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(54) Bundling apparatus.

(57) A bundling apparatus for clamping elongate articles (20-23) into a bundle, the apparatus having a zone into which the articles are brought for bundling, and an elongate flexible element (11) suspended so as to form a loop at least partly surrounding said zone. A pair of swingable tensioning arms (3,4) each has a contact member (9,10) for engaging the clamping element (11) from outside the loop and is swingable in a path about an axis (5) in a manner such that the contact member (9,10) moves above said zone while pushing said clamping element, the contact members (3,4) thus cooperate to effect tightening of the loop. The paths of swinging of said arms are arranged so that said arms are able to cross each other during their swinging movement.

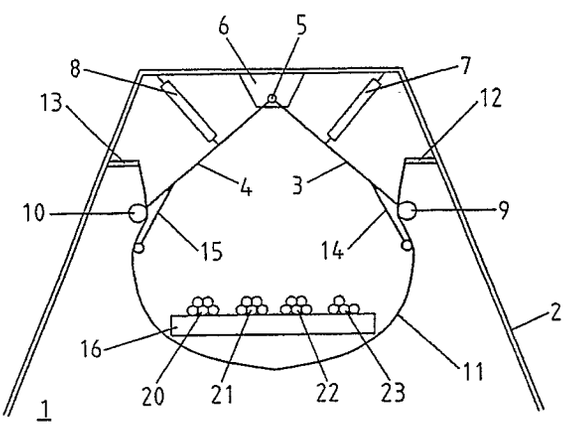

FIG. 1

EP 0 429 126 A1

BUNDLING APPARATUS

The invention relates to a bundling apparatus for clamping a plurality of elongate rod-shaped articles, for example steel bars, into a bundle.

It is a known practice to bind together into a bundle elongate objects such as concrete-reinforcing bars. In this practice, wire is passed manually or mechanically around a number of bars, the binding wire is then tightened and a knot is made in the binding wire as tightly as possible thus formed so that the bundle holds together.

When it is tightened, the binding wire fulfils the function of clamping means which has to be permanently capable of matching the shape of the bundle being formed. For this purpose, the wire must be flexible. After the bundle is formed, a knot is made in the binding wire. The knot should not loosen during further handling of the bundle. For this purpose, the wire must be stiff and permanently deformable. The two conflicting demands on the binding wire require a compromise so that in practice bundles are irregularly formed or not held tightly.

DE-A-1511826 describes a bundling apparatus in which a U-shaped swinging arm pushes a chain, which is initially in a loop below steel bars collected in a trough. The pushing end of the arm pushes the chain over the bars, thereby picking up the bars into a bundle. The aim is to reduce friction, to achieve good roundness of the bundle.

GB-A-1574349 shows a bundling apparatus in which two C-shaped arms swing to pull respective chains across the top of a bundle of bars, to tighten the bundle.

GB-A-1358472 shows a device with two swinging arms which push two sides of a loop of a sling towards each other to form a bundle. The bundle is then tightened by shortening the loop by pulling the ends of the loop.

None of the prior art proposals were suited for collecting rods from a wide span into a bundle, as may be required for example when steel bars arrive at the bundling apparatus on a roller table. It is desired to avoid the step of first collecting the bars in a trough. A subsidiary problem is to avoid fouling of the moving parts of the bundling apparatus by dirt and scale from the bars.

It is an object of the invention to provide a bundling apparatus which can pick up elongate articles over a relatively wide span, and from them into a bundle.

According to the invention there is provided a bundling apparatus for clamping a plurality of elongate rod-shaped articles into a bundle having

(a) a zone into which said articles are brought for bundling,

(b) an elongate flexible element suspended so as to form a loop at least partly surrounding said zone

(c) a pair of swingable tensioning arms each having a contact member for engaging said clamping element from outside said loop and each being swingable in a path about an axis in a manner such that said contact member moves above said zone while pushing said clamping element, said contact members thus cooperating to effect tightening of said loop around the articles to be bundled, said paths of swinging of said arms being arranged so that said arms are able to cross each other during their swinging movement..

