June 18, 1968 F. SEDLACEK ET AL 3,388,780

BUFFER DEVICE

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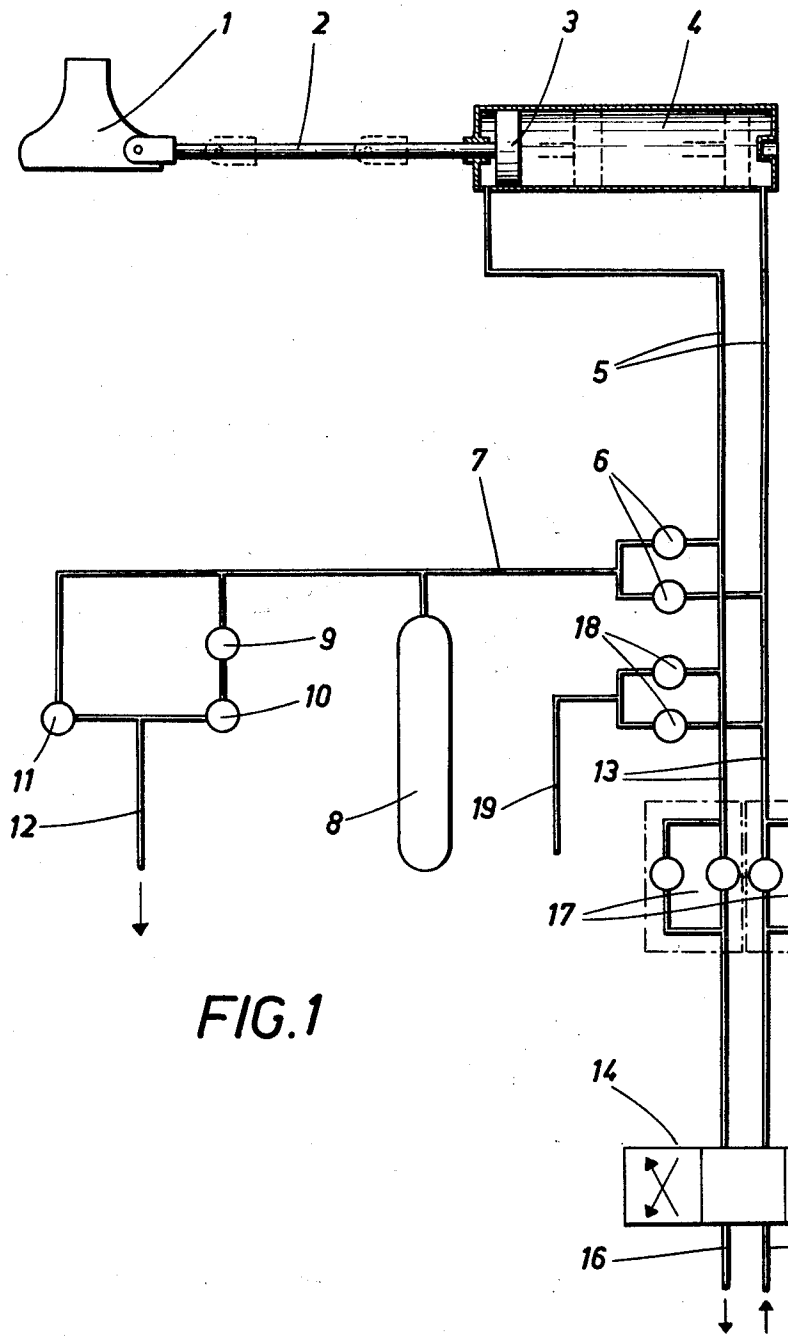

