO A1 94/02303
EP A2 239104
EP A2 208290
- (57) Claim

1. Apparatus for plasticizing thermoplastic synthetic plastics material, including a screw (18) bearingly supported within a housing (21), to which screw the material to be plasticized is supplied through a feed opening (16) of the housing (21), said screw conveying the synthetic plastics material to an exit opening (20) for the plasticized synthetic plastics material disposed in axial distance from the feed opening (16), a comminuting means for the synthetic plastics material being attached to the feed opening (16), which comminuting means includes comminuting tools (8) disposed on two shafts (3,4) which extend parallel to each other and are driven in opposite directions, each of the comminuting tools being provided with teeth (10) acting on the synthetic plastics material supplied between the shafts (3,4), characterised in that the shafts (3,4) are driven with different speeds of revolution, the direction of revolution of the shaft (4) running with greater speed being opposite to the direction of revolution of the screw (18), that the comminuting tools (8) are disposed axially spaced apart from each other on the shafts (3,4), the orbits of the teeth (10) of the comminuting tools (8) of the two shafts (3,4) overlapping each other, when seen in axial direction of the shafts (3,4), and that at least

on the shaft (4) running with greater speed spacer disks (9) having a circular periphery (13) are disposed between neighbouring comminuting tools (8), stationary knives (11) engaging between the comminuting tools (8) of this shaft (4) and extending with their flanks (15) facing the gap between the shafts (3,4) tangentially with respect to the periphery (13) of the spacer disks (9) of this shaft (4).



AU9342939

(51) Internationale Patentklassifikation ⁵ : B02C 18/14, B01F 13/10 B29C 47/10		A1	(11) Internationale Veröffentlichungsnummer: WO 93/25312 (43) Internationales Veröffentlichungsdatum: 23. Dezember 1993 (23.12.93)
(21) Internationales Aktenzeichen: PCT/AT93/00098 (22) Internationales Anmeldedatum: 8. Juni 1993 (08.06.93) (30) Prioritätsdaten: A 1212/92 12. Juni 1992 (12.06.92) AT		(74) Anwälte: BRAUNEISS, Leo usw. ; Landstraße Hauptstraße 50, A-1030 Wien (AT). (81) Bestimmungsstaaten: AU, BR, CA, JP, KR, US, europäisches Patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Veröffentlicht Mit internationalem Recherchenbericht.	
(71) Anmelder (für alle Bestimmungsstaaten ausser US): EREMA ENGINEERING RECYCLING MASCHINEN UND ANLAGEN GESELLSCHAFT M.B.H. [AT/AT], Unterfeldstraße 3, Freinorf, A-4052 Ansfelden (AT). (72) Erfinder; und (75) Erfinder/Anmelder (nur für US) : BACHER, Helmut [AT/AT]; Bruck/Hausleiten 17, A-4490 St. Florian (AT). SCHULZ, Helmut [AT/AT]; Badstraße 20, A-4490 St. Florian (AT). WENDELIN, Georg [AT/AT]; Waldbot-henweg 84, A-4033 Linz (AT).		(71) * Helmut Bacher of A - 4490 St Florian Bruck/Hausleiten 17, Austria * Helmut Schulz of A - 4490 St Florian, Badstrasse 20, Austria * Georg Wendelin of A-4033 Linz, Waldbotthenweg 84, Austria	

668184

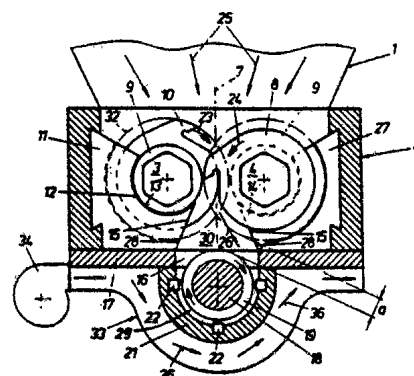


(54) Title: DEVICE FOR PLASTICISING THERMOPLASTIC MATERIAL

(54) Bezeichnung: VORRICHTUNG ZUM PLASTIFIZIEREN VON THERMOPLASTISCHEM KUNSTSTOFFGUT

(57) Abstract

A device for plasticising thermoplastic material, especially waste, has a plasticizing worm (18) carried in a housing (21) into which the material to be plasticised is introduced via an inlet aperture (16). At this inlet aperture (16) there is a masticating device in the form of two parallel shafts (3, 4) arranged parallel to the axis of the worm (18), each of which has a plurality of disc-like masticating tools (8) fitted on it. Between each two adjacent masticating tools (8) there is a circular spacer (9) and fixed upright blades (11) engage in the gap between adjacent masticating tools (8) with their sides (15) tangential to the circumference (13) of the spacers (9). The two shafts (3, 4) are driven at different speeds and their blades formed by the masticating tools (8) masticate the material and press it into the threads of the worm (18). This ensures a reliable construction with good mastication of the material.



(57) Zusammenfassung

Eine Vorrichtung zum Plastifizieren von thermoplastischem Kunststoffgut, insbesondere von Abfällen, hat eine Plastifizierschnecke (18), die in einem Gehäuse (21) gelagert ist und der das zu plastifizierende Kunststoffgut durch eine Einbringeöffnung (16) zugeführt wird. An diese Einbringeöffnung (16) ist eine Zerkleinerungseinrichtung in Form zweier parallel zueinander und parallel zur Achse der Schnecke (18) angeordneter Wellen (3, 4) vorgesehen, von denen jede mit einer Vielzahl von auf sie aufgesetzten scheibenförmigen Zerkleinerungswerkzeugen (8) versehen ist. Zwischen je zwei benachbarten Zerkleinerungswerkzeugen (8) liegt eine kreisförmige Distanzscheibe (9) und in die Spalte zwischen einander benachbarten Zerkleinerungswerkzeugen (8) greifen ortsfeste Standmesser (11) ein, deren Flanken (15) tangential zum Umfang (13) der Distanzscheiben (9) verlaufen. Die beiden Wellen (3, 4) sind unterschiedlich schnell angetrieben und ihre von den Zerkleinerungswerkzeugen (8) gebildeten Messer zerkleinern das Kunststoffgut und drücken es in die Gänge der Schnecke (18) ein. Dadurch ergibt sich eine betriebssichere Bauweise mit guter Zerkleinerung des Kunststoffgutes.

