(12) PATENT **(11)** Application No. **AU 199732468 B2**
(19) AUSTRALIAN PATENT OFFICE **(10)** Patent No. **719552**

(54) Title
Vibratory drive for a screening machine

(51)[7] International Patent Classification(s)
B07B 001/44

(21) Application No: **199732468** (22) Application Date: **1997.08.04**

(30) Priority Data

(31) Number	(32) Date	(33) Country
19631849	**1996.08.07**	**DE**

(43) Publication Date : **1998.02.12**
(43) Publication Journal Date : **1998.02.12**
(44) Accepted Journal Date : **2000.05.11**

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(56) Related Art
US 4529510
US 3704631
US 3226989

Abstract

The vibratory drive serves for a screening machine for draining and/or sizing of grain solids, the screening machine having at least one screen surface 2 held on a screen case 1, which screen surface is provided with a drive having two eccentric shafts which are driven synchronously and in counterrotation and have different unbalanced masses 7, 8. The eccentric shafts are arranged as near as possible to the mass centre 16 of the screening machine. The angle of the mass forces of the unbalanced masses 7, 8 of the eccentric shafts includes an angle of 60° to 90°, preferably 90°, with the main direction of oscillation 18, i.e. the long axis 19 of the ellipse oscillation as a resultant of the centrifugal forces, in relation to the zero line 17, i.e. the tie line of the eccentric shafts.

(Fig. 1)

AUSTRALIA

Patents Act 1990

COMPLETE SPECIFICATION

STANDARD PATENT

Applicant:

SVEDALA GfA AUFBEREITUNGSMASCHINEN GmbH & CO. KG

Invention Title:

VIBRATORY DRIVE FOR A SCREENING MACHINE

The following statement is a full description of this invention, including the best method of performing it known to me/us:

Vibratory drive for a screening machine

Specification

The present invention relates to a screening machine for draining and/or sizing of grain solids like gravel, coal or ore, comprising a screening frame suspended on a machine stand and an elliptical vibratory drive including two eccentric shafts, said shafts having different unbalanced masses and being driven synchronously and in counterrotation by said drive.

A screening machine with these features is known from the publication "Siebmaschinen mit elliptischer Schwingung und dynamischem Antrieb", Aufbereitungs-Technik Nr. 7/1982, pages 367 to 372 and this machine has a linear drive for draining and sizing gravel, sand and the like. On this machine, the masses creating unbalance sit on two shafts. These eccentric shafts are arranged at an angle of 40° to 50° to the main direction of oscillation and synchronized via toothed gearing. Here the main amplitude of oscillation can be varied with equal or unequal masses in its linear or elliptical form and size. The most significant

disadvantage of this known form of embodiment consists in the fact that in synchronous operation very high tooth flank forces pound in a positive and negative direction, which impairs the smoothness of running and also causes an increased temperature in the transmission. A further substantial disadvantage consists in the fact that an expensive special set of gears is needed whose susceptibility to trouble and failure rate are very high. In addition to this, in changing the distance of the eccentric shafts a different transmission is needed.

Furthermore, from DE-26 30 458 A1 or DE-78 11 967 U1 a drivable vibratory transmission is known on which a gear case is screwed above the screen case on to the side walls and a crosshead. Two side unbalance gears, which remain in the position in which they are arranged in the transmission, are driven via a central shaft. The essential disadvantage of this known form of embodiment consists in the fact that the drive mechanism is applied very much outside the centre of mass of the screen case which results in very high overall height of the machine. In both known screening machines, the unbalanced masses, in relation to the radial tie line of the eccentric shafts, are not opposite one another but off-set from one another by an angle of less than 180°.

From DE-23 56 542 B2 a screening machine with a triple-shaft drive is known on which the main direction of oscillation runs through the axis of the third shaft, arranged centrally.