FIG.1

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FIG. 3

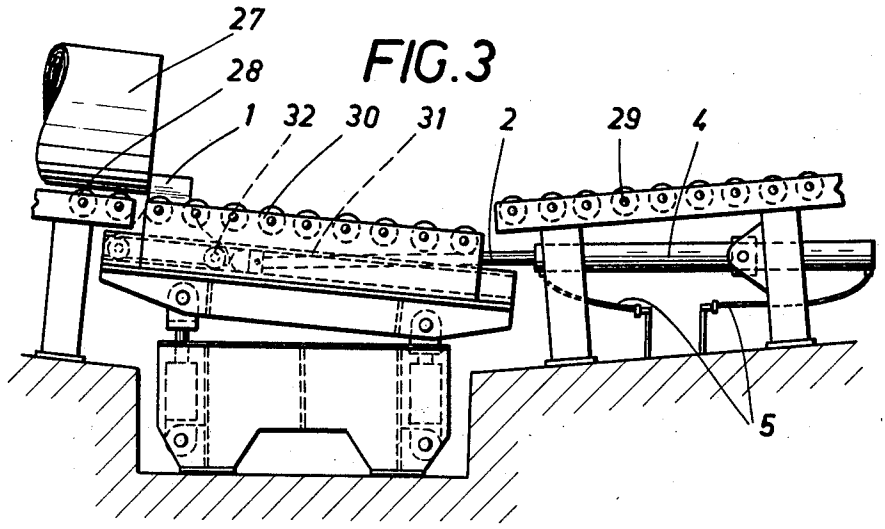

FIG. 2

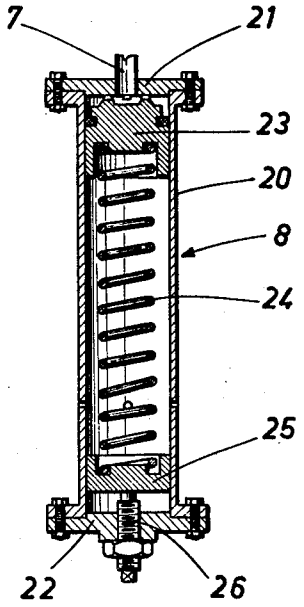

FIG. 4

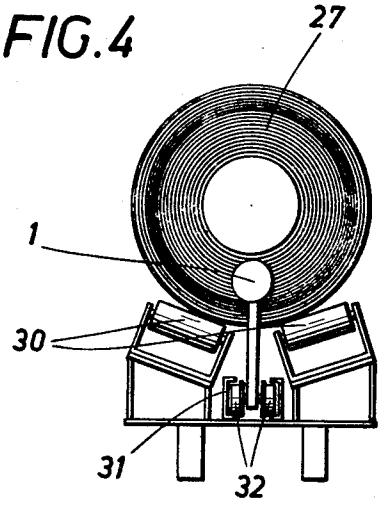

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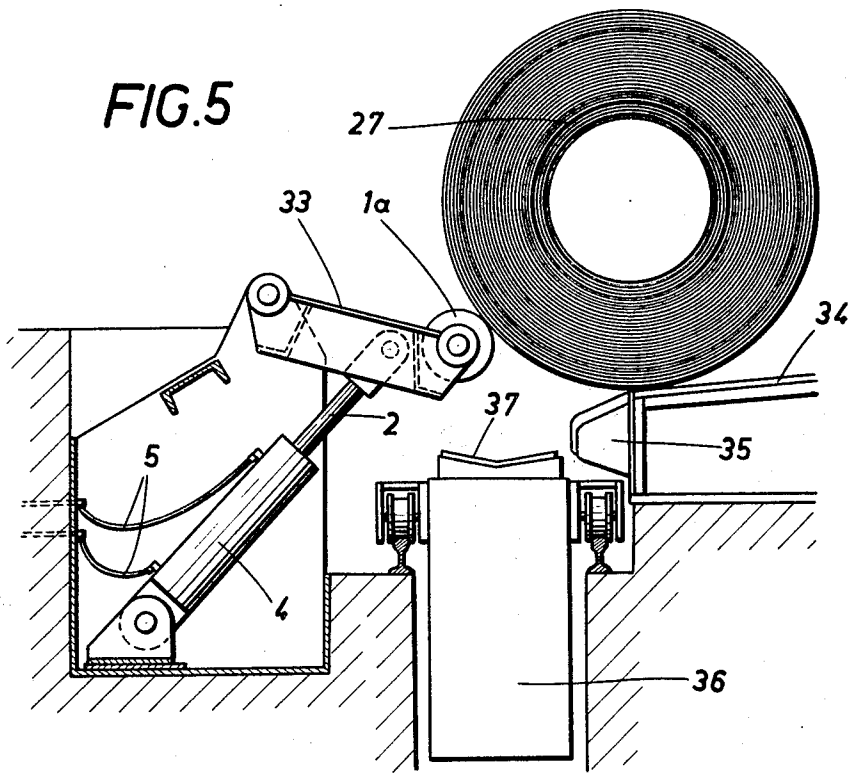
FIG.5



