April 22, 1969 C. MÜNCHBACH 3,439,517

CONTROL AND DRIVING SYSTEM FOR STRAIGHTENING AND CUTTING MACHINES

Filed July 26, 1967

FIG. 1

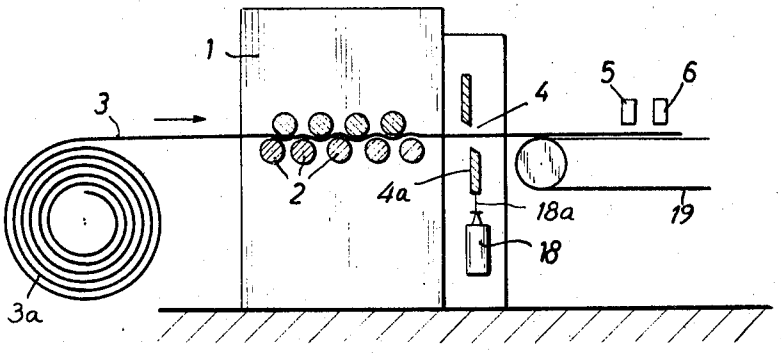
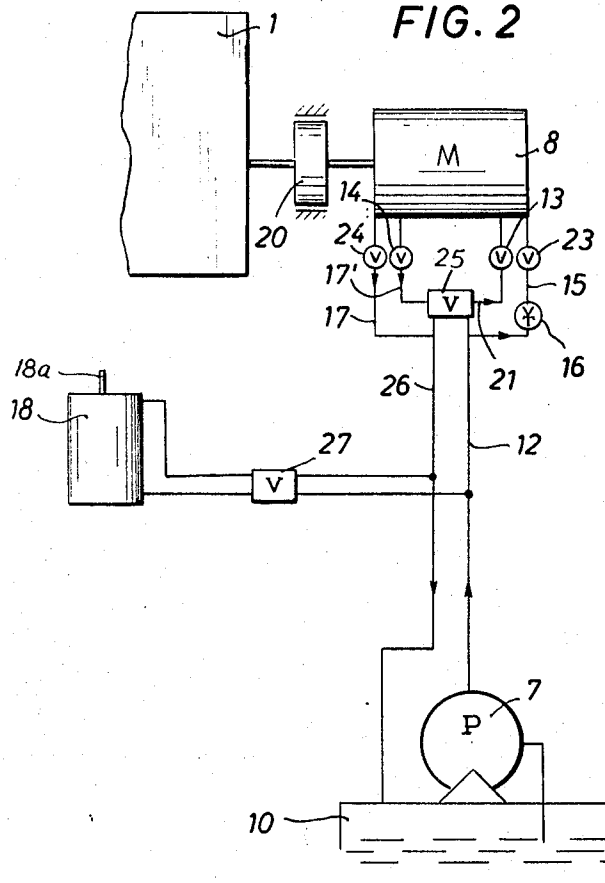


FIG. 2



INVENTOR

CURT MÜNCHBACH

BY Edwin E. Greigg

ATTORNEY

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CONTROL AND DRIVING SYSTEM FOR STRAIGHTENING AND CUTTING MACHINES

Curt Münchbach, Pforzheim, Sonnenberg, Germany, assignor to Karl Fr. Ungerer, Pforzheim, Germany, a company of Germany

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U.S. Cl. 72—11 4 Claims

ABSTRACT OF THE DISCLOSURE

There is described a driving system for a sheet straightening and cutting device including a single hydraulic motor energized by hydraulic fluid introduced into and withdrawn from said motor by means of a hydraulic conduit of large cross-section and a hydraulic conduit of small cross-section. Workpiece operated sensors actuate appropriate valves (1) to circulate the fluid in the conduit of large cross-section for operating the motor at normal speed; (2) to circulate the fluid in the conduit of small cross-section for operating the motor at creeping speed, and (3) to prevent circulation of the fluid in either conduit for (a) stopping the motor, and (b) energizing the cutting device.

Background of the invention

This invention relates to machines including a straightening device and a cutting mechanism for sheet material of indefinite length taken from a supply roll. More particularly, the invention concerns a novel, simplified and economical drive control system for changing the normal conveying speed of the advancing sheet to a creeping speed and subsequently to a full stop immediately prior to and during the cutting operation and for actuating the cutting mechanism responsive to said stoppage.

