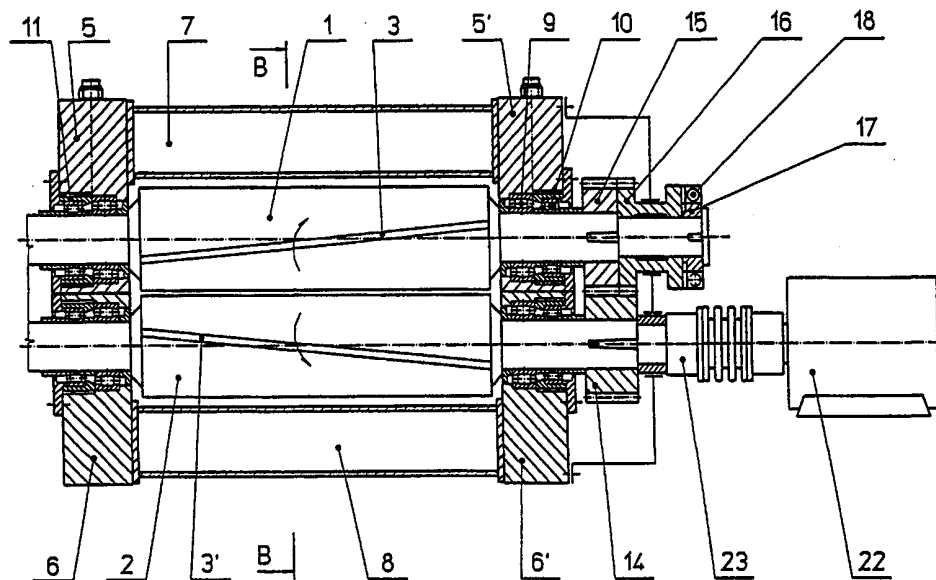


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (21) International Application Number: PCT/CZ98/00037<br>(22) International Filing Date: 14 September 1998 (14.09.98)<br>(30) Priority Data: PV 97-98 13 January 1998 (13.01.98) CZ<br>(71) Applicant (for all designated States except US): ŽĎAS, A.S. [CZ/CZ]; Strojírenská 6, 591 71 Žďár nad Sázavou (CZ).<br>(72) Inventor; and<br>(75) Inventor/Applicant (for US only): DOFEK, František [CZ/CZ]; Komenského 13/16, 591 01 Žďár nad Sázavou (CZ).<br>(74) Agent: BAUMOVÁ, Radmila; Nádražní 29, 591 01 Žďár nad Sázavou (CZ). |    | (81) Designated States: DE, GB, JP, US.<br><br>Published<br>With international search report.                      |

(54) Title: FLYING DRUM SHEAR



## (57) Abstract

Flying drum shear for cutting thin metal strips, consisting of a stand, in which are placed two drums (1, 2) with horizontally bevelled knives (3, 3') and coupled by gear wheels. Between the wheels and in the bearing of the drums (1, 2) are backlashes eliminated by prestressed springs. The sides of the shears' stand are horizontally spaced in the level (24) of the strip that is to be cut and form two bearing housings (5, 5') and (6, 6'), connected with anchors (19) and horizontal screws (21) through a fitting washer (20). The drive (22) of the shear is coupled by a backlash-free coupling (23) to one of the drums (1, 2) with a blade (3, 3') fastened behind the axis of the drum (1, 2) in the direction of the rotation. Bevelling of a blade (3, 3') has an opposite direction of inclination to the direction of the drum rotation (1, 2).

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## Flying drum shear

### Engineering area

This invention relates to a flying drum shear for cutting blanks from decoiled metal strips.

### Current state of the equipment

Presently, flying drum shears for cutting thin strip of sheet metal use straight blades on drums coupled to gear wheels on each side. That leads to a considerable mass inertia. The sides of the stand are compact and the axes of the drums have a fixed parallel position. It is very difficult to achieve precise parallelity of the shears' cutting edges when producing very thin strips. For consistent cutting it is necessary to prop the blades by thin foils.