Preferably the elongate flexible element e.g. a chian, is fixed at both ends to a frame of the apparatus.

The invention is based firstly on theconcept notion that the gripping of elongate articles into a bundle and the binding together of a bundle is done preferably by two separate apparatuses.

The system of frame, two swinging arm and flexible element forms a closed circle which may be changed in shape, and which essentially describes a flat plane, the gripping plane. Elongate articles, such as concrete-reinforcing bars may be fed through the closed circle transversely to the gripping plane. By rotating the arms suitably, the zone encompassed by the closed circle is reduced and the articles gripped into a bundle.

An advantage of the bundling apparatus in accordance with the invention is that it may be composed of a small number of individually simple elements.

Another advantage is that the bundling apparatus may comprise only a small number of moving parts and so be suitable for use in industrial surroundings. Moreover, movement of the moving parts is simple, so that the mechanization of the bundling apparatus is equally simple. The bundling apparatus is suitable for operating with a binding machine which turns binding wire around the gripped bundle and forms a knot. Because the bundling apparatus ensures the gripping of the elongate articles into a bundle, the binding machine is relieved both mechanically and in terms of time.

The crossing of the two swinging arms over the bundling zone enables the apparatus to pick up the articles from a wide zone. Thus the invention is particularly suitable for collecting and bundling articles lying on a flat surface, such as a conveyor table.

Reduction of the necessary rotation of the swinging arms is achieved in a preferred embodi-

ment of the bundling apparatus of the invention which the two arms rotate around the same axis. This embodiment is also structurally simple.

In a particularly preferred embodiment, the swinging axes or common axis of the swinging arms are above the bundling zone, e.g. directly above a table over which the articles to be bundled collect. This avoids the risk of contamination of the rotating mechanism by dirt and scale from the bundled articles, and gives good accessibility for maintenance. The flexible element can assume a wide, free catenary shape for collection of articles over a wide zone. The conveyor of the articles to be bundled is kept largely separate from the bundling apparatus.

As described above, the frame, first and second swinging arms, and gripping element describe a closed circle in a gripping plane. The elongate articles may be fed into the bundling apparatus transversely to this gripping plane. For some applications, when the bundling apparatus is in a position of rest, the feed-through size of the closed circle, i.e. the bundling zone, where the elongate articles are fed through is inadequate.

In order to enlarge the width of the bundling zone, preferably at least one of the swinging arms is provided with a guide for pushing the flexible gripping element, from inside the loop, at least when the swinging arms are at their open position.

Preferably the swinging arms, at least between their pivot axes and the pushing members which contact the elongate flexible element, are straight, which simplifies their production.

The invention will now be illustrated in the following by way of non-limitative example with reference to the drawing. In the drawing:-

Fig. 1 is a schematic representation of a bundling apparatus in accordance with the invention in its initial position of rest, and;

Fig. 2 is a schematic representation of the bundling apparatus of Fig. 1 in a position in which rod-shaped articles are gripped in a bundle.

The same reference numbers correspond to the same elements in both figures.

Fig. 1 shows a bundling apparatus 1 which comprises a frame or portal or grate shape2, a first swinging tensioning arm 3 and a second swingable tensioning arm 4. One end of each of the tensioning arms 3 and 4 is connected to a support 6 of the frame 2 so that it is free to rotate around an axis 5which is common for the two arms 3,4. Between the frame 2 and each tensioning arm 3,4 there is a piston-cylinder unit 7,8. Both piston-cylinder units 7,8 are double-action. The operating elements of suitable piston-cylinder units are generally known and are not further illustrated.