Apparatus for plasticizing thermoplastic synthetic plastics material

The invention relates to an apparatus for plasticizing thermoplastic synthetic plastics material, in particular scrap material, comprising a screw bearingly supported within a housing, to which screw the material to be plasticized is supplied through a feed opening of the housing, said screw conveying the synthetic plastic material to an exit opening for the plasticized synthetic plastics material disposed in axial distance from the feed opening, a comminuting means for the synthetic plastics material being attached to the feed opening, which comminuting means comprises comminuting tools disposed on two shafts which extend parallel to each other and preferably parallel to the axis of the screw and are driven in opposite directions, which comminuting tools convey the comminuted synthetic plastics material into the feed opening of the screw housing, each of the comminuting tools being provided with teeth acting on the synthetic plastics material supplied between the shafts.

Within such apparatus there is the problem that the synthetic plastics material which in the most cases is supplied in form of scrap material, must be comminuted but nevertheless must be reliably supplied to the screw without blocking the revolution of the comminuting tools and, respectively, or the screw. The known proposals were not satisfying with this respect.

It is the task of the invention to improve an apparatus of the initially described kind so that the problem mentioned above is solved satisfactory, that means that on the one hand the supplied synthetic plastics material is effectively comminuted and that on the other hand the comminuted synthetic plastics material is reliably taken along by the screw and is plasticized and is discharged through the exit opening without that the shafts carrying the comminuting tools or, respectively, the screw are blocked. The invention solves this task by the features that the shafts are driven with different speeds of revolution, the direction of revolution of the shaft running with greater speed being opposite to the direction of revolution of the screw, that the comminuting tools are disposed axially spaced apart from each other on the shaft, the orbits of the teeth of the comminuting tools of the two shafts overlapping each other, when seen in axial

direction of the shafts, and that at least on the shaft running with greater speed spacer disks having a circular periphery are disposed between neighbouring comminuting tools, stationary filler elements engaging between the comminuting tools of this shaft and extend with their flanks facing the gap between the shafts tangentially with respect to the periphery of the spacer disks of this shaft. The shafts running with different speeds effectively comminute the supplied synthetic plastics material by means of the teeth of the comminuting tools, inasmuch, so to speak, neighbouring comminuting tools frictionally engage each other. Thereby, the comminuted synthetic plastics material is reliably freed from the comminuting tools and is not - as this was frequently
10 the case within the known proposals - conveyed in a circle around the respective shaft. This is also supported by the tangentially extending flank of the stationary knife which, so to speak, strips off the synthetic plastics material elements which have proceeded in radial direction inwardly to the spacer disks from the spacer disks and also from the substantially disk-shaped comminuting tools. Thereby a stuffing component which is directed substantially tangential with respect to the shaft running with greater speed is exerted onto the comminuted synthetic plastics material, which force component tends to press the synthetic plastics material in direction towards the screw and into the revolutions thereof. Particularly favourable results are obtained if these flanks extend also tangentially with respect to the wall of the feed opening, since in such a manner it
20 is ensured that the synthetic plastics material supplied to the screw by the two shafts is continuously taken along.

According to a preferred embodiment of the invention both shafts are provided with circular spacer disks disposed between the disk-like comminuting tools, to which spacer disks the flanks of the stationary knives extend tangentially and symmetrically with respect to the central plane between the two shafts, and preferably those peripheral sections of the stationary knives which adjoin these flanks in direction of revolution of the shafts extend following the periphery of the spacer elements. Thereby

the favourable effects mentioned above are ensured for both shafts of the comminuting means.

Further, investigations have shown that it is favourable to dispose a certain clearance between the two shafts of the comminuting means and the screw. Within the spirit of the invention, such a clearance can be constituted by the feature that the orbit of the tips of the teeth is spaced apart from the periphery of the screw volutions in a distance that amounts to 0.5 to 1.5 times the distance by which the orbit of the teeth tips is spaced apart from the periphery of the spacer disks. Thereby, blockings of the revolving elements are still better avoided.

10 For the purpose to avoid that the comminuted synthetic plastics material taken along by the screw revolves together with the revolving motion of the screw and thereby is not conveyed effectively towards the exit opening, according to a further embodiment of the invention at least in the region of the feed opening protrusions or grooves are provided in the wall of the housing of the screw disposed spaced apart from the periphery of the screw volutions, which protrusions or grooves preferably extend in axial direction of the screw. These protrusions or grooves, respectively, prevent that the synthetic plastics material runs together with the screw.

20 Further features and advantages of the invention can be seen from the description of exemplative embodiments shown schematically in the drawing. Fig.1 shows a longitudinal section through the apparatus. Fig.2 is a cross section taken along the line II - II of Fig.1, in an enlarged scale. Fig.3 shows a variant in top view. Fig.4 shows a further variant taken in a section similar to Fig.2. Figs.5 and 6 each show a further embodiment taken in a section similar to Fig.1.

Within the embodiment according to Figs.1 and 2 the thermoplastic synthetic plastics material to be plasticized, mostly in form of recycling-articles or scrap material, is introduced into the apparatus through a funnel 1. The funnel leads into a housing 2 in which two shafts 3,4 are bearingly supported for rotation around horizontal axes which extend parallel to each other. The two shafts 3,4 are driven in common by a motor 6 via a gear means 5, and this in opposite directions and with different speeds of

