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DRIVE FOR A ROLLER BED MOUNTED BEHIND THE CROSS-CUT SHEARS IN A SHEARING LINE FOR METAL PLATES

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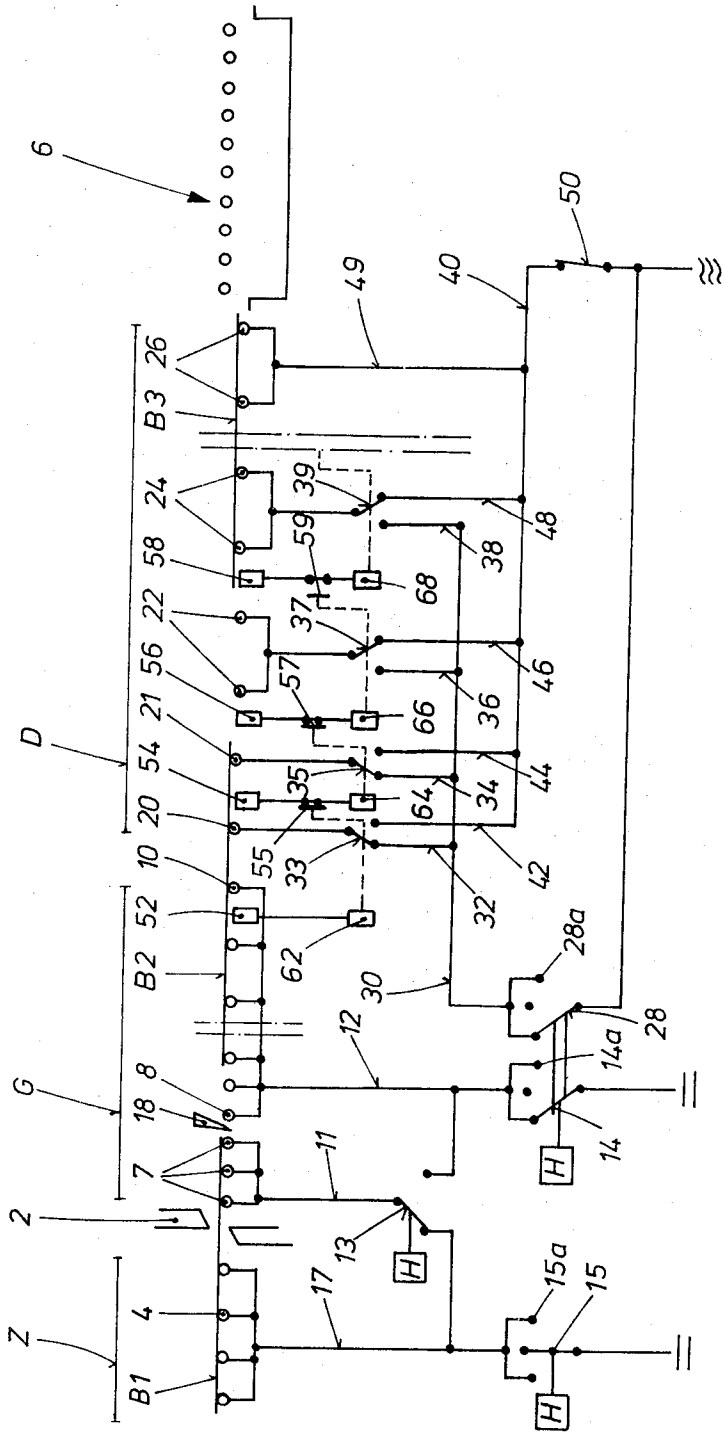

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DRIVE FOR A ROLLER BED MOUNTED BEHIND THE CROSS-CUT SHEARS IN A SHEARING LINE FOR METAL PLATES

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ABSTRACT OF THE DISCLOSURE

In the electrical drive for the rollers of a roller bed mounted behind the cross-cut shears of a shearing line for metal plates a first group of rollers in a roller bed are driven with direct current, a second group is driven with three-phase current. For positioning the plates which are advanced by the shears the rollers of the roller bed in the first group may be connected or driven in common while upon the crossing of plates over the joint between the two roller groups either individually and/or in groups the rollers of the second group driven with three-phase current are switched over by light barriers or the like in an additive matter on the advancing mode of the rollers driven with direct current.

The invention relates to a drive for a roller bed mounted behind the cross-cut shears of a shearing line for metal sheets and plates consisting of a first roller bed portion operated with direct current, or a direct current section, for positioning the plates over the desired cutting length and of a second roller bed portion, or three-phase section, whose rollers are operated with three-phase current for delivering the metal plates, for example to a stacking apparatus. During this operation both successively mounted roller bed sections are driven in a manner to obtain a travel of the plates over the joint which is as slip-free as possible so that they operate at about equal feeding speed and are similar also in their acceleration and braking mode, for example by a speed feedback between direct current and three-phase current roller bed motors.