The outer end of the tensioning arm 3 is provided with a guide wheel 9; the outer end of the tensioning arm 4 is provided with a guide wheel 10. Branch arms 14,15 carry further guide wheels below the guide wheels 9,10. An elongate flexible gripping element, in the form of a link-chain 11, is attached at its two ends to supports 12 and 13 respectively of frame 6. The link-chain 11 passes over the guide wheels 9,10 and 14,15. The link chain 11 has the tendency to hang freely in a loop according to a catenary shape. The guide wheels 9.10 push the chain 11 inwardly from outside the loop. The two guide arms 14 and 15 press the link-chain 11 under the guide wheels 9 and 10 outwards, so that the zone described by elements 6, 3, 14, 11, 15 and 4 at the position of a roller 16 supporting the articles to be bundled is enlarged. Each of the guide arms 14 and 15 comprises a rod-shaped element that is provided on the side facing away from the tensioning arm by a slider over which the link-chain may slide.

The roller 16 is a roller of a feed conveyor for part bundles 20, 21, 22 and 23. Each of the part bundles 20, 21, 22 and 23 is in itself a bundle of, for example, reinforced concrete rods. The four part bundles must then be bundled together into a main bundle 25 which is shown in Fig. 2.

In order to form the main bundle 25, the pistons of the two piston-cylinder units 7,8 are extended out of the cylinders, so that the two tensioning arms 3 and 4 rotate around axis 5, crossing each other as seen in Figs. 1 and 2. Thus both wheels 9.10 move substantially the whole width of the conveyor roller 16. The two guide wheels 9 and 10 move the link-chain 11 and tighten the loop of the chain 11 around the part bundles 20, 21, 22 and 23. By further extending the pistons, the part bundles are bundled together into a newly formed main bundle 25. A desired gripping force on bundle 25 is achieved by extending the pistons of the piston cylinder combination out to a selected position. After binding wire has been placed around main bindle 25 in a manner of itself well-known, the pistons are retracted into the cylinders whereby the bundling apparatus returns into the position of rest indicated in Fig. 1.

Claims

1. A bundling apparatus for clamping a plurality of elongate rod-shaped articles (20-23) into a bundle (25), having an elongate flexible clamping element (11) suspended so as to form a loop at least partly surrounding a zone into which said articles are to be brought for bundling, and a first swinging tensioning arm (3) having a contact member (9) for engaging said clamping element from outside said loop, said arm being swingable about an axis (5) so that said contact member moves above said zone

while pushing said clamping element (11) in a manner which tightens said loop around the articles to be bundled, characterized by a second swinging tensioning arm (4) also having a contact member (10) for engaging said clamping element (11) from outside said loop, said second arm (4) being likewise swingable about an axis (5) so that its contact member (10) moves above said zone while pushing said clamping element, said first and second arms (3,4) being able to cross during their swinging movements to ef fect tightening of said loop.

2. A bundling apparatus according to claim 1 having a frame (2), said clamping element (11) being fixed at its two ends to said frame.

3. A bundling apparatus according to claim 1 or claim 2 wherein said first and second arms (3,4) are swingable about a common axis (5).

4. A bundling apparatus according to any one of claims 1 to 3 wherein at least one of said first and second arms (3,4) has a second contact member (14,15) for engaging said clamping element (11) from inside said loop, thereby to increase the width of said loop prior to the tightening of the loop.

5. A bundling apparatus according to any one of claims 1 to 4 wherein said axes (5) of swinging of said first and second arms are located at a level above said zone into which said articles are brought for bundling.

6. A bundling apparatus according to any one of claims 1 to 5 wherein at least one of said first and second arms (3,4) is straight.