The disadvantage of current solutions is that higher output (greater production) i.e. the maximal speed of strip and the frequency of cutting is not possible.

### The object of the invention

The aforementioned disadvantages are - according to the invention - eliminated by using flying drum shears for cutting thin metal strips. These consist of a stand in which are two drums with horizontally bevelled blades coupled by gear wheels. The clearances between the wheels and in the bearings of the drums are eliminated by prestressed springs. The shears' sides of the stand are horizontally separated on the level of the sheet being cut forming two bearing housings. These are connected by anchors and horizontal screws through a fitting washer. The fitting washer serves for fine tuning of the parallelity of the cutting edges. The drive of the shears is coupled to one of the drums through a backlash-free coupling. The knife is fastened to this driven drum behind the axis of the drum in the direction of the drum rotation. The horizontally

bevelled knife has an opposite direction of inclination to the direction of the drum rotation.

The advantage of the device is a permanent elimination of all clearances in the cutting mechanism by means of springs and a reduction of load forces and cutting torques. With the above mentioned arrangement, the torque that is carried through the gear wheels to the second drum is minimalized, when the drive of the shear is connected to the first drum. This means that the gear width can be small, which provides lower mass inertia and facilitates final fitting of the knives' parallelity. The arrangement of separated sides of the stand simplifies assembly of the shears and allows fine tuning of the knives' parallelity both during assembly and during the shears' operation.

The arrangement of the shear allows an achievement of increased capacity, that is - speed of strip cutting 300-400 m/min and the frequency of cutting of up to 480 cuts per minute.

#### Survey of figures on the drawings

Fig. 1 and 2 of the enclosed drawing show the arrangement of the flying drum shear in accordance with the invention. Fig. 1 shows the vertical cross section (A-A) led by the axes of the drums, which is shown on fig.2 . Fig. 2 shows the horizontal cross section (B-B) led perpendicularly on the axes of the drums, which is shown on fig.1. The drums on fig.1 are turned through an angle of 90 behind the cutting position and on fig. 2 the drums are drawn with the blades in the cutting position.

#### Examples of the invention's performance

A flying drum shear consists of a stand, drums and a drive. The stand of the shear is horizontally separated in the level 24 of the strip that is to be cut and is formed by bearing housings 5, 5' and 6, 6', which are connected by prestressed vertical anchors 19 and horizontal screws 21 , that tightens the fitting washer 20. Upper and lower drums

1,2 are mounted in main bearings 9. Bearing housings are coupled by the upper and lower cross beams. There are balancing bearings 10 on each pin of the drum next to the bearing 9 which are mounted in balancing sleeves 11, in stands that are radially free. Each balancing sleeve 11 is connected with a draw rod 12, which pulls the drum 1, 2 over the prestressed spring 13 in an oblique direction of an angle, that is identical with the resultant of the vertical component of the shearing force and horizontal portion of the force from the cut, that is so called - separating forces. Thus the functional clearance in main bearing 9 of the drum is constantly eliminated in the same direction as bearing 9 is loaded by the resultant force from the cut.

The blade 3, 3' is in the drum fastened in a slot together with a bevelled plate 4, 4' so that the cutting edge 3, 3' is horizontally bevelled and has an opposite direction of inclination to the direction of the drum rotation 1, 2. The seating of the knife is - in accordance to fig. 2 - made so that the knife 3, 3' is located in the slot behind the axis of the drum 1, 2, i.e. the same direction as that of the rotation of the drum 1, 2. Both drums 1, 2 are mutually bound with gear wheels in a ratio 1:1. The gear wheel 14 of the lower drum is fixed with the pin of the lower drum 2, the gear wheel 15 of the upper drum is fixed with the pin of the upper drum 1. On the pin of the upper drum 1 is also mounted a freely rotating, eliminating gear wheel 16 and with this pin is fixed a driver 17. The eliminating gear wheel 16 and the driver 17 are stretched against each other by prestressed springs 18. Thus, by means of springs, the backlash is permanently eliminated in the mesh of gear wheels 14 and 15. The mesh of teeth is then prestressed by springs. The force of the springs 18 has to be big enough so that the dynamic torques of the shear drive 22 can be reliably carried by these prestressed springs during periodical acceleration and deceleration of the rotating parts of the upper drum. The shear drive 22 is a precisely regulated motor, connected by a torsionally rigid, backlash - free coupling 23. On fig.1 the drive 22 of the shears is connected with the lower drum 2 by a corrugated tube (type of a coupling).