The electrically operated rollers of the direct current section are generally arranged to be connected individually in order to deliver during the positioning of the plates before making a cross-cut a plate located already at the end of the direct current section in one movement and independently of the forward mounted rollers of the non-regulated and continuously moving three-phase section, which participate in a positioning operation in a slip-free manner. This plate crosses then over the three-phase section whose rollers are arranged so that they may be connected or driven in common to the stacking apparatus.

It is an object of the invention to eliminate the expensive individual drive of the rollers in a roller bed of the direct current section behind the cross-cut shears with the possibility of connecting individual rollers or groups of rollers. For this purpose it is proposed according to the invention that both roller bed sections are made at least as long as the maximum length of the metal plates, that the roller bed rollers of the direct current section may be connected or driven in common, so that all the metal plates carried by them are transported corresponding to the advance pace controlled for positioning the plates to be cut, and that the roller bed rollers of the three-phase section may be switched over individually and/or in groups during the period when the plates cross

over the joint by signals from detector devices mounted ahead of them which signal the cross-over of the plates, such as light barriers or the like, in an additive manner on the advancing mode of the direct current section.

By having thus according to the invention always that number of three-phase rollers in step with the stepwise actuated rollers of the direct current section during the positioning of the plates as are coupled with direct current rollers through the plate crossing the joint, it is now possible to avoid the conventional, selectively controllable individual drive of the direct current rollers in favor of a considerably less expensive group drive or a group connection.

The rollers of the three-phase section are preferably switched over from the constant operation (run-off connection) to the feeding mode of the direct current section (feeding connection).

An arrangement wherein not all the direct current rollers are controlled in common either mechanically or electrically falls also within the scope of the invention. It seems appropriate not to start and stop the entire direct current section as frequently as it is required for positioning plates over small plate lengths. Accordingly the invention provides that the rollers of the direct current section after the cross-cut shears and located within small cutting lengths may be connected for control purposes selectively to the roller bed mounted ahead of the cross-cut shears and to the remaining portion of the direct current sections.

In order to make sure that only those rollers of the three-phase section are switched over to the mode of the direct current section which are coupled over a plate to direct current rollers, it is proposed that the signal of the detector device mounted ahead of the first three-phase roller, when this detector is blocked out or covered by a plate, prevents the change-over of those continuously operating three-phase rollers which follow the not blocked or uncovered detector devices.

In this manner the plates whose end has crossed over the joint between the direct current section and the three-phase section travel in an uninterrupted fashion to the stacking apparatus although they travel themselves over detector devices. The change-over signals of the detector devices are thus suppressed in the case where not all the previous detector devices, including the first detector device, signal the cross-over of a plate.

The accomapnying drawing illustrates by way of a circuit diagram an embodiment of a drive for the roller bed of cross-cut shears according to the invention.

A feeding roller bed with a direct current drive of its rollers **4** is indicated by a line shown at Z and is located in front of the cross-cut shears **2**. The roller bed which connects the cross-cut shears **2** with a stacking device **6** comprising magnetic rollers consists of a section **6** operated by a direct current drive (direct current section) and a section D operated by a three-phase drive of the rollers (three-phase section). Each of the sections G and D is at least as long as the maximum plate length to be cut.

By far the largest portion of the direct current section G between the rollers **8** and **10** is combined into a group that may be connected in common, and which is connected over the line **12** by means of a switch **14**. Furthermore the three rollers **7** which follow the cross-cut shears **2** and lie within a short cutting length which is indicated for a plate B1 by the feeding distance **18** are combined into a group that can be connected in common, which may be connected over the line **11** and the switch **13** selectively to the feeding roller bed C with the switch **15** and the line **17** or to the remaining portion **8** through **10** of the direct current section G.

The three-phase section D consists of individually driven and connectable rollers **20**, **21**, and subsequent roller groups **22**, **24** etc. to **26** which may be connected in pairs. Over a switch **28** which is coupled to switch **14** of the direct current section G a feeding line **30** may be supplied with three-phase current, and from this line parallel branch lines **32**, **34**, **36** and **38** can lead off and may be connected over switches **33**, **35**, **37** and **39** to the motors of the rollers **20** through **24**.

In the drawing only the rollers **20** and **21** are connected through lines **32** respectively **34** with line **30**, while the roller pairs **22** and **24** (and other roller pairs up to **26** not shown) are connected over the switches **37** and **39** to a run-off line **40**, from which parallel branch lines **42**, **44**, **46** and **48** lead to the second contacts of the change-over switches **33**, **35**, **37**, **39**. The last roller pair **26** is constantly connected over line **49** with the run-off line **40**, which is connected over a main switch **50** to the three-phase circuit. The switch **50** lies in this respect parallel to switch **28** for feeding the plates to the three-phase section.