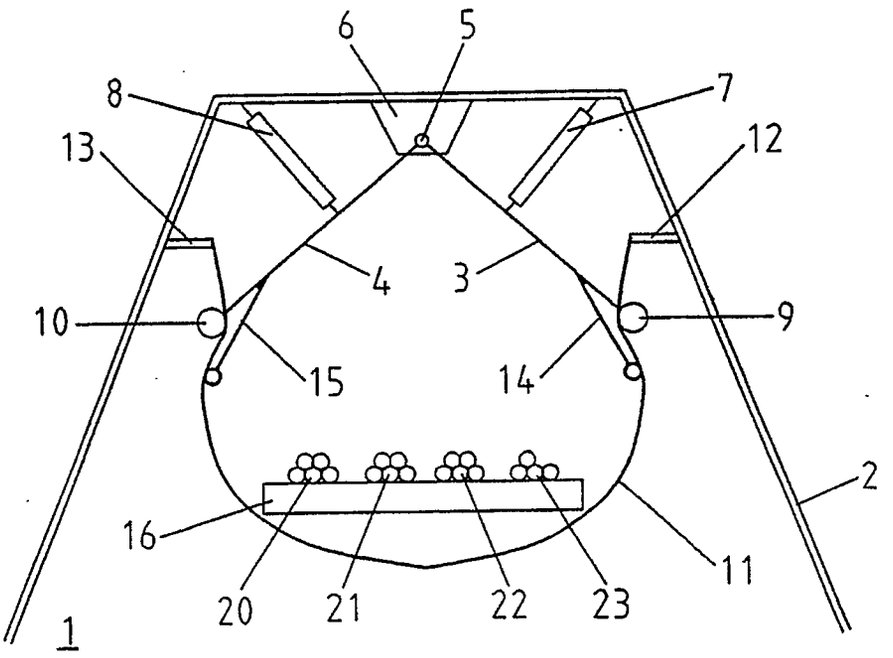
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FIG. 1

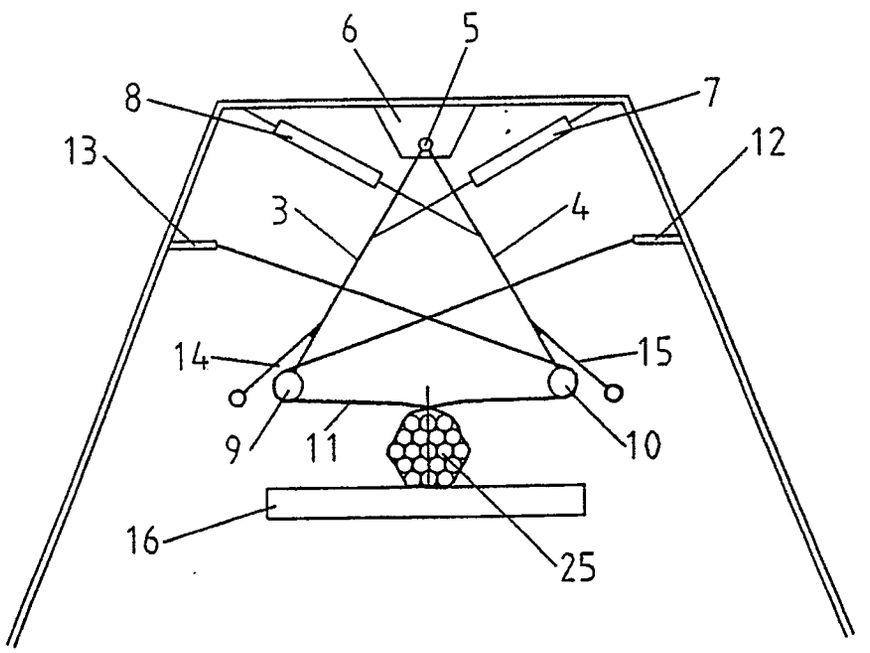
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FIG. 2

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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 2995

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.5)
D,X	GB-A-1 574 349 (ELEKTR. ZAVOD TYAZHELOGO MASHINOSTROENIA) * Page 1, line 88 - page 3, line 21; fig. *	1,2	B 65 B 13/20 B 65 B 27/10
D,A	DE-A-1 511 826 (E. THÄLMANN) * Page 3, line 6 - page 4, line 10; fig. *	1,2	
D,A	GB-A-1 358 472 (NORBERGS MEK. VERKSTAD)		
A	FR-A-2 223 244 (MORGAN)		
A	US-A-3 871 288 (F. WHITE)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 65 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	20 February 91	JAGUSIAK A.H.G.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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