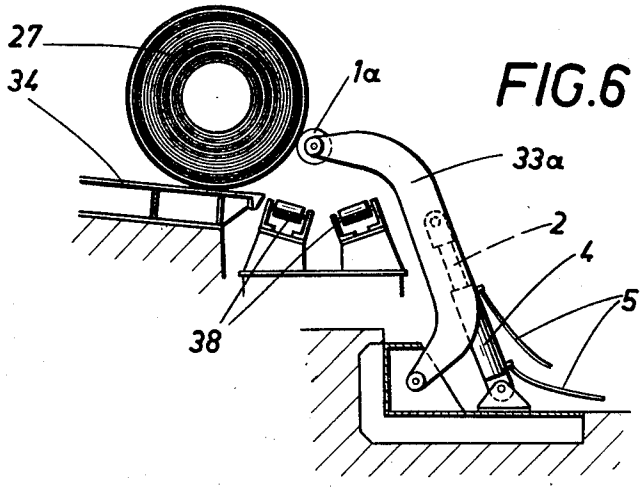


FIG.6

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BUFFER DEVICE

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Claims priority, application Austria, Nov. 9, 1965, A 10,082/65
8 Claims. (Cl. 193—35)

ABSTRACT OF THE DISCLOSURE

A yieldable stop for gently braking stock moving on a conveyor, which is connected to the piston of a hydraulic shock absorber. A take-up conduit is connected to that end of the shock absorber cylinder toward which the piston moves in response to an impact, a pressure limiting valve is connected to the conduit, a throttle is positioned in the conduit between the cylinder and the pressure limiting valve, a check valve is positioned in the conduit between the cylinder and the throttle, and a pressure accumulator is connected to the conduit between the check valve and the pressure limiting valve.

In rolling mills, particularly in cold rolling mills, coiled strip must be fed to and from various units, such as rolling units, pickling lines, shear lines, rewinders and the like. As a rule, feeding is effected on roller beds, roller type conveyors and similar conveying devices. To avoid damage to the surface of the coils and to prevent a rupture of the binding straps, the feeding movements of the coils must be gently braked.

Buffer devices which are known for this purpose comprise a stop which is cushioned by strong springs or pneumatic dashpots. These known devices have the disadvantage that they recoil so that the coils often rebound several times from the stops. Such rebounding may cause a rupture of the holding straps or other damage to the coil. In many cases it is required to move the braked coil for the subsequent processing step or to disengage the coil from the stop. The known buffer devices do not meet this requirement. Finally, the dimensions of the previous buffer devices are too large in many cases for installation in a confined space.

It is an object of the invention to eliminate all these disadvantages and provide a buffer device for intercepting rolling or sliding rolled stock, which device involves no rebounding of the arriving stock and enables a subsequent movement of the stopped stock into position for the next processing step as well as a mounting of the stop proper at a distance from the damping means for an improved utilization of the space which is available.

Based on a buffer device having a yieldable stop, the invention resides essentially in that the stop is connected to the piston of a hydraulic cylinder, which at its forward end in the direction of impact is connected by a conduit and an interposed check valve to a pressure accumulator and a pressure limiting valve, which is preceded by a throttle. The impact of the rolled stock on the stop causes a movement of the piston so that the liquid is forced from the forward end of the cylinder, considered in the direction of impact, into the accumulator and part of this liquid is exhausted through the throttle and the pressure limiting valve. The intercepting operation will be terminated and the piston will be stopped when the kinetic energy of the rolled stock has been converted into energy stored in the pressure accumulator and into work performed at the throttle and in the pressure limiting valve. The check valve reliably prevents an application of backpressure from the accumulator to the piston so that the rolled stock will not

rebound. When the intercepting operation has been terminated, the accumulator pressure can be gradually reduced through the throttle and the pressure limiting valve to a desired prestressing value, which is preset. The stop and the hydraulic cylinder, on the one hand, and the pressure accumulator and the valves, on the other hand, may be mounted at a distance from each other for optimum utilization of the space which is available, provided that the connecting conduit is short so that the liquid column to be moved during the intercepting operation is as small as possible.

In a development of the invention, a control conduit, which is controlled by a shut-off valve and adapted to be connected to a pressure source, opens into the conduit which leads from the cylinder to the check valve. During the intercepting operation, the control valve is closed so that the control conduit is inoperative. When the intercepting operation has been terminated and the control valve is then operated to connect the control conduit to the pressure source, the piston is moved in the reverse direction so that the stop is moved to its initial position or the rolled stock is previously moved to its position for the next processing step.

It will be particularly suitable if provision is made for applying pressure to the piston from both sides, each side of the piston is connected by a conduit incorporating a check valve to the common pressure accumulator and the common pressure limiting valve preceded by a throttle, two control conduits are provided, and the control valve is adapted to close both control conduits at the same time and to connect one of them to the pressure source and the other to a drain, and vice versa. Such a device can intercept stock arriving from both directions and can displace the piston in both directions when the intercepting operation has been terminated. This displacement of the piston may serve to change the position of the stopped stock, or to disengage the stop from the stock, or to move the stop to its initial position for the next intercepting operation.