Detector devices in the form of light barriers **52**, **54**, **56** and **58** are mounted in the roller bed in front of the rollers **10**, **21**, **22** and **24**, and emit signals to the relays **62**, **64**, **66** and **68** upon the cross-over of a plate, e.g. B2, the relays changing the switches **33**, **35**, **37** and **39** from the base position as shown for the switches **37** and **39** into the position shown for the switches **33** and **35**. It will be understood that the light barriers **52**, **54** which control these switches **33** and **35**, are blocked off by the plate B2. The light barrier **58** (and others not illustrated) is actually blocked off by a departing plate B3 but in the signal lines between the light barriers **54** through **58** and subsequent ones interrupter switches **55** through **59** are provided, which are actuated by the relay of the preceding light barrier and are closed only in the case where the particular preliminary relay receives a signal. This is the case only when the interrupter switch is closed before the particular preliminary relay and simultaneously the associated light barrier is blocked off.

Before the operation of the roller bed drive according to the invention is explained in greater detail it is to be understood that the illustration of the switches **15**, **14** and **28** with the auxiliary contacts **15***a*, **14***a* and **28***a* has the following significance: The switches **14** and **28** are in the "on" position. In order to stop the roller bed rollers connected to these switches, the coupled switches **14**, **28** are temporarily placed on the contacts **14***a* and **28***a* so that a counter-current braking effect occurs in order to rapidly brake the rollers during positioning of the plates. In view of the fact that such switching is known they could be illustrated diagrammatically by the auxiliary feed-back contacts **15***a*, **14***a* and **28***a*. Furthermore it is pointed out that the path of the current has been illustrated as single line only for the purpose of simplicity.

OPERATION

When a specific plate length which is set by the advancing device **18** is to be separated from a plate B1 by means of the cross-cut shears **2**, and when this length is so small that it does not exceed the length of the first three-member group of rollers **7** of the direct current section G, this three-member group **7** is connected up to switch **15** of the feeding roller bed Z disposed in front of the cross-cut shears **2** through the switch **13**, as may be seen in the drawing. The plate B1 is positioned just right in abutment at the advancing device **18** and therefore the switch **15** is in the "out" position.

Instead of the mechanical advancing device **18** any conventional electrical advancing device may be provided, e.g. with a measuring roller which may be set for a nominal value of the desired cutting length. In that case the switches **13**, **15**, **14** and **28** are not manually operated as illustrated but are connected through relays in a known manner.

When only the three-member group **7** is connected to the feeding roller bed Z at small cutting lengths has one the advantage that the metal plates B2 and B3 lying on the remaining rollers of the sections G and D can run off freely without being affected by the positioning process, and for this purpose the switches **14** and **28** are in the "on" position. The main switch **50** is always connected.

We take now the case in which according to the cut of the shears **2** a long plate section is to be severed which will be placed during positioning also on rollers of the actual direct current section between the rollers **8** and **10**. For this purpose switch **13** is first changed over so that the entire direct current section G is controlled by switch **14**. When during the introduction of the new cutting length a metal plate B2 crosses the joint between the direct current section G and the three-phase section D or extends already into the three-phase section, it is assured with the present invention that the three-phase rollers, which are actually constantly connected over **50**, **40** and over the switches **33**, **35**, **37** and **39** which are in the base position, are automatically changed over additively to the advancing mode of the direct current section G as the front edge of the plate approaches a three-phase roller **20**, **21** or a two-member group **22**, **24**.

The advancing mode of the direct current section G is fed to the auxiliary three-phase supplied feeding current **30** through **32**, **34**, **36**, **38** over the coupling of the three-phase switch **28** to the direct current switch **14**, but the three-phase rollers **22**, **24** are thereby still not affected because their switches **37** and **39** in the base position are still connected to the run off line **40**.

It will be appreciated, however, that the light barriers **52** and **54** which are disposed in front of the three-phase rollers **20** and **21** and are crossed over by the plate B2 have changed over the switches **33** and **35** over their relays **62** and **64** to the feeding line **30** and thus to the three-phase switch **28** coupled to the switching state of the direct current section G.

When the plate B2 is also stopped during positioning of a new plate the three-phase rollers **20** and **21** will also be stopped. Upon a further advance of the plate B2 the light barrier **56** is crossed over which now connects also the rollers **52** to the feeding line **30**, thus in an additive manner.

The plate B3 which is connected to the run off line would, because it covers the light barrier **54** and perhaps additional light barriers of succeeding two member groups of roller bed rollers, be included also in the advancing rhythm of the direct current section, unless the gates with the interrupter switches **55**, **57**, **59** etc. were provided, which are opened and kept open, if even a single preceding light barrier is not blocked off, which is the case when there is a gap between two plates. Thus in the example given the uncovered light barrier **56**, although its interrupter **57** is closed, if it receives no signal current maintains not only switch **37** connected to the run off line **40** but maintains also the interrupter **59** open. In this way the signal of the light barrier **58** is suppressed although the light barrier is blocked off.