revolution, so that the shaft portions neighbouring the central plane 7 (Fig.2) run from ~~below to above~~ ^{above to below}. Each shaft has a hexagonal cross section and comminuting tools 8 in form of toothed disks and circular spacer disks 9 are pinned up on the two shafts alternating with each other. The comminuting tools 8 have a greater diameter than the spacer disks 9 and the arrangement is so chosen that the orbits of the teeth of the comminuting tools 8 overlap each other, when seen in axial direction of the shafts 3,4. Suitably, the orbits of the teeth 10 extend near to the periphery of the spacer disks 9. The lateral surfaces of the comminuting tools 8 and of the spacer disks 9 extend perpendicularly to the axial direction of the shafts 3,4, and these lateral surfaces engage each other so that a stripper effect is exerted onto the synthetic plastics material on all these surfaces. On that side which does not face the respective other shaft 3 or 4, stationary knives 11 extend between neighbouring comminuting tools 8, and the peripheral section 12 of these knives facing the respective shaft 3 or 4 follows the periphery 13 of the circular spacer disk 9. This peripheral section 12 extends at least on the shaft 4 running with greater speed up to a tooth-like protrusion 14, the flank 15 thereof extends tangentially to the periphery 13 of the respective spacer disk 9 and from there towards a feed opening 16 in the bottom 17 of the housing 2, through which opening 16 the comminuted synthetic plastics material reaches a screw 18 which takes along the material by its screw volutions 19 and conveys it towards an exit opening 20 (Fig.1) disposed spaced apart from the feed opening 16 in axial direction, so that the synthetic plastics material is plasticized. Further apparatus known per se, for example filters, extruder plants and the like may be connected to the opening 20.

The direction of revolution of the screw 18 is opposite to the direction of revolution of the shaft 4 running with greater speed. At least in the region of the feed opening 16, the screw 18 or, respectively, its volutions 19 are spaced apart from the housing 21 of the screw. Protrusions 22 are inserted into the wall of that part of this housing 21 which is disposed in the region of the feed opening 16, which protrusions suitably extend in axial direction of the screw 18. These protrusions 22 prevent that the



synthetic plastics material taken along by the screw 18 rotates together with the screw. Instead of protrusions 22, also longitudinal grooves in the housing 21 may be provided. Suitably, the periphery of the screw volutions 19 is flush with the top surface of the bottom 17.

The directions of revolution of the two shafts 3,4 are indicated by arrows 23 or 24, respectively. Each comminuting tool 8 suitably has several teeth 10 from which one single each is shown in Fig.2 for simplification's sake. The teeth 10 catch the synthetic plastics material supplied in the funnel 1 in direction of the arrows 25 between the shafts 3,4 and tear it, which effect is still increased by the different speeds of revolution of the shafts 3,4. Suitably, the ratio of the speeds of revolution of the shafts 3,4 is about 1:2 to 1:5. The shaft 4 running with greater speed imparts to the comminuted synthetic plastics material a component of movement in direction of the arrow 26, what constitutes a stuffing component that tends to press the synthetic plastics material into the volutions of the screw 18. Within this, the flanks 15 of the stationary knives 11 act as guiding surfaces for the synthetic plastics material so that it cannot avoid but is pressed into the feed opening 16. For the purpose to also prevent that the synthetic plastics material can avoid between adjoining stationary knives 11, the gaps between neighbouring disk-shaped stationary knives 11 are filled by filler elements 27 which on their sides facing the shafts 3 or 4 extend up to the periphery or, respectively, to the orbit of the teeth 10 and, as well as the stationary knives 11, rest on the bottom 17. The ends of the filler elements 27 are disposed at the feed opening 16 and have there flanks 28 that are inclined towards the same side as the flanks 15 of the stationary knives 11 and suitably are flush with the flanks 15 of the stationary knives 11.

As it is shown in Fig.2, in the region of the feed opening 16 of the screw 18, its housing 21 is spaced apart from the outer periphery of the volutions 19 so that an annular free space 29 is formed into which protrude the protrusions 22. A further free space is built up above the feed opening 16 by the fact that there is a distance a

between the orbit of the teeth 10 of the two shafts 3,4 and the periphery of the screw
volutions 19, which distance as a rule amounts to 0.5 to 1.5 times the distance
between the orbit 32 of the tips of the teeth 10 and the periphery 13 of the spacer disks
9. This free space avoids blocking of the shafts 3,4 or, respectively, of the screw 18.

As a rule, the synthetic plastics material is substantially heated up during its
comminuting by the comminuting tools 8. In order to avoid an overheating of the
synthetic plastics material in the region of the feed opening 16 and thereby a thermic
damage of the synthetic plastics material or a blocking by glueing by plasticizing within
the comminuting chamber or, respectively, in the screw intake, a cooling means 33
10 may be provided in the region of the feed opening 16, for example a cooling blower 34
that blows cooled air into a cooling channel 35 surrounding the intake housing 21 of
the screw 18, cooling air streaming in this channel in direction of the arrows 36. In
order to ensure plasticizing of the synthetic plastics material, heating devices 37 may
be provided at the outer periphery of the housing 21 of the screw 18 in that region of
the housing which follows the feed opening 16, for example heating bands 38
surrounding the jacket of the housing 21.

The screw is driven by a drive means 39 disposed at that end of the screw
that opposes the exit opening 20.

Suitably, the arrangement of the comminuting tools 28, the spacer disks 9, the
stationary knives 11 and the filler elements 27 is symmetrical with respect to the
20 vertical central plane 9 in order to make the construction easy to survey.

For simplification's sake, in Fig.1 only a few comminuting tools 8 or spacer
disks 9, respectively, are shown. As it can be seen from Fig.3, however, in practice the
number of the comminuting tools 8 forming rotor knives, as a rule is relatively great
and correspondingly great is also the number of the spacer disks 9 or of the stationary
knives or of the filler elements 27, respectively.

Within the embodiment according to Fig.4, the flanks 15 of the stationary
knives 11 extend not only tangentially to the periphery of the spacer disks 9, but also

tangentially with respect to the periphery of the inner wall 45 of the screw housing 21 or to the wall of the feed opening 16, respectively. Thereby, the intake of the synthetic plastics material comminuted by the two shafts 3,4 or their comminuting tools 8, respectively, into the volutions of the screw 18 is still further enhanced

10 Within the embodiment according to Fig.5, a common drive means 40 is provided for the screw 18 and for the two shafts 3,4. For this, an elongation 41 of the shaft of the screw 18 is coupled by means of a toothed belt drive 41 to the two shafts 3,4. The necessary ratio of transmission or, respectively, the different speeds of revolution of the shafts 3,4 can be obtained by different number of teeth of the pinions constituting the toothed belt drive 41. Instead of a toothed belt drive also a chain drive means may be used.