According to the invention, each control conduit is connected by a further check valve to a suction conduit. This arrangement serves to prevent the occurrence of a vacuum and cavitation effects at the trailing end of the piston during the movement of the latter in response to the impact of the stock.

The pressure accumulator might consist of a pressure cylinder having an accumulator bag and filled with nitrogen. Alternatively, the pressure accumulator may comprise a gas- or spring-cushioned piston. The latter type of accumulator has the advantage that its initial stress can easily be changed.

The invention is illustrated by way of example on the accompanying drawings, in which

FIG. 1 is a diagram of the hydraulic system of the buffer device according to the invention,

FIG. 2 is an axial view showing the pressure accumulator as a detail,

FIGS. 3 and 4 are front and side elevations, respectively, showing a portion of a conveyor for rolled stock, which conveyor is provided with the buffer device according to the invention, and

FIGS. 5 and 6 are fragmentary sectional views showing two further embodiments of the buffer device.

The oncoming rolled stock impinges on a stop **1**, which is connected by a rod **2** to a piston **3** of a hydraulic cylinder **4**. Both ends of the cylinder are connected by respective conduits **5** incorporating respective check valves **6** to a common conduit **7**, which leads to a pressure accumulator **8** and through a throttle **9** to a pressure limiting valve **10**. The conduit **7** terminates in a relief valve **11**. The two valves **10**, **11** are connected to a common re-

turn conduit 12. Two control conduits 13 open into the conduits 5 and are provided with a control slide valve 14 for jointly closing both control conduits 13 (in the position shown in the drawing) and for connecting one control conduit to a pressure conduit 15 and the other control conduit to a drain conduit 16, and vice versa. Two valve combinations 17 serve for adjusting the speed of the piston movement. Each control conduit 13 is connected by a further check valve 18 to a suction conduit 19. The conduits 12, 16, 19 may be combined in a common conduit.

It may be assumed that the workpiece impinges from the left on the stop 1 and the piston 3 is then in its left-hand end position, shown in solid lines, whereas the control valve 14 is in its intermediate position. In response to the impact of the rolled stock, the piston 3 moves to the right so that the liquid is forced from the right-hand chamber of the cylinder through the right-hand conduit 5 and the associated check valve 6 and the conduit 7 into the accumulator 8 whereas a small amount of liquid is forced through the throttle 9 and the pressure limiting valve 10 into the return conduit 12. The piston movement ceases in the position indicated in dash-dot lines when the entire kinetic energy of the rolled stock has been converted into energy stored in the accumulator 8 and work performed during the passage of liquid through the throttle and the pressure limiting valve. The hydraulic cylinder 4, the pressure accumulator 8 and the throttle 9 as well as the pressure limiting valve 10 are so designed that the impact of rolled stock having the highest kinetic energy to be expected will move the piston to a position which is short of its right-hand end position and will not cause a pressure rise above the setting of the relief valve 11. The check valve 6 prevents an application of back-pressure from the accumulator to the piston 3. The accumulator pressure is released through the throttle 9 and the pressure limiting valve 10. During the movement of the piston in response to the impact, liquid is sucked on the left-hand end of the piston through conduit 19 and the associated check valve 18 so that the occurrence of a vacuum on this side is prevented.

When the intercepting operation has been terminated, the control valve 14 can be actuated to cause a movement of the piston 3 in one direction or the other so as to move the rolled stock in contact with the stop 1 to the position required for the next processing step or to disengage the stop from the rolled stop. When this piston movement has been terminated and the previously intercepted rolled stock has been removed, the control valve 14 is actuated to cause the piston 3 to move the stop 1 to its initial position. The control valve then returns or is returned to its intermediate or closed position so that the device is ready for the next intercepting operation. When the impact is from the right, the piston 3 will be in its right-hand end position, shown in dotted lines. The operation is analogous. In a device for intercepting rolled stock arriving always from the same direction, the hydraulic system will be simplified in that only one check valve 6 and one check valve 18 are required.

The pressure accumulator 8 may comprise a spring-loaded piston, as is shown in FIG. 2. This accumulator comprises a housing 10 having screw-threaded ends 21, 22, and a piston 23, which is guided in the housing and loaded by a spring 24. The latter bears on a spring abutment 25, which can be adjusted by an adjusting screw 26 to vary the initial stress of the spring. Pressure is applied to the piston 23 through conduit 7.