In view of the fact that the first light barrier **52** actuates in any case its relay **62** when it is blocked off by plate B2, this light barrier takes over the initiation of the closing of the interrupters **55**, **57**, **59** etc. for the additive connection of three-phase rollers to the advancing mode of the direct current section as well as in a sort of chain reaction the opening of these interrupters when the light barrier **52** is crossed over by the rear edge of the plate. All the switches **33**, **35**, **37**, **39** etc. are thereby changed over in the base position to the run off line **40** or are blocked in this position until a new plate crosses over

the light barrier **52** and the additive connection of three-phase rollers to the feeding line **30** begins again.

What is claimed is:

1. A drive for a roller bed disposed behind the cross-cut shears of a shearing line for metal plates, comprising:

(a) a first roller bed section whose rollers are commonly driven with a direct current so as to operate said rollers of said first roller bed section in an advancing mode for positioning the plates at a desired cutting length,

(b) a second roller bed section whose rollers are individually driven with a three-phase alternating current, each of said roller bed sections being at least as long as the maximum plate length and operating with approximately equal feeding speed, said rollers of said second roller bed section having a shiftable mode of operation,

(c) means for controlling said rollers of said first roller bed section in common,

(d) means for controlling said rollers of said second roller bed section individually,

(e) detector devices mounted in front of each individually controlled roller of said second roller bed section for detecting the presence of a plate moving in a direction from said first to said second roller bed section and for producing a signal indicating the presence of a plate approaching one of said rollers,

(f) switching and conducting means responsive to said signals of said detector means for operatively connecting the drive of each individually driven roller of said second roller bed section to said means for controlling said rollers of said first roller bed section for shifting said mode of operation of said rollers of said second roller bed section to correspond with said advancing mode of said first roller bed section.

2. A drive for a roller bed disposed behind the cross-cut shears of a shearing line for metal plates as recited in claim **1** wherein said shiftable mode of operation is normally such that said rollers of said second roller bed section operate at a constant speed.

3. A drive for a roller bed disposed behind the cross-cut shears of a shearing line as recited in claim **1** including:

(a) rollers disposed in front of the cross-cut shears,

(b) said first roller bed section including a first portion of rollers disposed directly after the cross-cut shears and a second portion of rollers comprising the remaining rollers of said first roller bed section,

(c) said first portion being selectively connectable for common control in a first control mode with said front rollers and in a second control mode with said second portion.

4. A drive for a roller bed disposed behind the cross-cut shears of a shearing line for metal plates as defined in claim **1**, including means for suppressing the signals of each of said detector devices following a first detector device upon cancellation of the signal of each respective preceding detector device.

5. A drive for a roller bed disposed behind the cross-cut shears of a shearing line for metal plates comprising:

(a) a first roller bed section whose rollers are commonly driven with a direct current so as to operate said rollers of said first roller bed section in an advancing mode for positioning the plates at a desired cutting length,

(b) a second roller bed section wherein groups of rollers are driven with a three-phase alternating current, each of said roller bed sections being at least as long as the maximum plate length and operating with approximately equal feeding speed, said rollers of said second roller bed section having a shiftable mode of operation,

(c) means for controlling said rollers of said first roller bed section in common,

(d) means for controlling said groups of rollers of said second roller bed section,

(e) detector devices mounted in said second roller bed section for detecting the presence of a plate moving in a direction from said first to said second roller bed section and for producing a signal indicating the presence of an approaching plate,

(f) switching and conducting means responsive to said signals of said detector means for operatively connecting the drive of said rollers of said second roller bed section to said means for controlling said rollers of said first roller bed section for shifting said mode of operation of said rollers of said second roller bed section to correspond with the advancing mode of said first roller bed section.

6. A drive for a roller bed disposed behind the cross-cut shears of a shearing line for metal plates as recited in claim **5**, wherein said shiftable mode of operation is normally such that said rollers of said second roller bed section operate at a constant speed.

7. A drive for a roller bed disposed behind the cross-cut shears of a shearing line as recited in claim **5**, including:

(a) rollers disposed in front of the cross-cut shears,

(b) said first roller bed section including a first portion of rollers disposed directly after the cross-cut shears and a second portion of rollers comprising the remaining rollers of said first roller bed section,

(c) said first portion being selectively connectable for common control in a first control mode with said front rollers and in a second control mode with said second portion.

8. A drive for a roller bed disposed behind the cross-cut shears for a shearing line for metal plates as defined in claim **5**, including means for suppressing the signals of each of said detector devices following a first detector device upon cancellation of the signal of each respective preceding detector device.

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