 Within the embodiment according to Fig.6 the screw 18 is provided with a tip drive means 42 which, therefore, is disposed at that end of the screw 18 that neighbours the exit opening 20. Within this, in a known manner a section 43 of the screw shaft is provided which follows the exit opening 20 and comprises screw volutions 44, the pitch thereof is opposite to that of the plasticizing screw 18. This section 48 provides for the necessary sealing.

Claims:

The claims defining the invention are as follows:

- 5 1. Apparatus for plasticizing thermoplastic synthetic plastics material, including a screw (18) bearingly supported within a housing (21), to which screw the material to be plasticized is supplied through a feed opening (16) of the housing (21), said screw conveying the synthetic plastics material to an exit opening (20) for the plasticized synthetic plastics material disposed in axial distance from the feed opening (16), a
 10 comminuting means for the synthetic plastics material being attached to the feed opening (16), which comminuting means includes comminuting tools (8) disposed on two shafts (3,4) which extend parallel to each other and are driven in opposite directions, each of the comminuting tools being provided with teeth (10) acting on the synthetic plastics material supplied between the shafts (3,4), characterised in that the shafts (3,4) are driven with
 15 different speeds of revolution, the direction of revolution of the shaft (4) running with greater speed being opposite to the direction of revolution of the screw (18), that the comminuting tools (8) are disposed axially spaced apart from each other on the shafts (3,4), the orbits of the teeth (10) of the comminuting tools (8) of the two shafts (3,4) overlapping each other, when seen in axial direction of the shafts (3,4), and that at least
 20 on the shaft (4) running with greater speed spacer disks (9) having a circular periphery (13) are disposed between neighbouring comminuting tools (8), stationary knives (11) engaging between the comminuting tools (8) of this shaft (4) and extending with their flanks (15) facing the gap between the shafts (3,4) tangentially with respect to the periphery (13) of the spacer disks (9) of this shaft (4).
2. Apparatus according to claim 1, characterised in that the flanks (15) extend also tangentially with respect to the wall (39) of the feed opening (16).
3. Apparatus according to claim 1 or 2, characterised in that both shafts (3,4) are provided with circular spacer disks (9) disposed between the disk-like comminuting tools (8), to which spacer disks the flanks (15) of the stationary knives (11) extend tangentially
 25 and symmetrically with respect to the central plane (9) between the two shafts (3,4).



4. Apparatus according to any of claims 1 to 3, characterised in that the orbit of the outermost portions of the teeth (10) is spaced apart for a distance (a) from the periphery of the screw volutions (19), which distance amounts to 0.5 to 1.5 times the distance for which the orbit of these tooth portions is spaced apart from the periphery of the spacer disks (9).

5. Apparatus according to any of claims 1 to 4, characterised in that filler elements (27) are provided between neighbouring stationary knives (11).

6. Apparatus according to any of claims 1 to 5, characterized in that at least in the region of the feed opening (16) protrusions (22) are provided in that wall of the housing (21) of the screw (18) which is spaced apart from the periphery of the screw volutions (19).

7. Apparatus according to any of the claims 1 to 6, characterised in that at least in the region of the feed opening (16) a cooling device (33), is associated to the housing (21) of the screw (18).

8. Apparatus according to any of claims 1 to 7, characterised in that at least in that region of the screw (18) which neighbours the exit opening (20), a heating device (37), is associated to the housing (21) of the screw (18).

9. Apparatus according to any of claims 1 to 8, characterised in that the screw (18) and the two shafts (3,4) are driven by a common drive means (40) (Fig.5).

10. Apparatus according to any one of the preceding claims characterised in that the thermoplastic synthetic plastics material is a synthetic plastics scrap material.

11. Apparatus according to any one of the preceding claims characterised in that the two shafts (3,4) which extend parallel to each other are also parallel to the axis of the screw (18).

12. Apparatus according to any one of the preceding claims characterised in that the comminuting tools (8) convey the comminuted synthetic plastics material into the feeding opening (16) of the screw housing (21).

13. Apparatus according to any one of claims 3 to 12 characterised in that the



peripheral sections of the stationary knives (11) which neighbour these flanks (15) when
 5 seen in direction of revolution of the shafts (3,4) follow the periphery (13) of the spacer
 disks (9).

14. Apparatus according to any one of claims 6 to 13 characterised in that grooves are
 provided instead of protrusions (22).

15. Apparatus according to any one of claims 6 to 14 characterised in that the
 10 protrusions or grooves extend in an axial direction of the screw (18).

16. Apparatus according to any one of claims 7 to 15 characterised in that the cooling
 device (33) is a cooling blower.

17. Apparatus according to any one of claims 8 to 16 characterised in that the heating
 device comprises heating bands engaging the jacket of the housing.

18. Apparatus for plasticising thermoplastic synthetic plastics material substantially as
 15 hereinbefore described with reference to any one of the accompanying drawings.



DATED THIS 22ND DAY OF JANUARY 1996

Adrian King

EREMA ENGINEERING RECYCLING MASCHINEN
 UND ANLAGEN GESELLSCHAFT m.b.H.

