

[54] **LOOSE BAND COILER FOR USE WITH HORIZONTAL CONTINUOUS CASTING MACHINE**

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[22] Filed: **July 16, 1973**

[21] Appl. No.: **379,889**

[30] **Foreign Application Priority Data**  
July 19, 1972 Germany..... 2236388

[52] U.S. Cl..... 72/9, 29/33 C, 72/DIG. 18, 72/146, 164/270

[51] Int. Cl..... B21b 37/12, B21c 47/00

[58] Field of Search..... 29/33 C; 164/269, 270, 164/154, 4; 72/8, DIG. 18, 9, 146; 242/75.51

[56] **References Cited**  
**UNITED STATES PATENTS**

3,196,516 7/1965 Bongiovanni..... 29/33  
3,623,532 11/1971 Cofer..... 164/270 X

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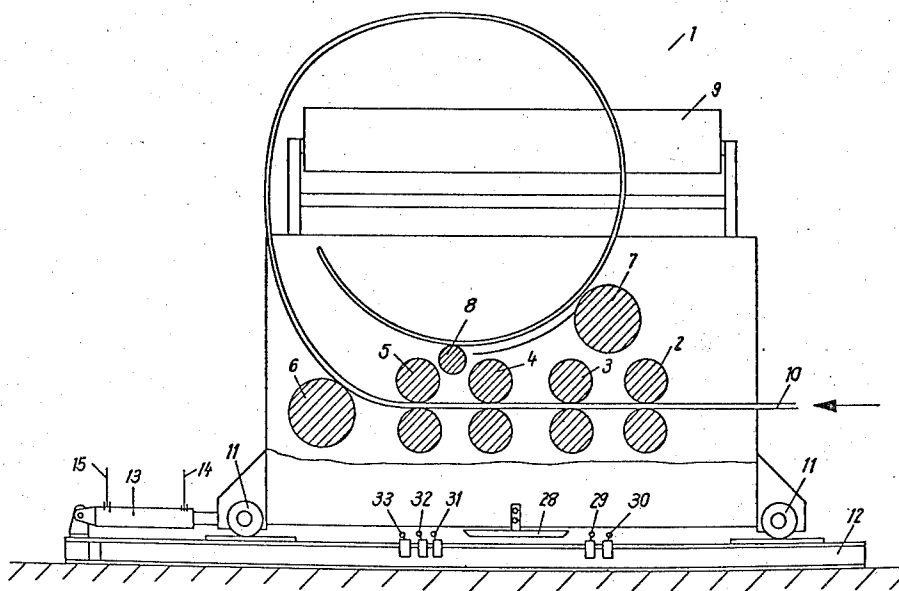
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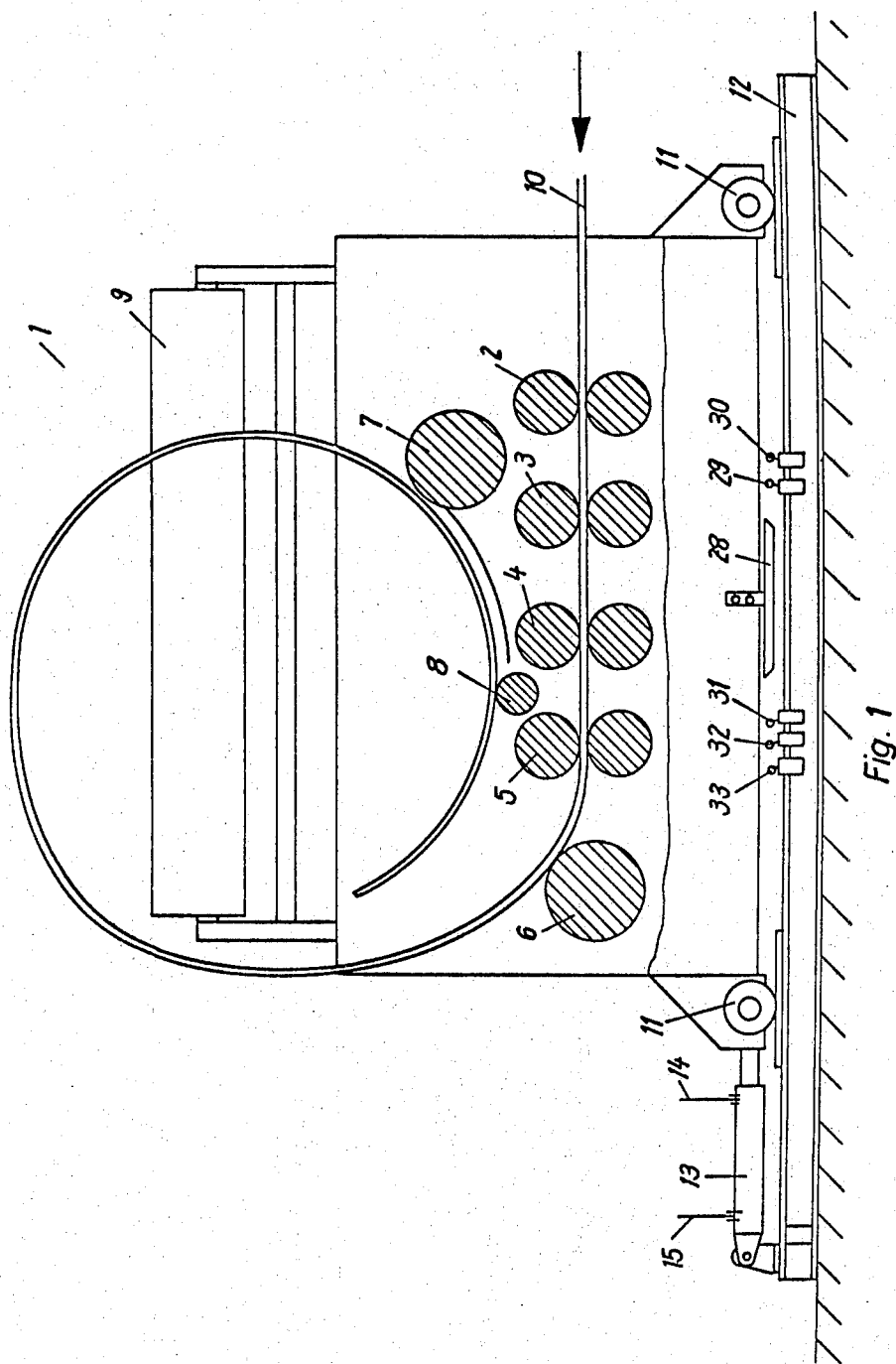
[57] **ABSTRACT**

