United States Patent [19]

Groos et al.

[11] **3,896,652**

[45] **July 29, 1975**

[54] **LOCKING SYSTEM FOR A ROTARY DIE CARRIER OF AN EXTRUSION**

[75] Inventors: **Horst Hans Groos; Urban Richardt,** both of Metzkausen, Germany

[73] Assignee: **Schloemann-Siemag Aktiengesellschaft,** Dusseldorf, Germany

[22] Filed: **Sept. 11, 1974**

[21] Appl. No.: **505,025**

[52] **U.S. Cl.** **72/263;** 72/255

[51] **Int. Cl.** **B21c 21/00**

[58] **Field of Search** 72/263, 255

[56] **References Cited**

UNITED STATES PATENTS

3,197,994 8/1965 Samuel 72/263

3,357,226 12/1967 Snell 72/255

Primary Examiner—C. W. Lanham
Assistant Examiner—Robert M. Rogers
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

The invention is applicable to extrusion presses which have a rotary die carrier. The invention provides a rotary die carrier locking system which has two separate locking members which prevent both axial and rotary movement of the die carrier, the locking members sliding perpendicular to the press axis and sliding in a block fixed to the press front platen.

10 Claims, 4 Drawing Figures

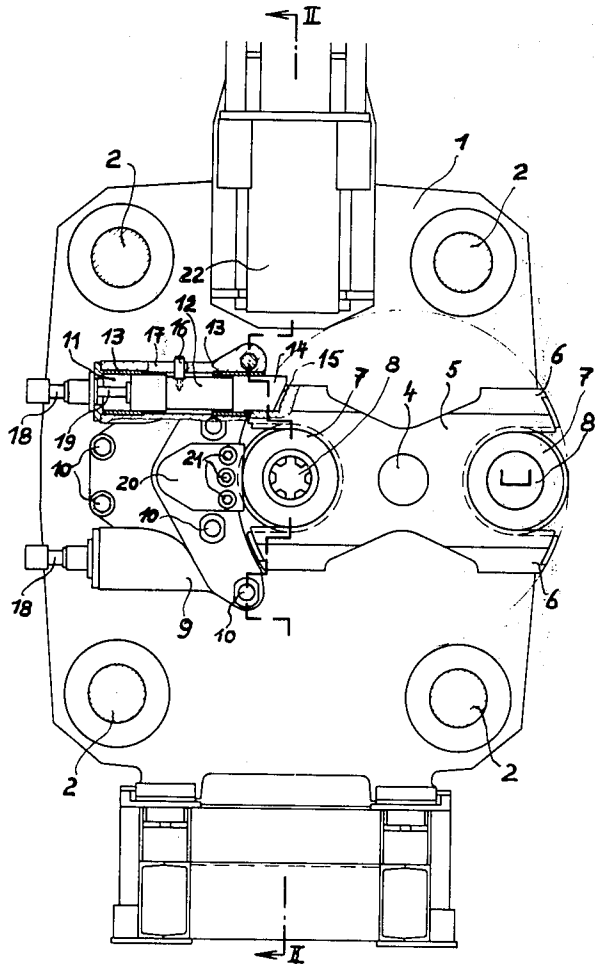


Fig. 1

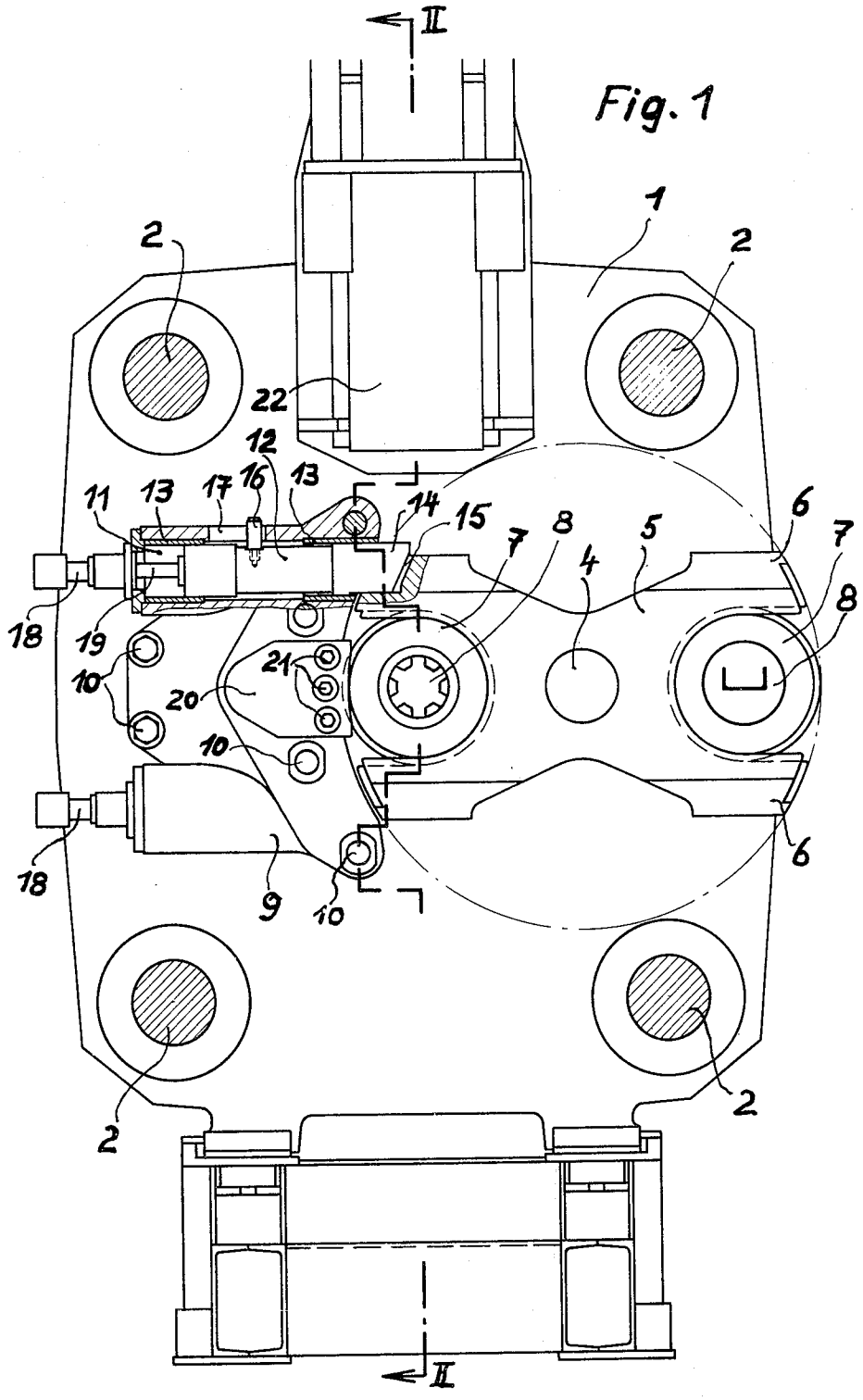
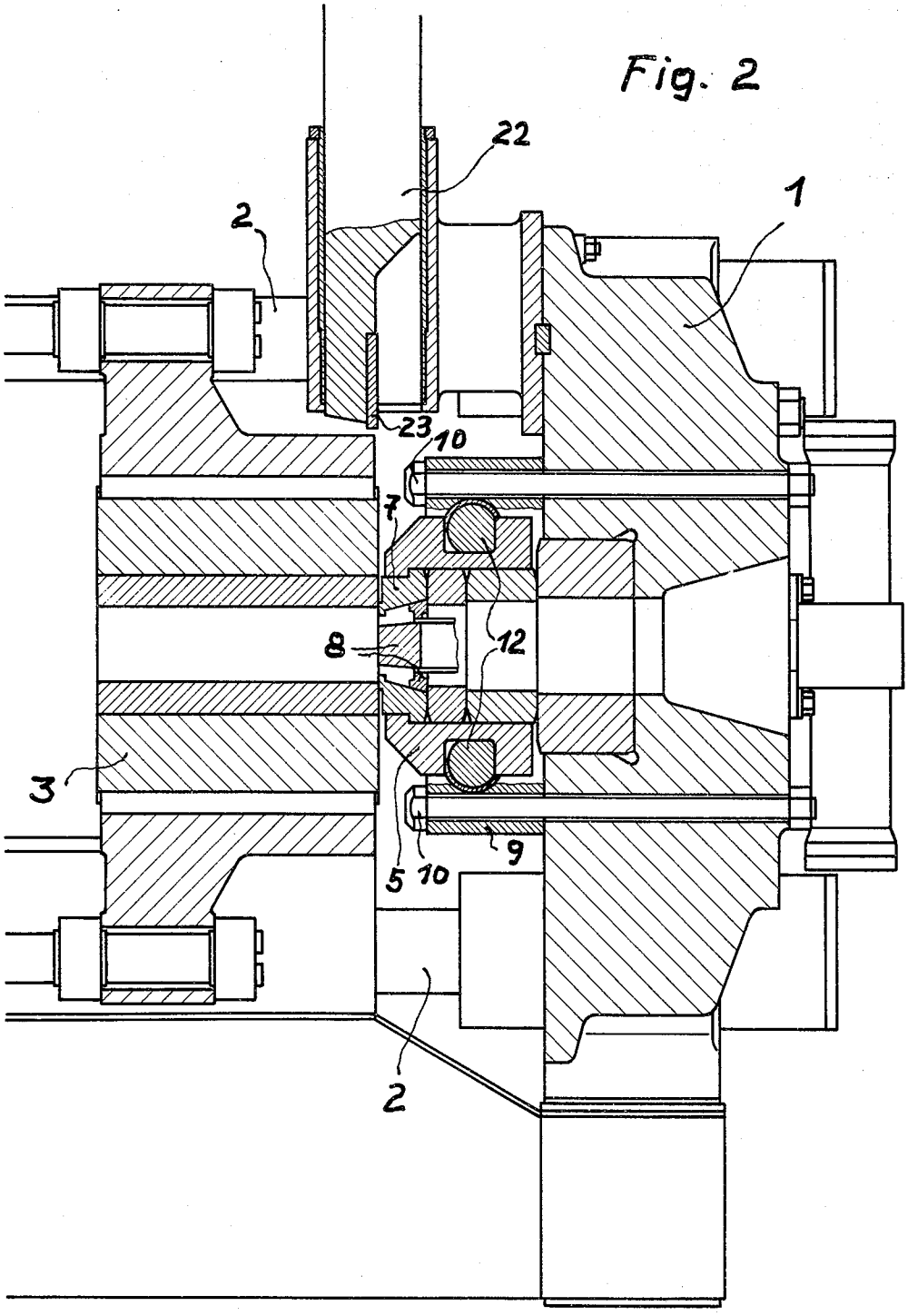