By their Patent Attorneys
 KELVIN LORD AND COMPANY
 PERTH, WESTERN AUSTRALIA



Abstract

10 An apparatus for plasticizing thermoplastic synthetic plastics material, in particular scrap material, comprises a plasticizing screw (18) bearingly supported within a housing (21), to which screw the synthetic plastics material to be plasticized is supplied through a feed opening (16). At this feed opening (16) a comminuting means in form of two shafts (3,4) disposed parallel to each other and parallel to the axis of the screw (18) is provided, each of the shafts (3,4) being provided with a plurality of pinned-up disk-shaped comminuting tools (8). Between two neighbouring comminuting tools (8) each a circular spacer disk (9) is disposed and stationary knives (11) engage into the gaps between adjoining comminuting tools (8), the flanks (15) of which knives extend tangentially with respect to the periphery (13) of the spacer disks (9). The two shafts (3,4) are driven with different speeds and the knives constituted by the comminuting tools (8) comminute the synthetic plastics material and press it into the volutions of the screw (18). This results in a construction which is reliable in operation and comminutes the synthetic plastics material effectively. (Fig.2)

Fig. 1

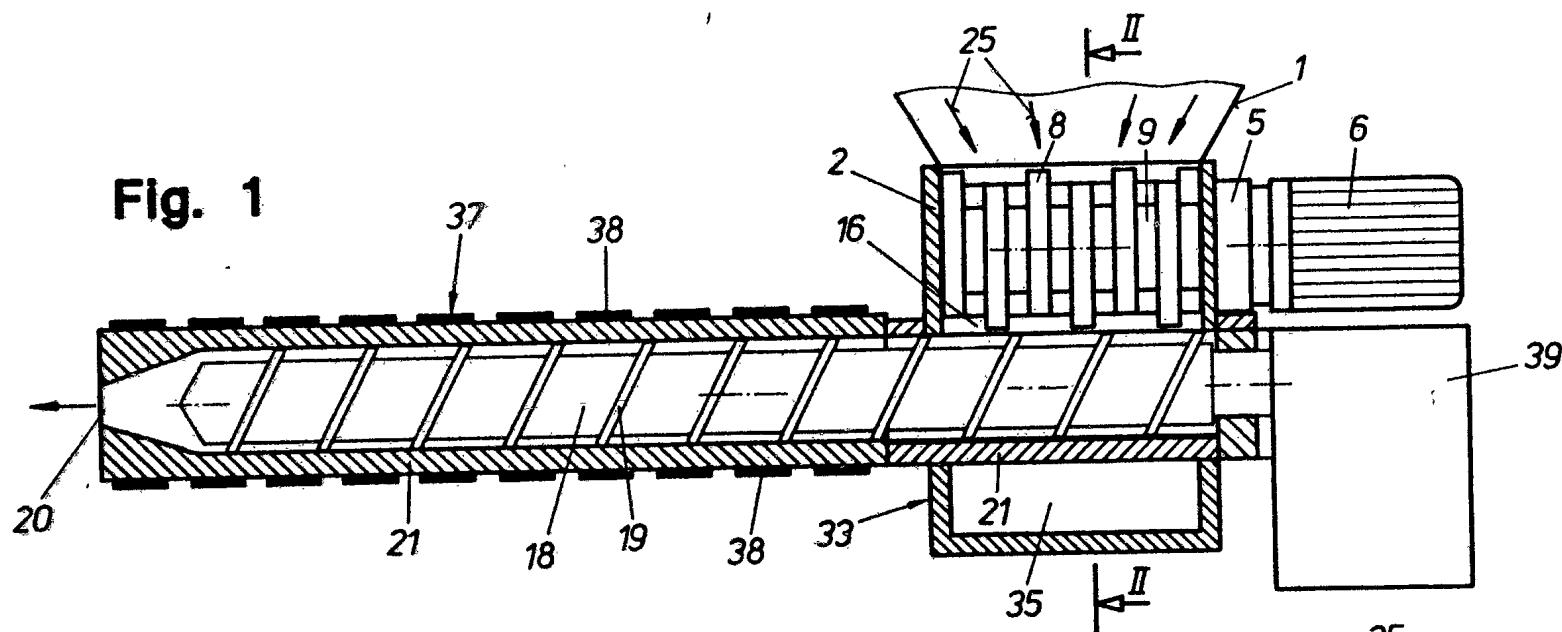
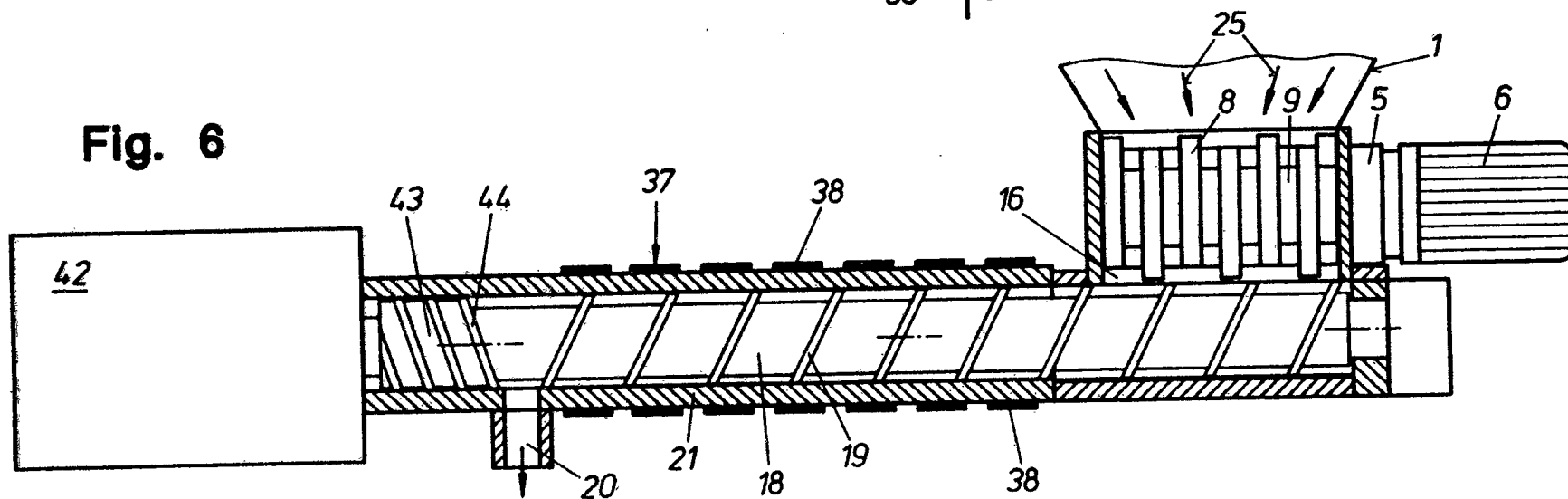