A loose band coiler having support wheels is mounted

for rolling movement on rails adjacent a horizontal continuous casting machine having the usual holding furnace, mold, drawing unit and cutting device adjacent which the coiler is positioned. The coiler has motor driven drive rolls for moving the strand therebetween, a bending cylinder, guide rolls directing the coiling and lateral guide rolls at the sides of the coil. The coiler has a double ended cam and limit switches controlling the motors of the strand drive rolls which are fixedly mounted on a rail in the line of movements of the cam ends to be actuated thereby. A hydraulic power cylinder has the cylinder fixedly connected to the rail while the piston is connected by its rod to the loose band wheel mounted coiler or vice versa to supply support movement to the coiler. There is a hydraulic control system or device supplying hydraulic pressure to the ends of the power cylinder. The system consists of a source of hydraulic pressure, of a pipe line leading from the pressure source through a pressure reducing valve and a check valve to one end of the power cylinder. The other end of the power cylinder is connected by a pipe line to a pressure reducing valve which is connected by a pipe line to a solenoid actuated reversing valve connected selectively by a pipe line to the oil pressure supply line from the pressure source and another pipe line which returns to the pressure source. A by-pass line connects with the first mentioned line to the cylinder and through a pressure reducing valve to the return pipe line to the pressure source. A second by-pass line connects the second mentioned pressure reducing valve with the return line to the pressure source.