The purpose underlying the invention is so to develop a vibratory drive of the kind mentioned initially that whilst keeping the overall height of the machine low, different oscillation patterns can be set and the direction of oscillation changed, whereby especially operating noises and temperatures are also lessened.

According to the present invention there is provided a screening machine for draining and/or sizing of grain solids like gravel, coal or ore, comprising a screening frame suspended on a machine stand and an elliptical vibratory drive including two eccentric shafts, said shafts having different unbalanced masses and being driven synchronously and in counterrotation by said drive,

characterised in that

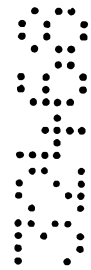
resultant forces formed by rotation of said unbalanced masses engages a centre of mass of the screening machine or in its immediate proximity, and that a radial tie line of said eccentric shafts and a longitudinal axis of a vibratory ellipse of the resultant forces, form an angle in the range of 60° to 90°.

Under the term "immediate proximity" is to be understood that the resultant of the mass forces of the unbalanced masses engages so closely to the mass centre of the screening machine that the rocking of the screening machine

caused by the deviation does not exceed its internal damping.

An advantageous form of embodiment consists in the fact that the mass forces of the unbalanced masses may be adjusted.

It is furthermore advantageous that the eccentric shafts may be synchronized by means of V-belts or synchronous belts.



It is furthermore proposed that the V-belts or synchronous belts be attached to a motor console stationary between the motors.

An advantageous form of embodiment provides for the eccentric shafts to be driven via gearing, the belts being fitted between the countershafts.

It is furthermore advantageous that the synchronization takes place via an electrical synchronization control system.

It is furthermore proposed that the direction of oscillation and form of the unbalanced mass be capable of being changed in size and relative position to the main direction of oscillation by manual or electrical adjustment of one or both eccentric shafts.

Finally, it is advantageous that on the motor console one or two synchronous shafts are mounted via which the cardan shafts of the motors are connected by means of the belts.

The invention brings particularly the advantage that the synchronization forces on the belts or electrical components are practically zero and there is thus no fluttering of the drive mechanism. An additional substantial advantage consists in the fact that, once

the machine has been started, the smaller motor can be switched off and the residual forces of the smaller unbalanced masses taken over by the large motor, resulting in a saving of energy. Energy saving of this kind also results from the lowered temperatures and running noises. Where the axle distance of the eccentric shafts is changed, no new drive parts (e.g. gears) are necessary, which also simplifies the drive, no additional drive assemblies or turbo-coupling being necessary. The belts used effect damping through their spring action. Environmental pollution, such as is caused by oil escaping, can be avoided.

The invention is explained in greater detail in the following description with the aid of embodiments, given by way of example and shown in the drawings. These show:

Fig. 1 a screening machine with a vibratory drive according to the invention in elevation with a setting of the unbalanced masses in the direction of the small ellipse axis according to the force diagram,

Fig. 2 a side view of Fig. 1,

Fig. 3 a view of the motor console with the different drive assemblies as per Fig. 1,

Fig. 4 a corresponding view of the motor console as per a further form of embodiment for the drive assemblies, and

Fig. 5 the force diagram for the vibratory drive shown.

The vibratory drive shown in Figures 1 to 3 is attached to a screening machine with a screen case 1, screen surfaces 2 and resilient mounts 3.

The actual vibratory drive consists of two unbalanced masses 7, 8 which are mounted on the screen case 1 via unbalance shafts or eccentric shafts 14, 15. The drive of these eccentric shafts 14, 15 proceeds via cardan shafts 5, 6 which are driven by motors 9, 10, which are retained on a stationary motor console. The cardan shafts 5, 6, and with them also the eccentric shafts 14, 15, are synchronized via synchronous shafts 11, which are connected via belts 12, 13 to the motor drives 9, 10. The motor console 20 is arranged on a motor stand 4. In addition, on both sides of an eccentric shaft 14 or 15 sits an unbalanced mass 7 or 8.