Fig. 6



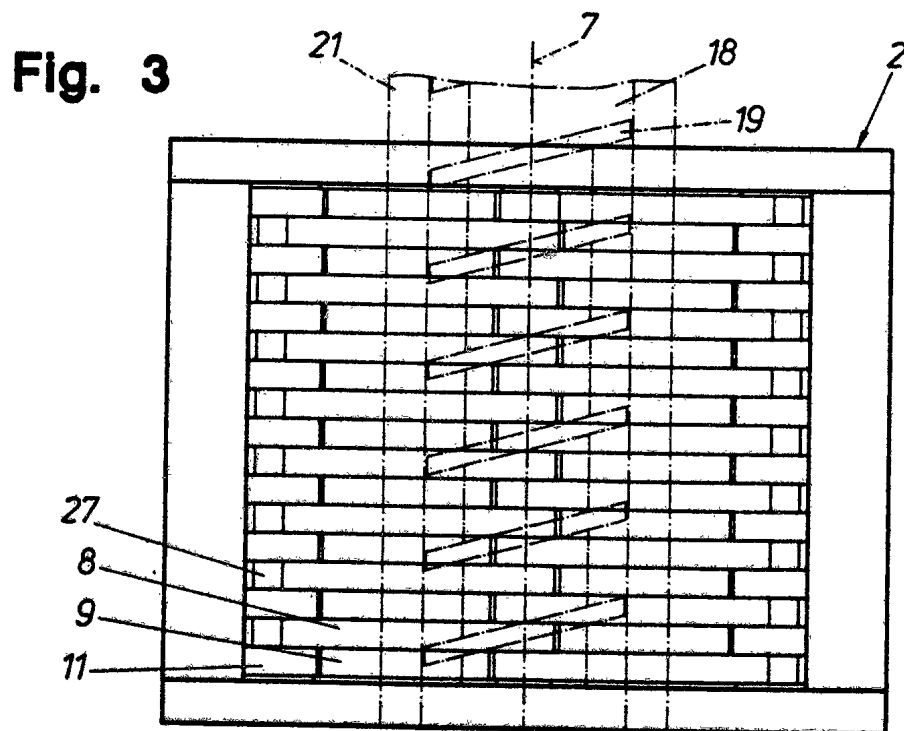
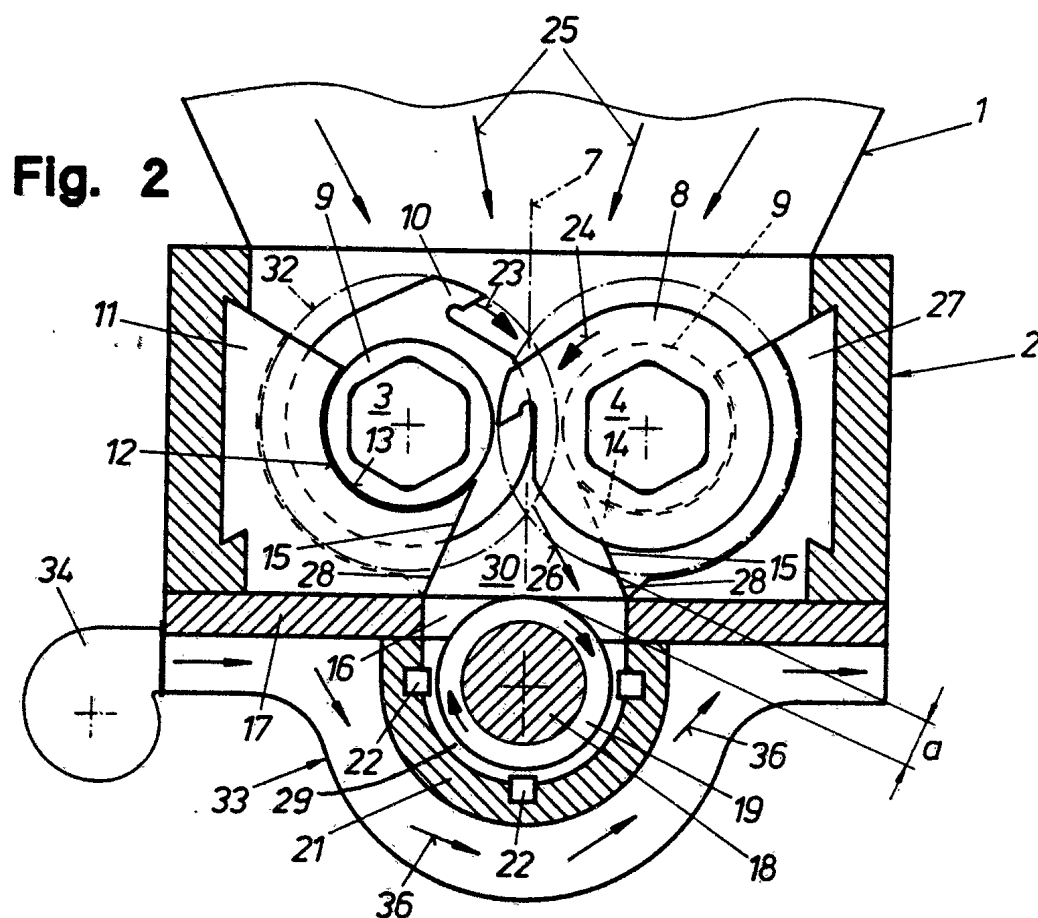