II
1
2
2
22
12
16
13
11
13
17
14
15
7
8
4
5
6
7
8
18
19
10
21
20
10
18
9
10
6
2
2
II

Fig. 2



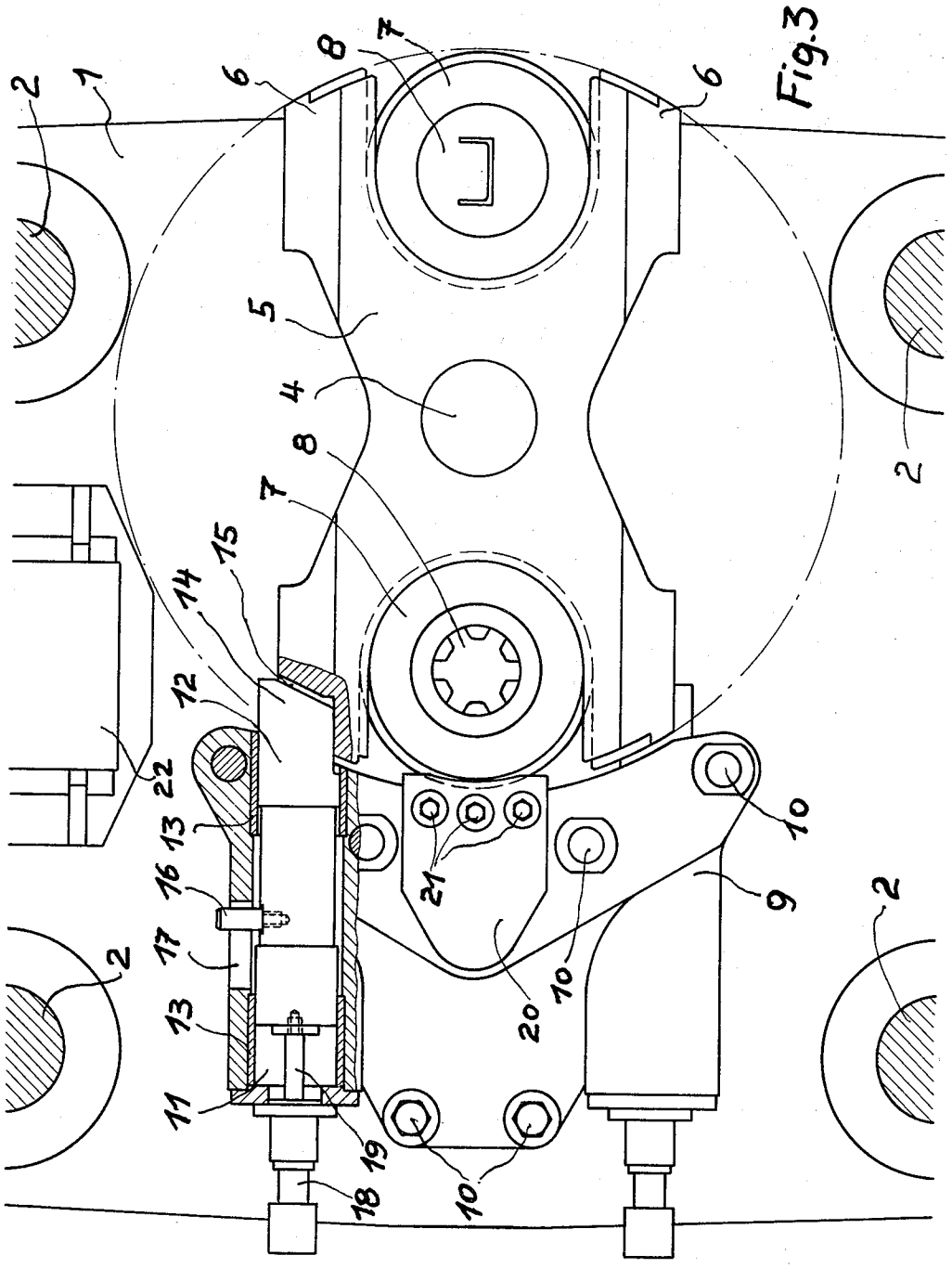


Fig.3

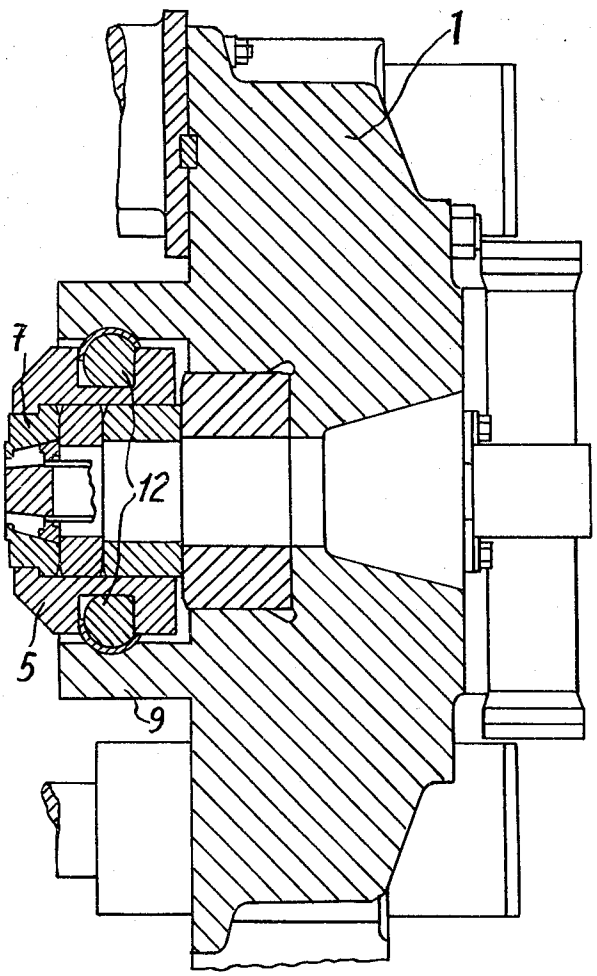


Fig. 4.