It is essential for the invention that the eccentric shafts 14, 15 are arranged as near as possible to the mass centre 16 of the screening machine. Furthermore, the unbalanced forces 7 or 8 rotate in opposite

directions and this results, on the basis of the force diagram, in an oscillating movement of the screen case as per the ellipse shown (Figs. 1 and 5), the main direction of oscillation 18 coinciding with the longitudinal axis 19 of the ellipse 21. The tie line through the middle of the eccentric shafts 14, 15 is the zero line 17, where, in addition, the resultant of the mass oscillating forces is smallest. The angle α between this line 17 and line 18 is preferably 90°, satisfactory results being still achieved in the region to 60°. In the "zero setting", the unbalanced masses 7, 8 lie opposite one another on the zero line 17, i.e. on the tie line of the axes of the eccentric shafts 14, 15, i.e. rotated by 180° towards one another, so that no angular acceleration or deceleration of the unbalanced masses occurs.

According to the form of embodiment shown in Fig. 4, the synchronization of the two cardan shafts, 5, 6 takes place via a single synchronous shaft 11 and a single belt 12 which connects the motors 9, 10 and the synchronous shaft 11.

The force diagram is shown in Fig. 5. The two circles shown in broken lines symbolize the circulating unbalanced masses 8 or 7, unbalanced mass 7 being shown in two dimensions, namely as a smaller unbalanced mass and in dash-dot lines as a larger unbalanced mass 7'. Correspondingly, an ellipse 21 or an ellipse 21' arises

with the larger unbalanced mass 7'. With the aid of the parallelogram of forces, the resultant can be produced whose locus curve is vibratory ellipse 21. Some points of the unbalanced mass positions are drawn in, these being points 0 to 6 or 0' to 6'. From the diagram it can also be easily seen that the angle between the long ellipse axis 19 and the zero line 17 is 90°.

By changing the unbalanced masses, the mass forces can also be set in the required form, likewise, too, the relative position to the main direction of oscillation 18, and this can be done either manually or electrically.

The synchronization of the two eccentric shafts 14, 15 can also be effected by an electrical synchronization control system. The eccentric shafts 14, 15 can also be driven by gears, the corresponding drive belts then being fitted between the countershafts.

In this specification, except where the context requires otherwise, the words "comprise", "comprises" and "comprising" mean "include", "includes" and "including", respectively, that is when the invention is described or defined as comprising specified features, various embodiments of the same invention may also include additional features.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A screening machine for draining and/or sizing of grain solids like gravel, coal or ore, comprising a screening frame suspended on a machine stand and an elliptical vibratory drive including two eccentric shafts, said shafts having different unbalanced masses and being driven synchronously and in counterrotation by said drive, characterised in that resultant forces formed by rotation of said unbalanced masses engages a centre of mass of the screening machine or in its immediate proximity, and that a radial tie line of said eccentric shafts and a longitudinal axis of a vibratory ellipse of the resultant forces, form an angle in the range of 60° to 90°.

2. The screening machine according to claim 1, characterised in that the mass forces of the unbalanced masses are adjusted.

3. The screening machine according to claim 1 or 2, characterised in that the eccentric shafts are synchronized by means of V-belts or synchronous belts.

4. The screening machine according to claim 3, characterised in that the V-belts or synchronous belts are attached to a motor console stationary between two motors for driving the V-belts or synchronous belt.

5. The screening machine according to claim 3, characterised in that

the eccentric shafts are driven by gears, the V-belts or synchronous belts being fitted between the countershafts.

6. The screening machine according to claim 1 or 2, characterised in that
the shafts are driven in synchronization by an electrical synchronization control system.

7. The screening machine according to any one of claims 1 to 6,
characterised in that
the direction of oscillation and form of the unbalanced mass may be altered in size and relative position to the main direction of oscillation by manual or electrical adjustment of one or both of the eccentric shafts.