Fig. 4

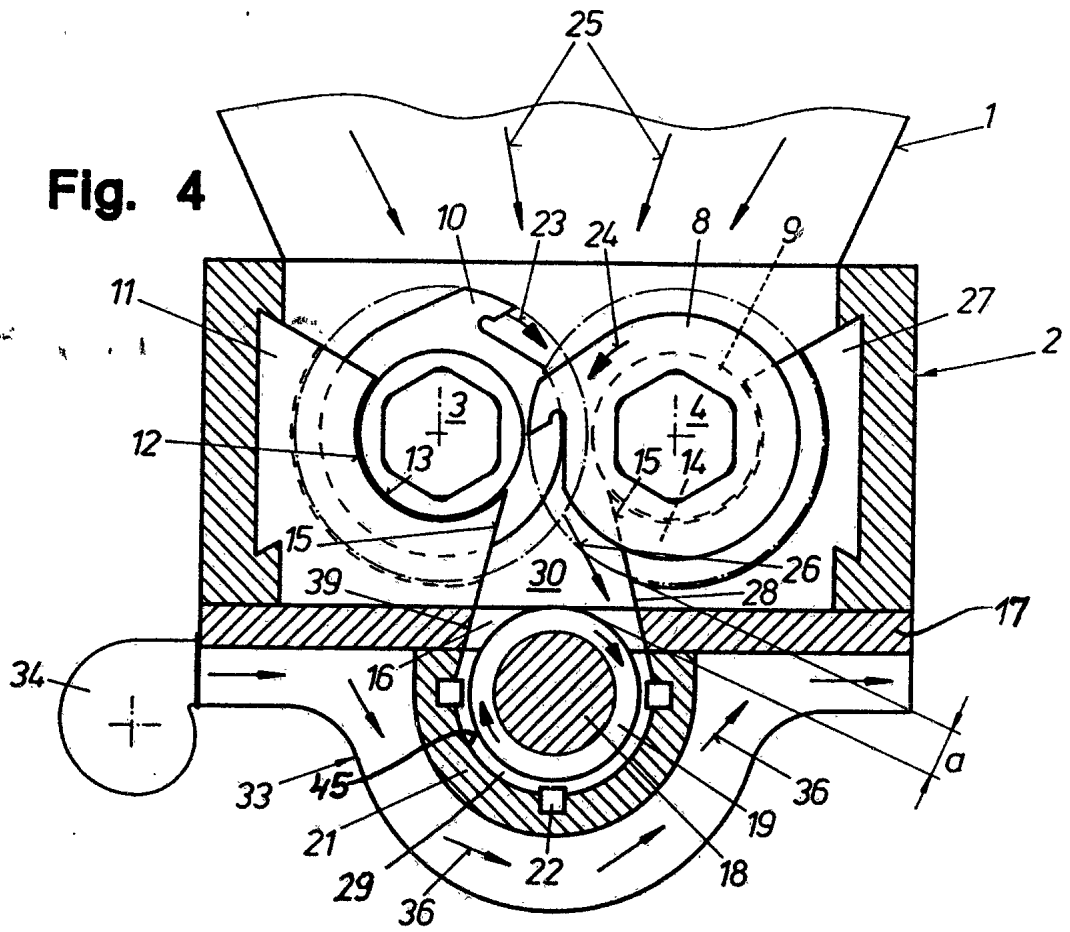
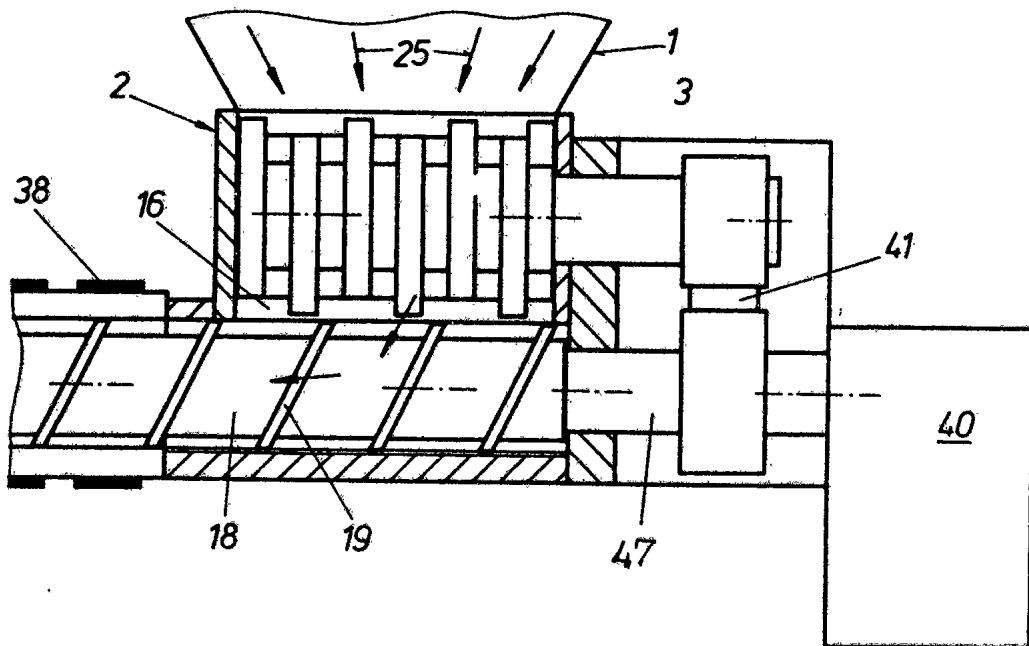


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/AT93/00098

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.⁵ : B02C 18/14; B01F 13/10; B29C 47/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl.⁵ : B02C; B01F; B29C; B29B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP, A, 0 239 104 (SCHWELLING) 30 September 1987, see column 1, line 34 - column 2, line 18; figures 1,2	1,3-9
Y	EP, A, 0 140 869 (R. FALKNER) 8 May 1985, see page 9, line 34 - page 10, line 17; figures 3,4	1,3-9
A	DE, A, 3 430 087 (K. ACKERMANN) 27 February 1986 see page 9, lines 7-9, figure	1
A	EP, A, 0 174 148 (MOCHIZUKI PRECISION MACHINE INDUSTRIES CO. LTD.) 12 March 1986, see abstract; figure 4 see page 14, line 1 - page 15, line 3; figures 19-21	1,3
A	DE, A, 2 842 162 (A. KOLB MASCHINENBAU) 17 April 1980, see page 10, line 14 - page 11, line 6, figure 1	1
A	DE, U, 9 017 387 (BER) 14 March 1991, see page 5, lines 4-26; figures 1,2	1

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
13 August 1993 (13.08.93)

Date of mailing of the international search report
25 August 1993 (25.08.93)