LOCKING SYSTEM FOR A ROTARY DIE CARRIER OF AN EXTRUSION

BACKGROUND OF THE INVENTION

The invention relates to a locking system for locking a rotary die carrier of an extrusion press.

Broadly, in an extrusion press, a die is held at the exit end of a billet container by means of a die carrier, and a billet is loaded into the rear end of the container and is forced through the die to form an extrusion or extruded strand or section. The die is held on a front platen, which may be referred to as a counterplaten or merely as a platen, and which is usually secured to a cylinder platen by columns or tie rods which extend parallel to the press axis, the cylinder platen mounting a ram for carrying out the extrusion operation. At the termination of the operation, there is a butt or billet discard of material still in the container and die entry, a short length of the extrusion in the die and the remainder of the extrusion beyond the die. Normal practice is to have an axially slidable billet container and to withdraw the container axially at the end of the extrusion operation. This action applies a considerable axial force to the die, the force being referred to as a tear-off or tear-out force. There are two different methods of operation; in one, the tear-out force pulls the billet discard out of the container, leaving it projecting rearwardly from the die; in the other, the tear-off force draws the extrusion a short distance back through the die. The axial force is particularly large when a bridged or chamber die is being used, for instance for extruding aluminium tubes; if the latter method referred to above is being used, the part of the material at the entrance to the die is stretched and torn off because the extrusion cannot be pulled back through the die due to for instance the bridges. In both methods, the billet dicard is shorn off at the rear face of the die by means of a cropping device having a shear blade which cooperates with the die itself, applying a considerable transverse force to the die, though usually a force which is less than the axial force applied when withdrawing the container. The short length of extrusion within the die can be drawn out by pulling the extrusion forwards prior to stretch levelling the extrusion, or by cutting the extrusion off at the front face of the die and for instance punching out. Any discard left within the container can be punched out.

Rotary die carriers are common, though they may be referred to by a number of alternative terms, such as turret heads, die or tool turrets, tool carriers, die or tool heads or die or tool tables. The rotary die carrier is mounted on the front platen of the press and is journalled for rotation about an axis parallel to the press axis, usually by being fixed to a shaft which is journalled in the front platen. Rotary die carriers normally have at least two, and usually just two, die holding positions which may for instance be U-shaped recesses (recesses with semi-circular bases) for receiving the die assemblies, that is to say the dies and associated parts such as die holders and pressure rings - if the die carrier is a two-position carrier, it will usually be of two-armed construction, each arm having a bifurcated end forming a die receiving recess. Normally, the cropping shear slides along an axis which is at right angles to the plane in which the press axis and the rotary die carrier axis lie, so that the blade applies a tangential force or torque

to the rotary die carrier. Some locking system must therefore be provided to lock the rotary die carrier against both axial movement and rotary movement.

Various different kinds of locking systems are known. In one kind of locking system, disclosed in British Pat. Specification No. 946 756, a heavy bifurcated slide or bolt is provided on the front platen of the press to lock a two-armed die carrier with one die on the press or extrusion axis, the bolt locking the die carrier against rotation and against axial displacement. The bolt is hydraulically actuated and slides in a direction perpendicular to the extrusion axis on guides which are mounted on the front platen; to prevent rotation and axial movement of the die, the forked end of the bolt engages on either side of the end of the die carrier arm. The bolt is however very heavy and requires a corresponding heavy guideway which must be able to transmit large forces. This locking system is therefore expensive and occupies a large amount of space.

In another kind of locking system, disclosed in British Pat. Specification No. 1 282 543, the front platen is provided with two shafts whose axes are parallel to the press axis, the shafts having radially projecting arms which when the shafts are rotated, pivot to engage in recesses in the die carrier, and are thus intended to ensure that the rotary die carrier is locked against rotation as well as against axial movement.

However, in order to accommodate large tear-out or tear-off forces, for example when using bridged dies for extruding aluminium tube, the arms of the shafts would have to be of such a size that there would not be any room for them. Furthermore, the production of the special arms would be very costly.