8. The screening machine according to any one of claims 3 to 5, characterised in that
cardan shafts extending from the motors and are connected to synchronous shafts mounted to the motor console and the V-belts or synchronous-belts are driven by the synchronous shafts.

9. A screening machine substantially as herein described with reference to the accompanying figures.

Dated this 7th day of March 2000
SVEDALA GFA AUFBEREITUNGSMASCHINEN GMBH & CO. KG
By their Patent Attorneys
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Trade Mark Attorneys of Australia

Fig. 1

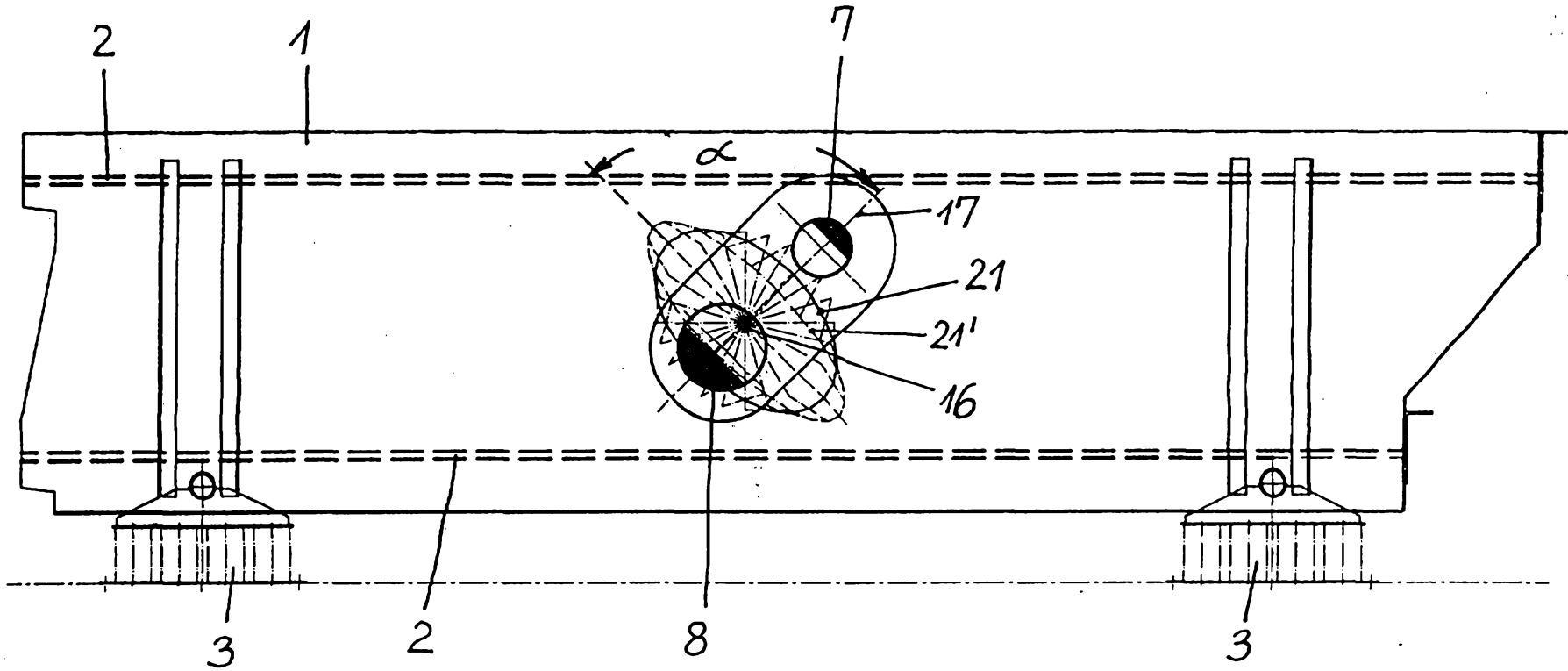

Fig. 2

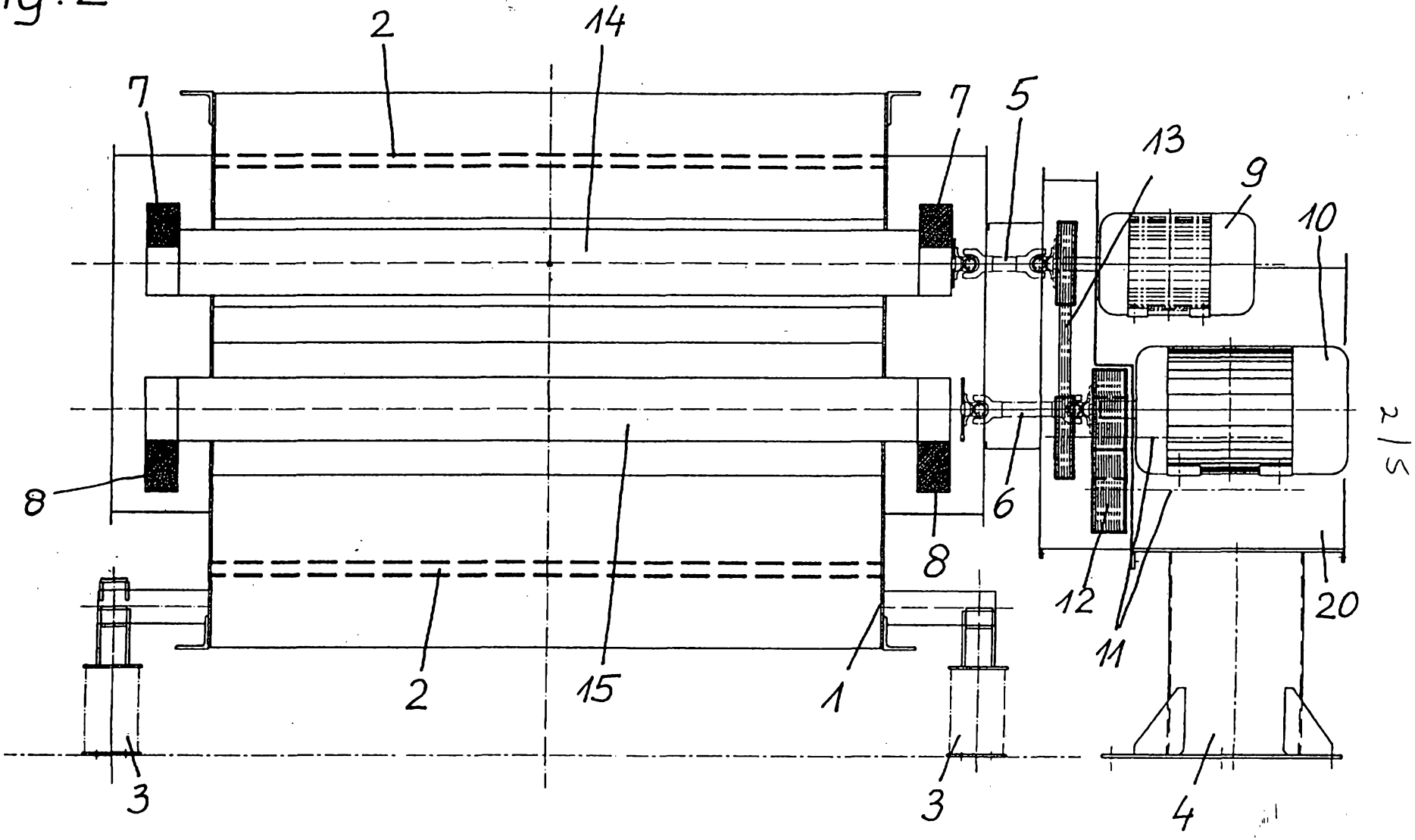

Fig. 3

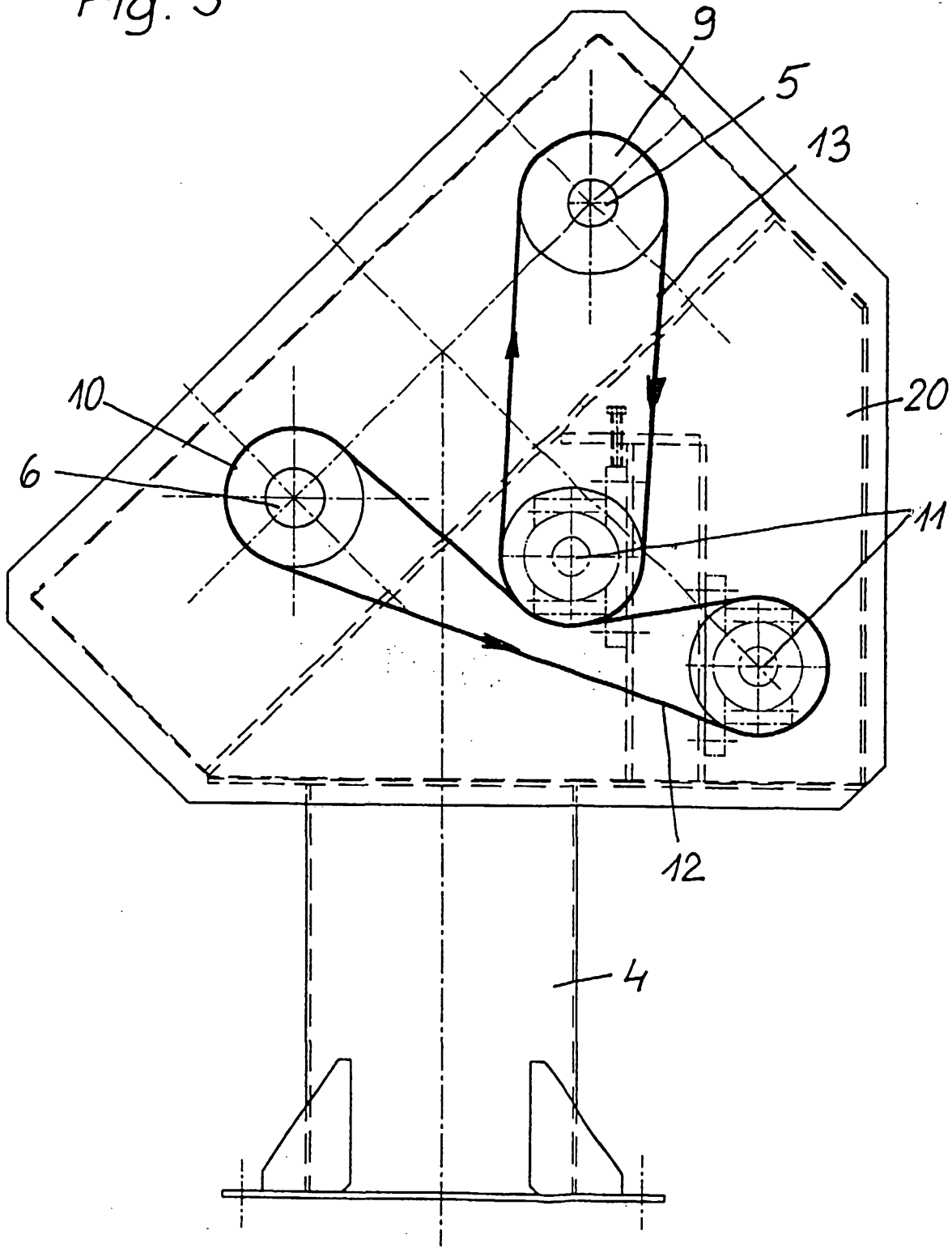

Fig. 4

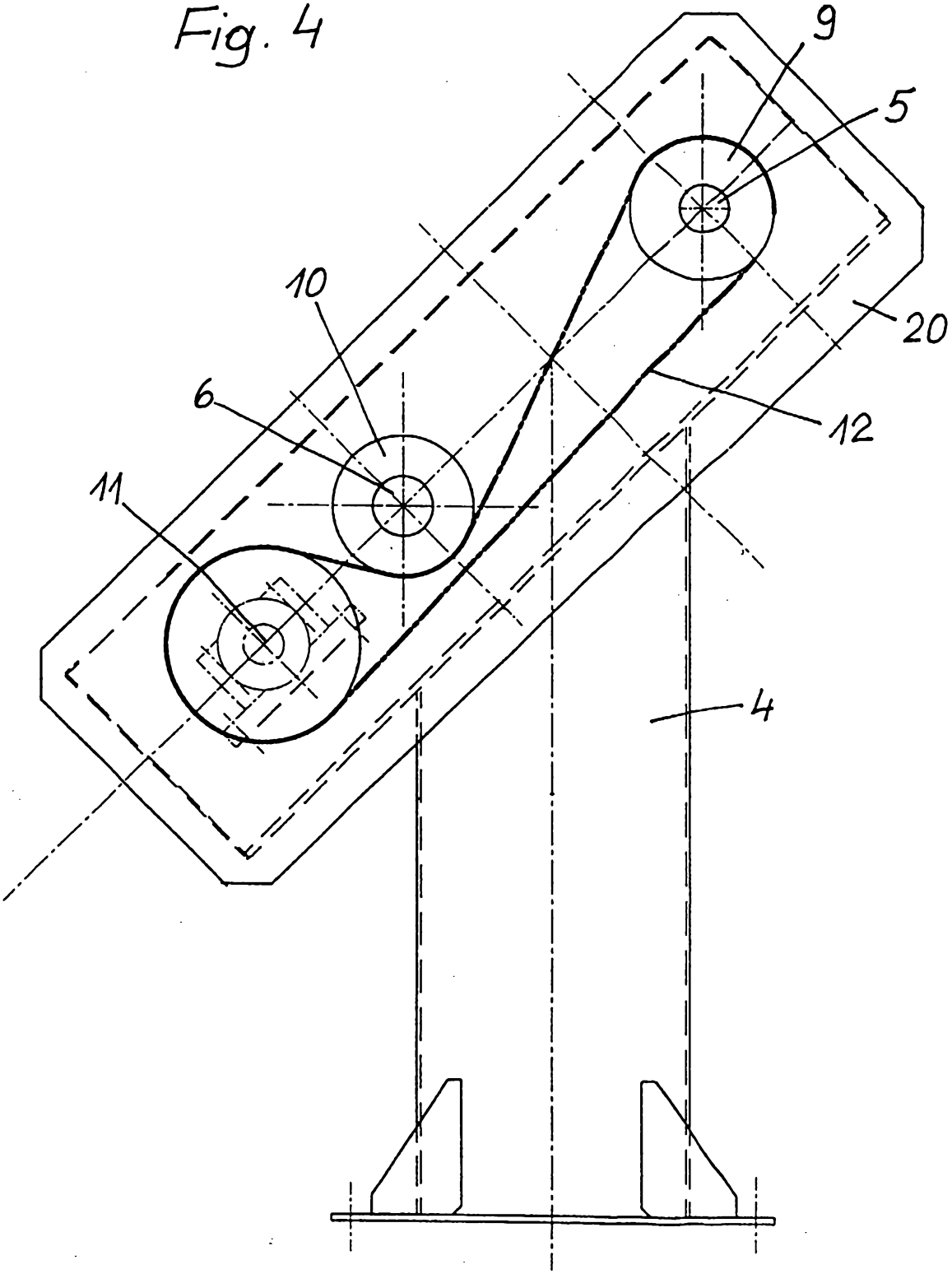

Fig. 5