The type of machine with which the novel control system is associated is well known in the art. It comprises a series of straightening rolls between which the sheet—usually of metal—passes and an adjacent sheet cutting mechanism which, by means of shears, periodically severs definite lengths from the sheet emerging from the straightening rolls and advanced thereby. It has further been recognized that for ensuring precise desired lengths of the cut pieces, it is not sufficient to merely stop the sheet in its motion but to slow it down first to a "creeping speed" immediately prior to stoppage.

In one of the known devices, for example, the straightening rolls are driven at their normal conveying speed through a differential gear means by a large electric motor provided with an electromagnetic clutch arrangement and functioning as the principal driving means. At their creeping speed, on the other hand, the rolls are driven by a small electric motor provided with a brake mechanism and functioning as an auxiliary driving means. An arrangement such as the one outlined above is, on the one hand, very expensive and requires, on the other hand, substantial space laterally of the straightening mechanism to accommodate the differential gear means and both motors which must be combined with clutches and brakes.

Summary of the invention

It is an object of the invention to provide a novel, simplified and relatively inexpensive system for controlling the speed and operation of a combined straightening and cutting mechanism for sheet material.

Briefly stated, according to the invention, the straightening and cutting machine is, at either speed (conveying speed or creeping speed), driven by a single hydraulic motor which is energized by a hydraulic pump connected to the motor by means of two hydraulic circuits controllable in a known manner. One of the circuits is formed by a hydraulic conduit having a small cross-section and associated with the creeping speed, while the other circuit is formed by a hydraulic conduit having a large cross-section associated with the normal conveying speed. Thus, expensive drive means, clutches and the additional auxiliary motor (all essential elements in the known prior art devices) are eliminated. Furthermore, the new and improved apparatus disclosed herein using the novel control system has a very short length, requires only limited lateral space and needs only a minimum attendance during operation.

The invention will be better understood and further objects and advantages will become more apparent from the ensuing detailed specification of an exemplary embodiment taken in conjunction with the drawings.

Brief description of the drawings

FIG. 1 is a schematic side elevational view in section of a straightening and cutting machine used in accordance with the invention; and

FIG. 2 is a diagram of the novel hydraulic drive and control system associated with the machine shown in FIG. 1.

Description of the embodiment

Turning now to FIG. 1, there is schematically shown a sheet straightening mechanism **1** including a series of straightening rolls **2**. In addition to their straightening function, the rolls **2** also serve to unwind the sheet material **3** from a supply roll **3***a* and advance the straightened sheet to a fixedly stationed cutting mechanism **4**, the lower shear **4***a* of which is operated by the piston rod **18***a* of a hydraulically-actuated cylinder **18**. Viewing in the direction of sheet advance, following the cutting mechanism **4** and spaced therefrom, there is disposed, above a belt **19** for conveying the severed sheets, a photoelectric cell **5** as "start" contact and thereafter a photoelectric cell **6** as "stop" contact, the utility of which will become apparent as the description progresses.

Referring now to both FIGS. 1 and 2, the straightening rolls **2** are drivably connected to a hydraulic motor **8** by means of a gear mechanism (not shown) and a braking device including a braking disk **20**. To motor **8** there are connected supply conduits **21**, **15** arranged to convey a hydraulic fluid, as well as return conduits **17**, **17'**. Conduits **21**, **17'** constitute a first hydraulic circuit having a large cross-section to circulate hydraulic fluid necessary for maintaining a normal motor speed, while conduits **15**, **17** constitute a second hydraulic circuit having a smaller cross-section to circulate hydraulic fluid necessary for maintaining a creeping speed of motor **8**. Conduits **15**, **17** include solenoid blocking valves **23**, **24**, respectively, while conduits **21**, **17'** include respective solenoid blocking valves **13**, **14**. Conduit **15** further includes a metering valve **16**. Conduits **15**, **17** are directly connected to conduits **12**, **26**, respectively, while conduits **21**, **17'** communicate with conduits **12**, **26** by means of a distributor valve **25**. The supply conduit **12** is connected to a hydraulic fluid pump **7** while return conduit **26** communicates with the storage tank **10** associated with pump **7**. To conduits **12**, **26** there is also connected—through reversing valve **27**—a hydraulic cylinder **18**, the piston rod **18***a* of which is operatively coupled to the lower shear **4***a* of cutting mechanism **4**.