In a further kind of locking system, disclosed in British Pat. Specification No. 1 160 727, a two-armed die carrier is locked by means of two separate locking jaws. The locking jaws are wedge-shaped, are guided in the front platen and are hydraulically thrust against inserts on the sides of the die carrier arms, adjacent the die. This only locks the die carrier against rotation. Using a wedge-shaped surface to lock against rotation is detrimental because the hot extruded strand heats the inserts strongly via the die, the die pressure rings and the die holder. This gives a risk of jamming so that it could be difficult to release the wedge-shaped locking jaws. To support the die carrier against axial tear-out or tear-off forces, for example when using bridged dies for extruding aluminium tubes, the front platen is provided with two detachably mounted bars or yokes which extend over the bifurcated ends of both of the die carrier arms.

THE INVENTION

The invention provides a rotary die carrier locking system which has two separate locking members which prevent both axial and rotary movement of the die carrier, the locking members sliding perpendicular to the press axis and sliding in a block fixed to the press front platen.

Using the invention, one can provide a moderately priced, light-weight, efficient and technologically sound locking system which avoids the disadvantages noted above in relation to the prior art and does not require a large amount of close tolerance machining. The locking member(s) can be left relatively small because they need not absorb large axial, tear-out or tear-off forces, because the rotary forces and the axial forces

are not applied simultaneously, and because part of the axial forces can be absorbed by way of the shaft which mounts the rotary die carrier - if large axial forces are to be applied to the die, for instance using bridged or chamber dies, the axial forces can be in part or wholly absorbed by a stationary retaining member, which may be in the form of a retaining plate which is fixed to the front platen and engages the die holder or another part of the die assembly during the billet discard tear-out or tear-off operation. By using relatively small locking members, less space is required adjacent the front platen..

The or each locking member may have a flat or planar side which engages the rotary die carrier, and particularly if the opposite side of the locking member does not engage the rotary die carrier, the rotary die carrier can expand somewhat on heating during the extrusion operation without jamming the locking members in position.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

FIG. **1** is a view, partly in transverse section, of the front platen of a metal extrusion press in accordance with the invention;

FIG. **2** is a longitudinal section, along the line II—II of FIG. **1**;

FIG. **3** is a view corresponding closely to that of FIG. **1** but on a larger scale and omitting certain parts; and FIG. **4** shows part of the section of FIG. **2**, illustrating a modification.

DETAILED DESCRIPTION OF ONE EMBODIMENT OF THE INVENTION

Only part of the extrusion press is shown in the drawings, but apart from its die carrier locking system, the press is conventional, and can be as illustrated in FIG. **4** of British Pat. Specification 946756. The press has a front platena **1** connected to a cylinder platen (not shown) by means of tie rods **2**. The cylinder platen mounts a conventional extrusion ram (not shown) for extruding the material to be extruded. An axially slidable billet container **3** is movable against and retractable from the front platen **1** by conventional power means (not shown). A rotary die carrier **5** is fixed to a shaft **4** journalled in the front platen **1** so that the die carrier **5** can rotate about an axis parallel to the press axis.

The die carrier **5** is two-armed, and holds in each of its two forked ends **6** a die assembly consisting of a die holder **7** and a die **8** as well as conventional pressure rings (not referenced). The die **8** shown in FIG. **2** is a bridged die. The shaft **4** can be rotated by a conventional rack-and-pinion gear (not shown).

A mounting member or block **9** is detachably fixed to the inner face of the front platen **1** by detachable means in the form of bolts or studs **10**. Alternatively, as shown in FIG. **4**, the block **9** could be in one piece with the front platen **1**. Circular cross-section locking or clamping members or bolts **12** are slidably mounted in bushes **13** contained in respective bores **11** in the block **9**, the locking bolts **12** thereby sliding in the block **9** in the sense of each bolt **12** having a substantial length which is substantially surrounded on all sides by the block **9**; each bolt **12** slides in a direction perpendicular to the direction of the press axis, though the axes of the bolts **12** do not intersect the press axis. The head **14** of each bolt **12** is ground flat or planar on two faces at 90° to each other and extending parallel to the direction of movement of the bolt **12**. The heads **14** engage in recesses **15** in the forked end **6** of the die carrier **5**; these recesses also have flat ground faces where they will engage with the bolt heads **14**, the recess faces being parallel to those on the bolt heads **14** so that some axial movement can occur between the bolts **14** and the recesses, to avoid jamming and to allow for differential expansion. To avoid the bolts **12** twisting in their guides in the block **9**, the bolts **12** have guide pegs **16** which are guided in slots **17** in the block **9**.