Name and mailing address of the ISA/
European Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE, A, 2 450 936 (E. BAIKOFF) 30 April 1975, see page 18, lines 26-32; figure 2 ---	5
A	DE, C, 917 571 (DR. R. HESSEN) 6 August 1953, see page 2, right-hand column, lines 37-42; figure ---	6
A	DE, B, 1 268 823 (DR. Z. LORENIAN) 22 May 1968, see column 7, lines 14-29; figure 4 -----	6

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

AT 9300098
SA 74750

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13/08/93

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0239104	30-09-87	DE-A- 3610537	01-10-87
		DE-A- 3610539	01-10-87
		US-A- 4773603	27-09-88
EP-A-0140869	08-05-85	AT-A- 378922	25-10-85
		DE-A- 3474416	10-11-88
DE-A-3430087	27-02-86	None	
EP-A-0174148	12-03-86	JP-C- 1587432	19-11-90
		JP-B- 2010700	09-03-90
		JP-A- 61141946	28-06-86
		US-A- 4691871	08-09-87
DE-A-2842162	17-04-80	None	
DE-U-9017387	14-03-91	None	
DE-A-2450936	30-04-75	CH-A- 587082	29-04-77
		CH-A- 576812	30-06-76
		AT-B- 339705	10-11-77
		CA-A- 1071604	12-02-80
		FR-A,B 2257346	08-08-75
		GB-A- 1491611	09-11-77
		JP-C- 1024146	28-11-80
		JP-A- 51005655	17-01-76
		JP-B- 54032978	17-10-79
		NL-A- 7504824	07-01-76
		SE-B- 400484	03-04-78
		SE-A- 7504299	07-01-76
		US-A- 3991944	16-11-76
DE-C-917571		None	
DE-B-1268823		None	

I. KLASSEFIZIKATION DES ANMELDUNGS-GEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)⁶

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC
 Int.Kl. 5 B02C18/14; B01F13/10; B29C47/10

II. RECHERCHIERTE SACHGEBIETERecherchierter Mindestprüfstoff⁷

Klassifikationssystem	Klassifikationssymbole
Int.Kl. 5	B02C ; B01F ; B29C ; B29B

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen⁸

III. EINSCHLAGIGE VERÖFFENTLICHUNGEN⁹

Art. ⁹	Kennzeichnung der Veröffentlichung ¹¹ , soweit erforderlich unter Angabe der maßgeblichen Teile ¹²	Betr. Anspruch Nr. ¹³
Y	EP,A,0 239 104 (H. SCHWELLING) 30. September 1987 siehe Spalte 1, Zeile 34 - Spalte 2, Zeile 18; Abbildungen 1,2 ---	1,3-9
Y	EP,A,0 140 869 (R. FALKNER) 8. Mai 1985 siehe Seite 9, Zeile 34 - Seite 10, Zeile 7; Abbildungen 3,4 ---	1,3-9
A	DE,A,3 430 087 (K. ACKERMANN) 27. Februar 1986 siehe Seite 9, Zeile 7 - Zeile 9; Abbildung --- -/-	1

* Besondere Kategorien von angegebenen Veröffentlichungen¹⁰:

- "A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist
- "E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist
- "L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)
- "O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht
- "T" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist

- "T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist
- "X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden
- "Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist
- "A" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche 13.AUGUST 1993	Abgeschlossenheit des internationalen Recherchenberichts 25 -08- 1993
Internationale Recherchenbehörde EUROPAISCHES PATENTAMT	Unterschrift des bevollmächtigten Bediensteten TOPALIDIS A.

III. EINSCHLAGIGE VERÖFFENTLICHUNGEN (Fortsetzung von Blatt 2)

Art *	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
A	EP,A,0 174 148 (MOCHIZUKI PRECISION MACHINE INDUSTRIES CO. LTD.) 12. März 1986 siehe Zusammenfassung; Abbildung 4 siehe Seite 14, Zeile 1 - Seite 15, Zeile 3; Abbildungen 19-21 ----	1,3
A	DE,A,2 842 162 (A. KOLB MASCHINENBAU) 17. April 1980 siehe Seite 10, Zeile 14 - Seite 11, Zeile 6; Abbildung 1 ----	1
A	DE,U,9 017 387 (BER) 14. März 1991 siehe Seite 5, Zeile 4 - Zeile 26; Abbildungen 1,2 ----	1
A	DE,A,2 450 936 (E. BAIKOFF) 30. April 1975 siehe Seite 18, Zeile 26 - Zeile 32; Abbildung 2 ----	5
A	DE,C,917 571 (DR. R. HESSEN) 6. August 1953 siehe Seite 2, rechte Spalte, Zeile 37 - Zeile 42; Abbildung ----	6
A	DE,B,1 268 823 (DR. Z. LORENIAN) 22. Mai 1968 siehe Spalte 7, Zeile 14 - Zeile 29; Abbildung 4 -----	6

**ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT
ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.**

AT 9300098
SA 74750

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.

Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

13/08/93

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
EP-A-0239104	30-09-87	DE-A- 3610537	01-10-87
		DE-A- 3610539	01-10-87
		US-A- 4773603	27-09-88
EP-A-0140869	08-05-85	AT-A- 378922	25-10-85
		DE-A- 3474416	10-11-88
DE-A-3430087	27-02-86	Keine	
EP-A-0174148	12-03-86	JP-C- 1587432	19-11-90
		JP-B- 2010700	09-03-90
		JP-A- 61141946	28-06-86
		US-A- 4691871	08-09-87
DE-A-2842162	17-04-80	Keine	
DE-U-9017387	14-03-91	Keine	
DE-A-2450936	30-04-75	CH-A- 587082	29-04-77
		CH-A- 576812	30-06-76
		AT-B- 339705	10-11-77
		CA-A- 1071604	12-02-80
		FR-A,B 2257346	08-08-75
		GB-A- 1491611	09-11-77
		JP-C- 1024146	28-11-80
		JP-A- 51005655	17-01-76
		JP-B- 54032978	17-10-79
		NL-A- 7504824	07-01-76
		SE-B- 400484	03-04-78
		SE-A- 7504299	07-01-76
		US-A- 3991944	16-11-76
DE-C-917571		Keine	
DE-B-1268823		Keine	

EPO FORM P0073

Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/83