Flying drum shear works - in accordance with the invention - in the following way :

A strip of sheet metal that is to be cut is fed to the shear by a set speed by means of a feeder. Programme controlled drive 22 of the shear periodically accelerates and

decelerates drums 1, 2 of the shears between two cuts so that the horizontal element of the circumferential velocity of the blades is identical with the velocity of the strip feeding and the shear can cut the exact length, that was preset. With this arrangement of the knives 3, 3' cutting starts on the other side of the drums 1, 2 to where the drive 22 is connected. The horizontally bevelled knives 3, 3' cause a progressive cut, the vertical inclination of the cutting edge is the largest at the beginning of cutting and gradually decreases towards the end of cutting.

That means, that at the beginning of cutting the cutting force is the smallest and gradually increases at the end of cutting and that is why the required torque supplied by the upper drum on the beginning of cutting is the smallest. That has a positive influence on minimal torsion of the drum. Due to the described arrangement of knives, with regard to the axes of drums, the resulting torque affecting the lower drum 2, is a sum of a torque of a vertical cutting force and a horizontal separating force. On the upper drum 1 the torque of the horizontal separating force is deducted from the torque of the vertical cutting force. That is why the torque, transmitted by gear wheels 14, 15 is very small and the width of these wheels is also smaller.

For cutting very thin sheet metals, for example around 0, 1 mm, the clearance between the knives must be in thousandths of mm and the cutting edges 3, 3' must be almost absolutely parallel. It is possible to conduct very fine final tuning of this parallelity during mounting and after some time of operation by adjustment of a fitting washer 20. This is also possible because the width of gear wheels 14, 15 has been reduced and misalignment of the upper drum 1 against the lower drum 2 in range of thousandths, possibly hundredths of mm has no influence on function of gear wheels. Assuring of the precise parallelity of knives 3, 3' has a positive influence on the quality of cut surfaces of sheets and also increases service life of cutting edges.

## P A T E N T   C L A I M S

Flying drum shear for cutting thin metal strips, consisting of a stand in which are mounted two drums with horizontally bevelled blades and coupled by gear wheels, that have between them and the seating of the drums backlashes eliminated by prestressed springs *characterized by* the sides of the shears' stand that are horizontally spaced in the level (24) of a cut sheet and form two bearing housings (5,5') and (6,6'), connected with anchors (19) and horizontal screws (21) through a fitting washer (20) and the drive (22) of the shear is coupled by a backlash - free coupling (23) to one of the drums (1,2) with a blade (3,3') that is fastened behind an axis of a drum (1,2) in the direction of the rotation, when the bevelling of a blade (3,3') has an opposite direction of inclination to the direction of the drum rotation (1, 2).