Actuation of the bolts **12** is effected by actuating means in the form of rams or piston-cylinder units **18** on the block **9** and connected to the bolts **12** by rods **19**; the rams **18** can if desired be independently connected to a source of hydraulic pressure so that they can be independently actuated, though alternatively they may be interconnected by T-piece connections.

To assist in absorbing the axial, tear-off force produced when the billet container **3** is withdrawn, a stationary retaining member in the form of a retaining plate **20** is fixed to the block **9** by bolts **21** (see FIG. **3**). This retaining plate **20** is particularly useful when a bridged die or chamber die is being used, because the axial tear-off force is higher. The retaining plate **20** engages the die holder **7** and has a step which overlaps a step on the die holder **7** when the die carrier **5** is in position. The die carrier **5** and the retaining plate **20** are arranged so that the retaining plate **20** does not obstruct rotation of the die carrier **5**.

A cropping device **22** having a shear blade **23** is arranged above the table platen **1** to shear the extruded section between the die **8** and the billet container **3**.

The operation of the press is conventional, and is as follows. While the billet container **3** and the front platen **1** are apart, the die **8** is positioned on the press axis by the rotary die carrier **5**. The billet container **3** and the table platen **1** are then brought together to clamp the die **8** in position, and a billet is introduced into the container **3**. The billet is extruded through the die **8**, and at the end of extrusion, there is still a small part of the billet (the container discard) remaining in the billet container **3**. To sever the container discard from the extruded section, the billet container **3** and the table platen **1** are parted by withdrawing the billet container **3**, and the extruded section is pulled back a small distance through the die **8** by the billet discard which remains in the billet container **3**. The extruded section is then severed by the cropping device **22** at the billet side of the die **8**.

We claim:

1. In an extrusion press comprising a front platen, a cylinder platen, tie means connecting said front platen to said cylinder platen, a billet container for receiving material to be extruded, means mounting said billet container for movement along a press axis, power means for retracting said billet container, a rotary die carrier mounting a die on said press axis, means mounting said rotary die carrier for rotation about an axis spaced from but parallel to said press axis, extrusion ram means for extruding said material through said die along said press axis to form an extrusion and a billet discard left behind said die, and a cropping device for

cropping off said billet discard between said billet container and said die,

a die carrier locking system comprising:

two separate locking members defining engagement surfaces for engaging said die carrier to prevent both axial movement of said die carrier during billet discard tear-out or tear-off and rotary movement of said die carrier during billet discard shearing;

mounting means mounting said locking members for sliding movement in a direction perpendicular to the direction of said press axis, said mounting means being fixed to said front platen and each said locking member having a substantial length thereof which is substantially surrounded on all sides by said mounting means; and

means for actuating said locking members to engage said die carrier.

2. The locking system of claim **1**, and further comprising means detachably mounting said locking means on said front platen.

3. The locking system of claim **1**, wherein said mounting means is formed in the same piece of material as said front platen.

4. The locking system of claim **1**, wherein said die is a bridged or chamber die, and further comprising a stationary retaining member for in part preventing said axial movement of said die carrier.

5. The locking system of claim **4**, wherein said die carrier carries a die holder which in turn carries said die, and wherein said retaining member is a plate fixed to said mounting means and engaging said die holder.

6. The locking system of claim **4**, wherein said die carrier carries a die assembly including said die, and wherein said retaining member is a plate fixed to said mounting means and engaging said die assembly.

7. The locking system of claim **1**, wherein each said locking member has only two said engagement surfaces, said engagement surfaces being planar, at 90° to each other and extending parallel to the direction of movement of the respective said locking member, and said engagement surfaces engaging mating planar surfaces on said die carrier.

8. The locking system of claim **4**, wherein each said locking member has only two said engagement surfaces, said engagement surfaces being planar, at 90° to each other and extending parallel to the direction of movement of the respective said locking member, and said engagement surfaces engaging mating planar surfaces on said die carrier.

9. The locking system of claim **1**, wherein said actuating means are independent power means for actuating respective said locking members.

10. The locking system of claim **7**, wherein said actuating means are independent power means for actuating respective said locking members.

* * * * *