The operation of the above-described system is as follows:

In the open position of valves **13**, **23**, **14** and **24** the

hydraulic motor **8** is supplied with a flow of hydraulic fluid sufficient to operate it at the normal conveying speed and rolls **2** are thus driven by motor **8** accordingly. Consequently, the rolls **2** forward the metal sheet **3** through the open cutting mechanism **4** at a normal conveying speed. When the leading edge of the sheet reaches photocell **5**, the latter transmits a signal to close solenoid valves **13** and **14** thus blocking the main flow across motor **8**. Valves **23** and **24** remain open so that the motor continues to be supplied with fluid through the hydraulic circuit formed by conduits **15, 17**. These conduits, however, have a smaller cross-section than that of conduits **13, 17'** so that the amount of hydraulic fluid now being circulated through motor **8** is, e.g., only 5% of the amount supplied when valves **13, 14** are open. Consequently, the speed of motor **8** will drop to its creeping speed, in this instance approximately $\frac{1}{20}$ of the normal conveying speed. Thus, the sheet **3** will now be advanced by rolls **2** at a creeping speed up to the point where the leading edge of sheet **3** reaches the photocell **6**. At that instant photocell **6** transmits a signal to close solenoid valves **23, 24**, thus cutting off entirely the circulation of the hydraulic fluid through motor **8**, deenergizing the same, and thus stopping the advance of sheet **3** in the desired cutting position. At the moment the entire circulation of the hydraulic fluid is blocked through motor **8**, the pressure in hydraulic cylinder **18** builds up to a sufficient value to displace its piston (not shown), the rod **18*a*** of which thus actuates the shear **4*a*** of the cutting mechanism **4**. As the shears of the cutting mechanism **4** reopen, the solenoid valves **13, 14, 23, 24** are also reopened by automatic control means not shown, and a new cycle of operation may begin. By adjusting metering valve **16**, the creeping speed may be further decreased if particularly accurate cut lengths are desired.

It is to be understood that instead of two photocells a single cell may be used which then would include an adjustable time delay circuit to operate solenoid valves **23, 24** for stopping motor **8**. Also, instead of a photocell or cells any other suitable sensing means may be used for energizing valves **13, 14, 23, 24** when sheet **3** has reached predetermined positions.

Although only a single embodiment of the invention has been depicted and described, it will be apparent that this embodiment is illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims.

What is claimed is:

1. In a machine of the type including a straightening mechanism for receiving a sheet of indefinite length and advancing the same to a cutting mechanism associated with said machine, the improvement comprising a hydraulic motor for driving said straightening mechanism, a hydraulic pump operatively connected to said motor by a plurality of conduits, said conduits forming a first hydraulic circuit adapted to circulate a relatively large amount of fluid through said motor, said conduits forming a second hydraulic circuit adapted to circulate a relatively small amount of fluid through said motor, first valve means in said first circuit and second valve means in said second circuit, said motor operable at a relatively high conveying speed when all said valves are in an open position, sensing means associated with said first and second valve means and adapted upon detection of at least one predetermined position of said sheet to first close said first valve means causing said motor to assume a relatively low creeping speed and to subsequently close said second valve means to cut off the circulation of fluid through said motor causing the same to stop.

2. The improvement as defined in claim **1**, wherein said sensing means includes a first photocell associated with said first valve means and a second photocell spaced from said first photocell in the direction of travel of said sheet and associated with said second valve means.

3. The improvement as defined in claim **1**, wherein said sensing means includes a photocell having a first energizing circuit associated with said first valve means and a second energizing circuit associated with said second valve means, said first circuit adapted to instantaneously transmit actuating signals to said first valve means upon said detection, said second circuit adapted to transmit actuating signals to said second valve means after a time delay subsequent to said detection.

4. The improvement as defined in claim **1**, including an additional hydraulic circuit connected to said pump and to said cutting mechanism and communicating with at least said second hydraulic circuit, said additional hydraulic circuit adapted to deliver operating pressure to actuate said cutting mechanism only when said first and said second valve means are closed.

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RONALD D. GREFE, *Primary Examiner.*

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