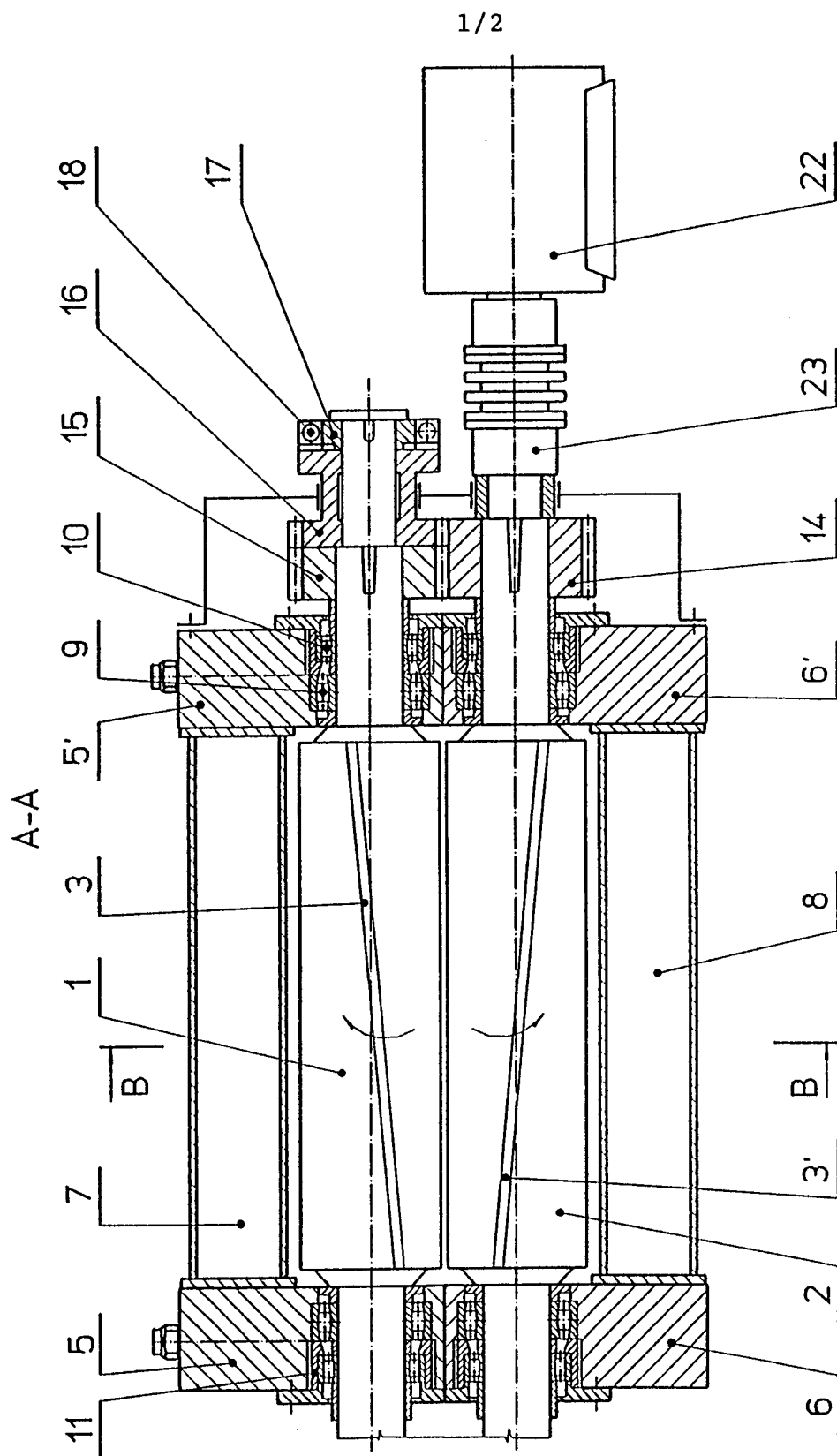
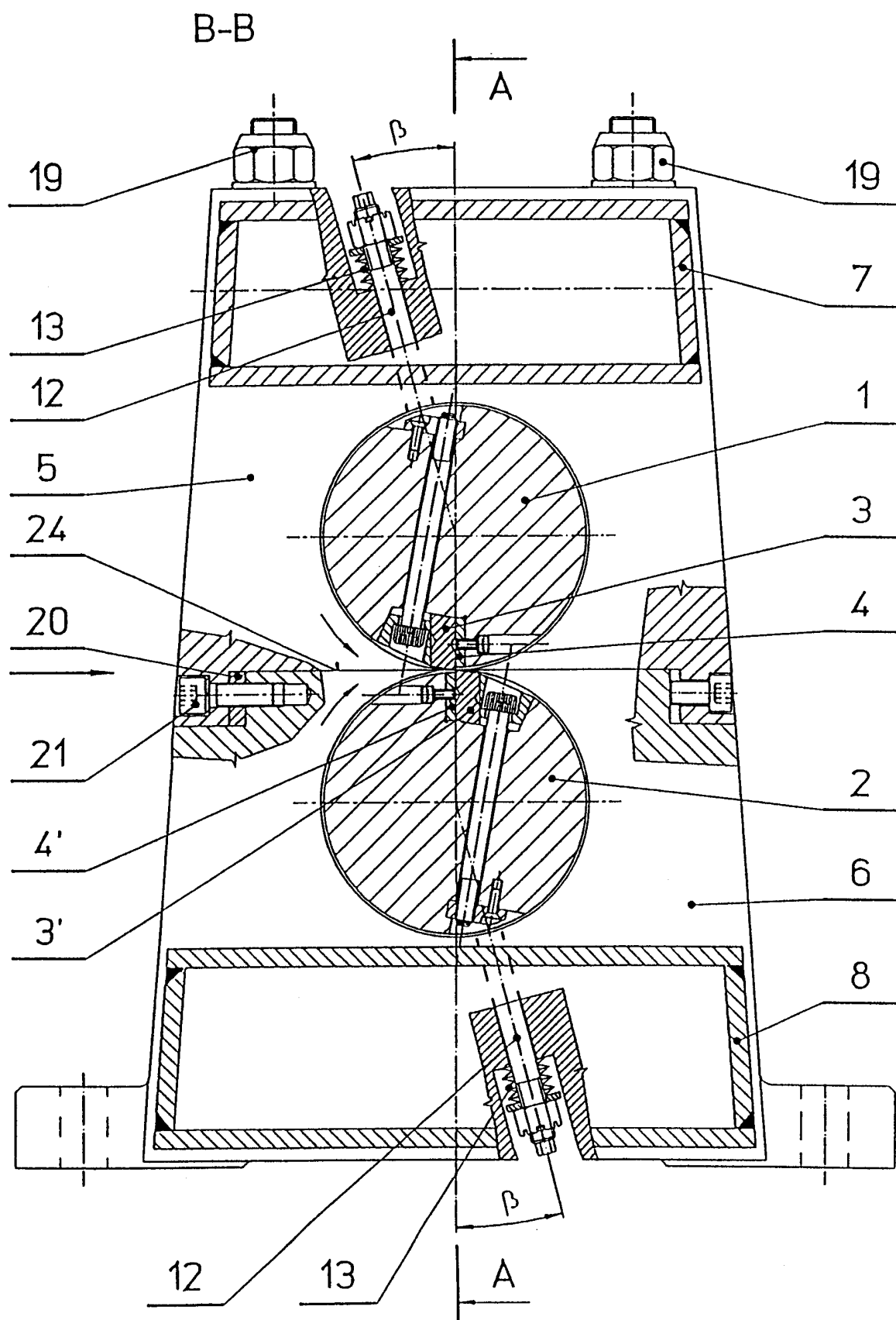


FIG. 1

2/2



# INTERNATIONAL SEARCH REPORT

Int. l. Application No  
PCT/CZ 98/00037

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B23D25/12 B26D1/62 B26D7/26

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)

IPC 6 B23D B26D

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 practical, 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          | US 3 289 518 A (RICHMOND) 6 December 1966<br>see column 1, line 53 - column 2, line 62;<br>figures 1-4 | 1                     |
| Y          | US 4 004 479 A (BODNAR) 25 January 1977<br>see column 2, line 49 - column 5, line 23;<br>figures 1-5   | 1                     |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

15 December 1998

Date of mailing of the international search report

29/12/1998

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. .ional Application No

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| US 3289518      A                         | 06-12-1966          | NONE                       |                     |
| US 4004479      A                         | 25-01-1977          | NONE                       |                     |