**21 Claims, 3 Drawing Figures**





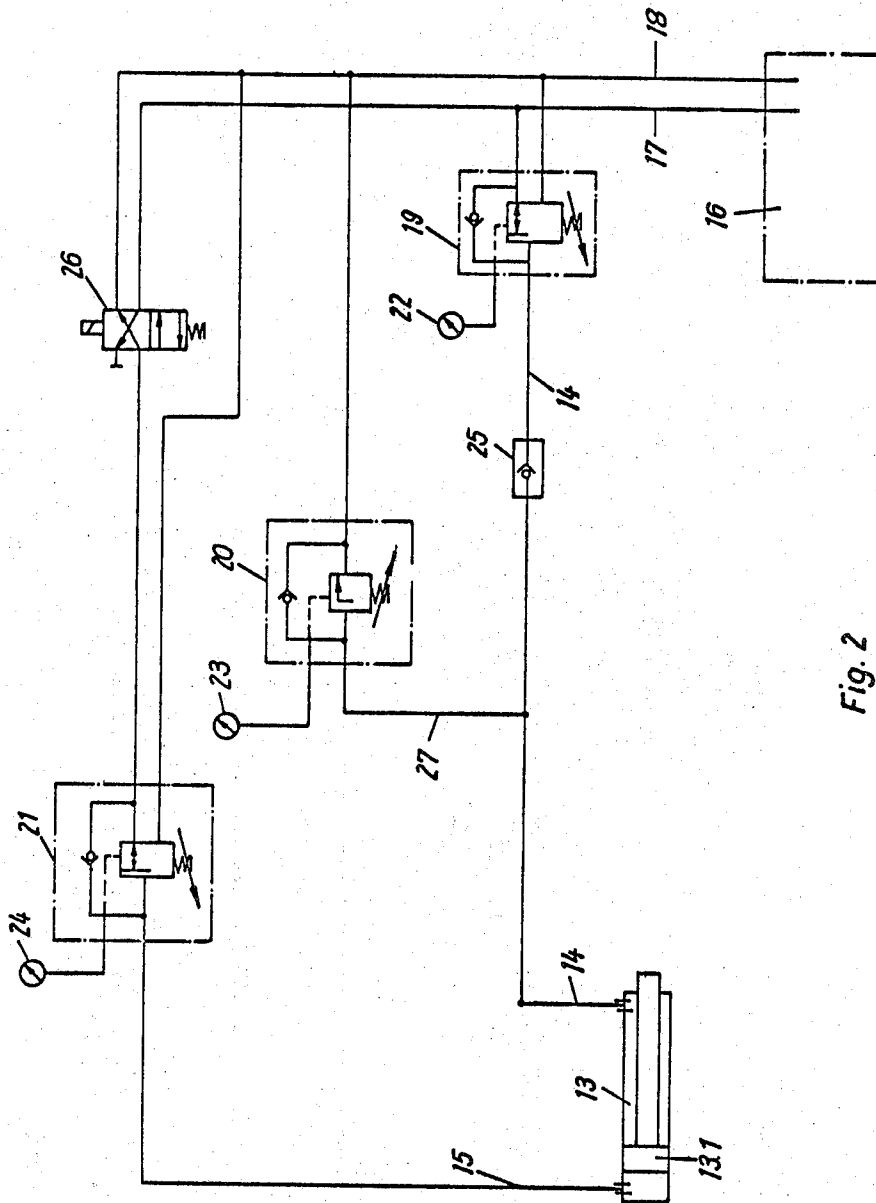


Fig. 2

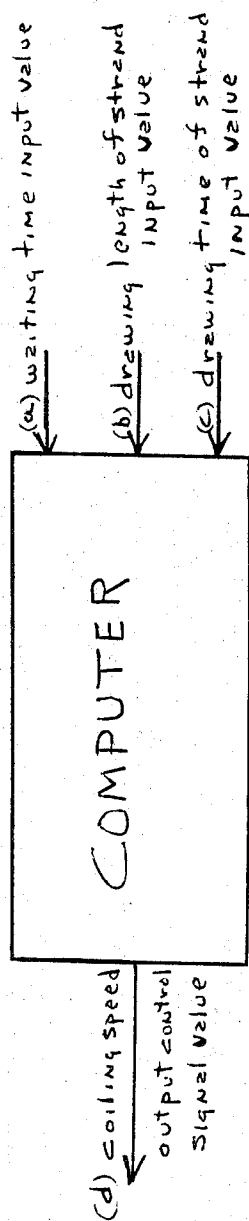


Fig. 3

## LOOSE BAND COILER FOR USE WITH HORIZONTAL CONTINUOUS CASTING MACHINE

The invention concerns a loose band coiler which is arranged for use with a continuous casting machine consisting of holding furnace, mold, drawing unit and cutting device.

With known loose band coilers of this type, a relatively larger space of about 20 feet is required between the last component, i.e., the cutting device and the loose band coiler. The space is arranged for sagging the strand. The movement of the loose band coiler is controlled in dependence on this sag, but this has disadvantages. Firstly the space causes a great length of the machine. Secondly the drawing process is influenced by the loose band coiler in dependence on a too small or too great sag respectively. In the case of a too small sag the loose band coiler draws the strand out of the strand drawing unit inspite of being clamped by the drive rolls.

The object of the invention is to avoid the appearing disadvantages and to construct the loose band coiler so that a short length of the device is required and the drawing process is not influenced by the position of the loose band coiler.

According to the invention the problem is solved owing to the fact that the loose band coiler is movably arranged on wheels and movable with respect to the continuous casting machine and is provided with a device for controlling the coiling speed in dependence on the drawing speed of the continuous casting machine and/or in dependence on the travel of the loose band coiler.