In the apparatus shown in FIGS. 3 and 4, strip coils 27 are selectively fed on inclined feeding roller beds 28, 29. Another roller bed 30 is provided between the two feeding roller beds 28, 29 and can be pivotally moved to one side or the other into alignment with one of the feeding roller beds 28, 29 or the other. The pivoted roller bed 30 comprises a guideway 31, in which a carriage 32 is reciprocable, which carries the stop 1. The piston rod 2 is pivoted to the carriage 32. The hydraulic cylinder 4 is pivoted to the frame of the apparatus. To intercept a strip coil 27 coming from the left-hand feeding roller conveyor 28, the stop 1 will be in its left-hand end position, shown in the drawing. In response to the impact, the stop is moved to the right until the rolled stock has been stopped. In this position, the rolled stock is not centered with respect to the pivoted roller bed 30. When the intercepting operation has been terminated, pressure is applied to the piston 3 while the coil 27 is still in engagement with the stop 1 so that the stop carriage 32 is moved further to the right, until the coil has been centered on the pivoted roller bed 30 and has thus assumed the starting position for a subsequent processing step. If the coil 27 arrives from the right-hand feeding roller bed, the same operations are performed in another direction.

According to FIG. 5, the stop consists of a roller 1*a*, which is mounted on a pivoted arm 33 pivotally connected to the piston rod 2 of the pivoted hydraulic cylinder 4. The strip coil 27 is rolled on an inclined ramp 34 and a transition portion 35 and impinges on the stop 1*a*, which is in the position shown on the drawing. This impact causes a downward pivotal movement of the stop 1*a* and of the arm 33 so that the piston in the hydraulic cylinder 4 is urged back until the coil 27 is stopped on the transition portion 35. In this position, the coil is not centered with respect to the coil carriage 36. When the intercepting operation has been terminated, the pivotal movement of the stop 1*a* is continued so that the table 37 of the coil carriage can be raised to remove the coil 27.

The device shown in FIG. 6 is similar to that of FIG. 5 with the difference that a V-shaped roller bed 38 is provided instead of the coil carriage 36. When the intercepting operation has been terminated, the coil 27 does not yet lie on the rollers of the roller bed 38. A further operation of the pivoted arm 33*a* causes the coil to be deposited on the roller bed 38. The stop roller 1*a* is then disengaged from the coil, which can now be conveyed further.

What is claimed is:

1. A buffer device for intercepting articles, which comprises a hydraulic cylinder, a piston slidable in said hydraulic cylinder, a stop adapted to be subjected to an impact by an article to be intercepted, said stop being operatively connected to said piston to move the same in said cylinder in response to such impact, a take-up conduit connected to that end of the cylinder toward which the piston is moved in response to such impact, a pressure limiting valve connected to said conduit, a throttle incorporated in said conduit between said cylinder and said pressure limiting valve, a check valve incorporated in said conduit between said cylinder and said throttle, and a pressure accumulator connected to said conduit between said check valve and said pressure limiting valve.

2. A buffer device as claimed in claim 1, which comprises a control conduit connected to said take-up conduit between said cylinder and said check valve, and a control valve operable to alternatively close said control conduit and to connect it to a pressure source.

3. A buffer device as claimed in claim 1, which comprises a second take-up conduit which incorporates another check valve and connects the other end of said cylinder to the first-mentioned take-up conduit between said first-mentioned check valve and said throttle, a second control conduit, and a drain conduit, said control valve being operable to close both said control conduits and to connect one of said control conduits to a pressure source and the other to said drain conduit, and vice versa.

4. A buffer device as claimed in claim 3, which comprises a suction conduit and two additional check valves each of which connects said suction conduit to one of said control conduits.

5. A buffer device as claimed in claim 1, in which said pressure accumulator comprises a piston and energy storage means operatively connected to said piston.

6. A buffer device as claimed in claim 5, in which said energy storage means comprises a spring.

7. A buffer device as claimed in claim 5, in which said energy storage means comprises a gas cushion.

8. In a conveyor for moving rolled stock along a predetermined path, a buffer device which comprises a hydraulic cylinder, a piston slidable in said hydraulic cylinder, a stop disposed in said path and arranged to be subjected to an impact by rolled stock moving along said path, said stop being operatively connected to said piston to move the same in said cylinder in response to such impact, a take-up conduit connected to that end of the cylinder toward which the piston is moved in response to such impact, a pressure limiting valve connected to said conduit, a throttle incorporated in said conduit between said cylinder and said pressure limiting valve, a check valve incorporated in said conduit between said cylinder and said throttle, and a pressure accumulator connected to said conduit between said check valve and said pressure limiting valve.

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