Furthermore the invention uses a computer for ascertaining the coiling speed as an average value of waiting time, drawing length and drawing time of the continuous casting machine.

In dependence on the travel of the band coiler the control can be provided by a limit switch or by a potentiometer. The limit switches are arranged either to switch several coiling speeds or to switch on or off the coiling movements. The switching on or off is very simple. A normal three-phase motor can be used.

A hydraulic cylinder is arranged between the rails on which the coiler moves and the loose band coiler to support the movement of the loose band coiler.

An embodiment of the invention is hereinafter described by way of example with reference to the accompanying drawings, but it is to be clearly understood that the invention is by no means restricted to the details of this embodiment.

FIG. 1 shows a side view of the loose band coiler; FIG. 2 a hydraulic diagram of a system for controlling a hydraulic power cylinder and FIG. 3 a computer representation with represented inputs and output signal values.

A loose band coiler 1 consists of pairs of drive rolls 2 to 5 and of a bending cylinder 6 and guiding rollers 7 and 8 and furthermore of lateral guiding rollers 9, which give a strand 10 the form of a coil. The pairs of drive rolls 2 to 5 are driven by driving motors (not shown). The loose band coiler is supported on wheels 11 and movable within limits in strand drawing direction with respect to a continuous casting machine. The wheels 11 run on rails 12 which lie on the ground of foundry. A hydraulic cylinder 13 is connected with the rails 12 and the piston 13.1 of which is journaled to the loose band coiler while the pipes 14, 15 of which lead to a hydraulic control device. It supports the movement

of the loose band coiler caused by drawing and coiling.

A diagram of a hydraulic control device or system is shown in FIG. 2. The hydraulic control device consists of a source 16 for supply of oil under pressure, of a pipe line 17 leading from the pressure source, of a return oil line 18 to the pressure source 16, pressure reducing valves 19, 20, 21, pressure indicators 22, 23, 24, of a check valve 25 and a solenoid valve 26.

A hydraulic medium is led from the pressure oil source 16 to the pressure reducing valve 19 through the pipe line 17. The predetermined pressure can be read from the pressure indicator 22. The pipe line 14 connects reducing valve 19 and the hydraulic cylinder 13. In the pipe 14 there is built in a check valve 25. A pipe 27 is branched off from the pipe 14. The pipe 27 is connected with the return oil line 18 via the pressure reducing valve 20. The line 15 of the hydraulic cylinder 13 is connected with the return oil line 18 or the pressure oil line 17 respectively via the pressure reducing valve 21, depending on the position of the solenoid valve 26. Valve 26 is a two way valve having connections selectively with the lines 17 and 18 and a single hydraulic line connection with pressure reducing valve 21. Pressure reducing valve 21 also has a single hydraulic line connection with return line 18 to the pressure oil source 16.

The mode of action of the hydraulic controlling device is as follows:

The strand 10 drawn acts as a rigid connection to the loose band coiler 1 because of the short travel. When the wheels 11 are free to run smoothly, the loose band coiler 1 acts against the drawing force because of the power of its masses. The object of the hydraulic cylinder 13 is to support the shifting of the loose band coiler 1 during the drawing operation which often acts with a jerk. The piston 13.1 see FIG. 2, in the hydraulic cylinder 13 is permanently under the pressure which is predetermined at the pressure reducing valve. The pressure is so high that the strand 10 stands under pulling tension. The loose band coiler 1 for that reason easily follows the drawing movement when the drawing process begins. The coiling speed being controlled in dependence on the medium drawing speed, the loose band coiler 1 runs back to the continuous casting machine during the waiting time because of the coiling process and reaches its starting position at the beginning of the next drawing process.

The drawing process being finished, the solenoid valve 26 is reversed so that pressure reducing valve 21 is supplied from line 17 and the line 15 stands under pressure which is predetermined by the pressure reducing valve 21. This pressure is suitably higher than the pressure controlled by the pressure reducing valve 20. The quantity of oil standing before the right hand end of piston 13.1 now flows off through the line 27. The pressure reducing valve 20 is adjusted somewhat higher than the pressure reducing valve 19. By this hydraulic control system or device movement of the loose band coiler 1 is supported in both directions.

In order to provide control of the coiling in dependence on the shifting travel of the coiler 1, a switch cam 28 is arranged on the frame of the loose band coiler 1 and limit switches 29 to 33 that are fixedly mounted on the rails 12 are operated by the cam. During the drawing process the switching cam 28 moves with the coiler to contact the limit switches 29 or 33 which actuate the driving motors by means of a control box (not shown)

to cause the pairs of drive rolls 2 to 5 to rotate more slowly or more quickly so as to match, more closely, the desired coiling speed of the coiler 1. When the coiling speed is higher than the drawing speed, the limit switch 29 is actuated. By that, the motors driving the pairs of rolls 2 to 5 are caused to run more slowly or they are switched off respectively. When the cam 28 deflects the limit switch 31, the motors driving the pairs of rolls 2 to 5 are switched to a higher speed; when the switch 32 is actuated, a still higher speed is switched on. The limit switches 30 and 33 are security switches, in case the limit switches 29, 31 or 32 should fail. The computer in FIG. 3 supplies an output signal value which is connected in said control box (not shown) to represent an average value of (a) waiting time value (b) drawing length of strand input value and (c) drawing time of strand input value to provide a control for the desired coiling speed.

What is claimed is:

1. A loose band coiler for use with a horizontal continuous casting machine, said coiler being mounted on wheels for movement towards and away from the casting machine, said coiler having coiling means for coiling the cast strand, control means connected with the coiling means for controlling the coiling speed dependent on the strand drawing speed and dependent on the travel movement of said loose band coiler.

2. A loose band coiler according to claim 1 wherein said control means includes a computer for providing the coiling speed, said computer having input means representing an average value of waiting time, drawing length and drawing time of the continuous casting machine.

3. A loose band coiler according to claim 1 wherein said coiler includes cooperating drive rolls for the strand, said control means includes driving motors for the drive rolls and limit switches spaced along the path of travel movement of the coiler for actuation by movements of said coiler, said limit switches being connected with said control means whereby the driving motors drive said drive rolls at several speeds and switch on and off said driving motors.

4. A loose band coiler according to claim 1 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

5. A loose band coiler according to claim 2 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

6. A loose band coiler according to claim 3 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

7. A loose band coiler according to claim 6 including rails for receiving the wheels of the coiler and wherein said power cylinder has one portion fixed to a rail and its other portion attached to said coiler and said limit

switches are attached along said rail for operation by a cam on said coiler.

8. A loose band coiler for use with a horizontal continuous casting machine, said coiler being mounted on wheels for movement towards and away from the casting machine, said coiler having coiling means for coiling the cast strand, control means connected with the coiling means for controlling the coiling speed dependent on the strand drawing speed.

9. A loose band coiler according to claim 8 wherein said control means includes a computer for providing the coiling speed, said computer having input means representing an average value of waiting time, drawing length and drawing time of the continuous casting machine.

10. A loose band coiler according to claim 8 wherein said coiler includes cooperating drive rolls for the strand, said control means includes driving motors for the drive rolls and limit switches spaced along the path of travel movement of the coiler for actuation by movements of said coiler, said limit switches being connected with said control means whereby the driving motors drive said drive rolls at several speeds and switch on and off said driving motors.

11. A loose band coiler according to claim 8 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

12. A loose band coiler according to claim 8 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

13. A loose band coiler according to claim 10 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

14. A loose band coiler according to claim 13 including rails for receiving the wheels of the coiler and wherein said power cylinder has one portion fixed to a rail and its other portion attached to said coiler and said limit switches are attached along said rail for operation by a cam on said coiler.

15. A loose band coiler for use with a horizontal continuous casting machine, said coiler being mounted on wheels for movement towards and away from the casting machine, said coiler having coiling means for coiling the cast strand, control means connected with the coiling means for controlling the coiling speed and dependent on the travel movement of said loose band coiler.

16. A loose band coiler according to claim 15 wherein said control means includes a computer for providing the coiling speed, said computer having input means representing an average value of waiting time, drawing length and drawing time of the continuous casting machine.

17. A loose band coiler according to claim 15 wherein said coiler includes cooperating drive rolls for

the strand, said control means includes driving motors for the drive rolls and limit switches spaced along the path of travel movement of the coiler for actuation by movements of said coiler, said limit switches being connected with said control means whereby the driving motors drive said drive rolls at several speeds and switch on and off said driving motors.

18. A loose band coiler according to claim 8 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

19. A loose band coiler according to claim 9 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between

the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

20. A loose band coiler according to claim 10 including a hydraulic power cylinder and a hydraulic pressure supply operably connected thereto and having a fixed portion and a movable portion and positioned between the loose band coiler and a fixed position whereby the power cylinder supports the movements of the loose band coiler.

21. A loose band coiler according to claim 20 including rails for receiving the wheels of the coiler and wherein said power cylinder has one portion fixed to a rail and its other portion attached to said coiler and said limit switches are attached along said rail for operation by a cam on said coiler.

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