Jan. 24, 1967 M. D. STONE ET AL 3,299,900

STRIP COOLING SYSTEM

Filed March 25, 1965 2 Sheets-Sheet 1

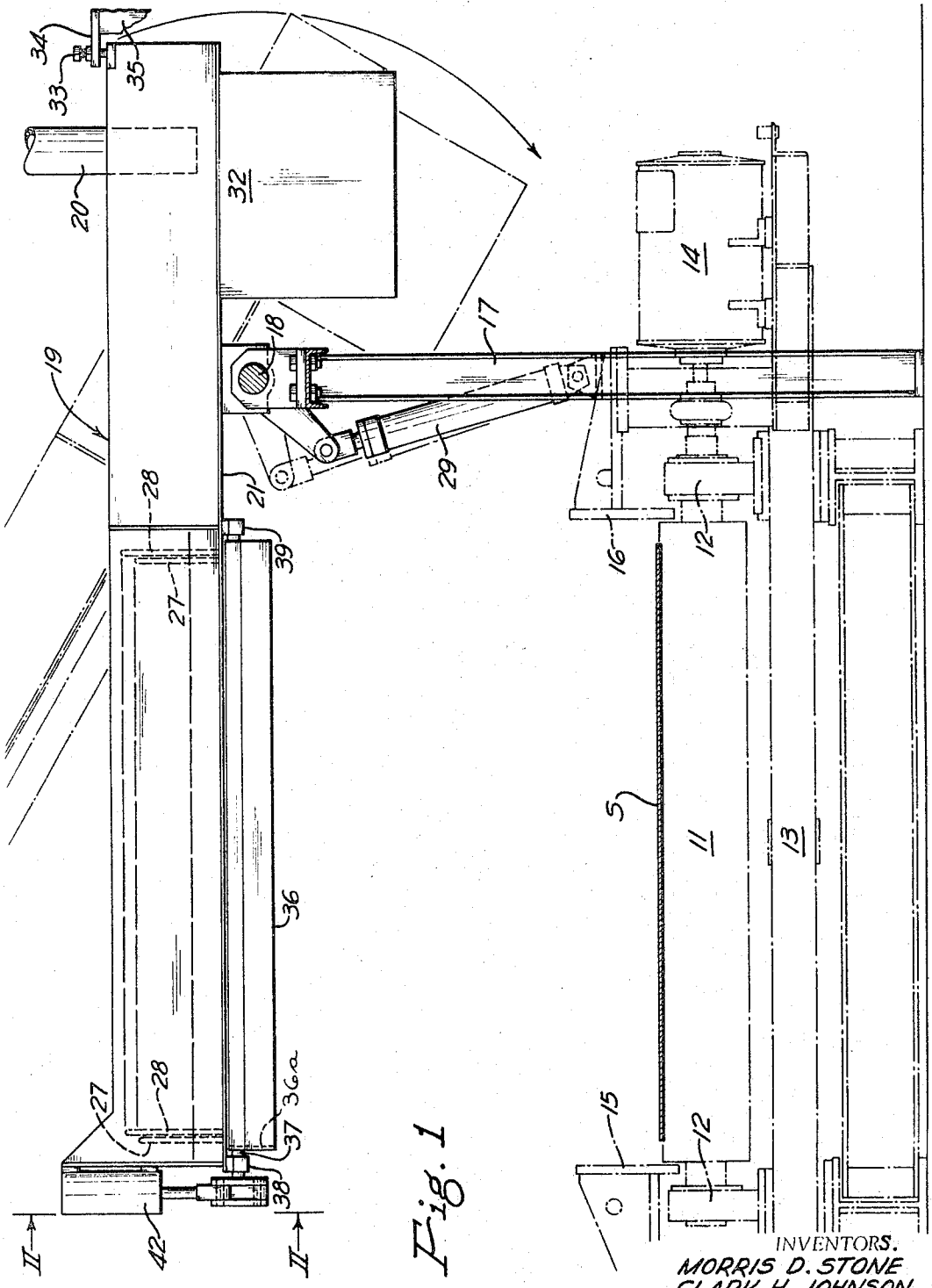

Fig. 1

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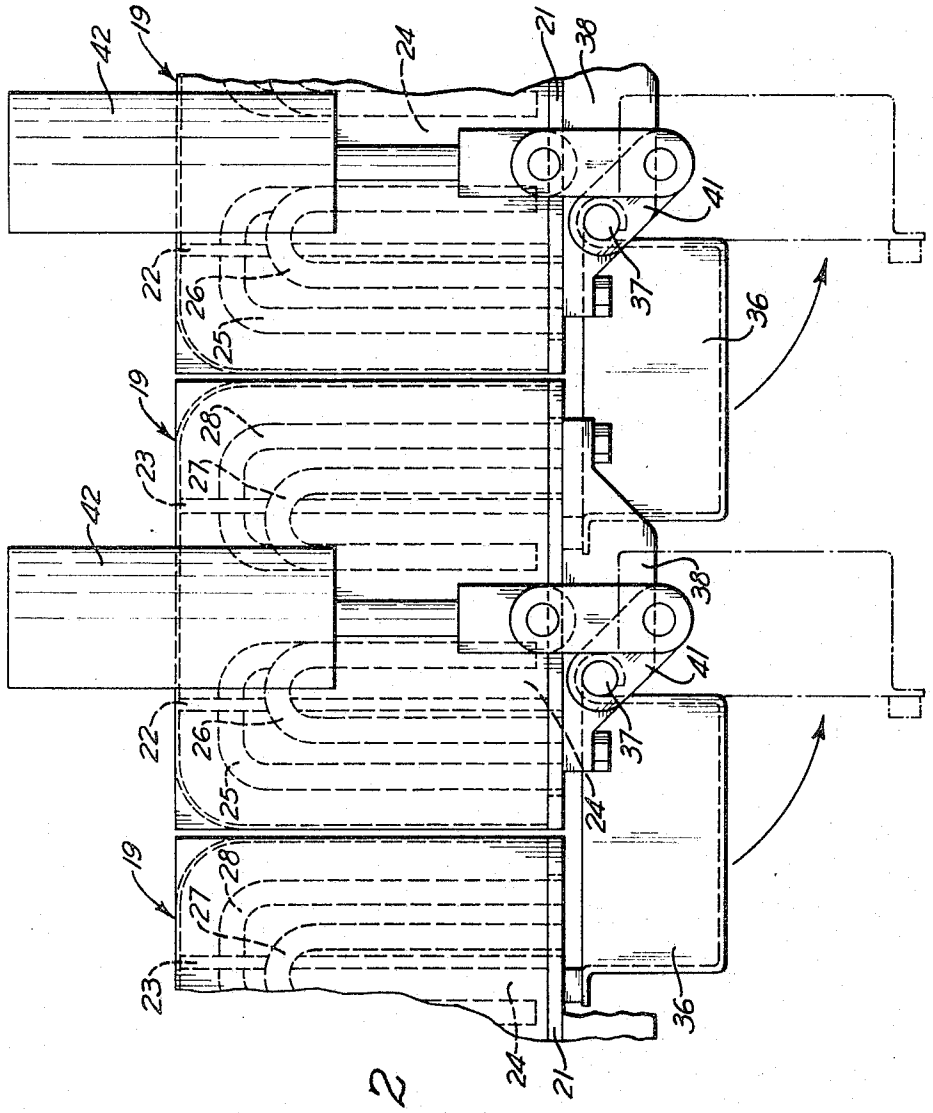

Fig. 2

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STRIP COOLING SYSTEM

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2 Claims. (Cl. 134—122)

This invention relates to a liquid-diverting apparatus for use with a cooling system for hot workpieces, such as, strip, plate and the like and, more particularly, to such apparatus employed to divert quickly coolant delivered by a cooling system wherein it is not possible, at least practically, to instantaneously commence or discontinue the flow of the coolant onto the workpiece.

A cooling system that does not permit the instantaneous commencing or interruption of the coolant, such as, water, is disclosed in U.S. Patent No. 3,025,865 which issued on March 20, 1962 in the name of J. N. Adcock, entitled "Apparatus for Cooling Hot Metal Strip or Plate by Laminar Liquid Flow." Since the device illustrated in this patent operates on a siphon principle, it requires the maintenance of a certain depth of water in order to establish the siphon action. This, of course, not only requires a certain period of lost time to obtain the required depth of water; but the water continues to flow after it is necessary until the water level is lowered to where the siphon action is interrupted.

The present invention provides a diverting apparatus for selectively and quickly controlling the delivery of the coolant onto a workpiece, particularly when the coolant is delivered by a device that requires lost time in either being able to commence the flow or interrupt the flow of coolant onto a workpiece.

The limitation noted above becomes important in at least two respects:

One, it prevents the operator from being able to control the application of the coolant on the workpiece as the temperature needs thereof rapidly vary.

For example, if the leading portion of the strip is hot enough to require the application of maximum cooling, whereas the trailing portion requires little or no cooling, if the cooling system is not capable of almost instantaneous off-on control, the proper workpece temperature cannot be realized. This limitation becomes quite serious in mills where the speed of the strip is first maintained at a low level, say, of the order of 2000 f.p.m. which enables the strip to be fed to the coilers, after which the speed of the strip is raised in 5/10 second to a level of approximately 3500 f.p.m., which speed is employed to obtain maximum productivity. It is important to realize in this connection that at the higher speed of the mill, as much as 50% more coolant may be required.

Two, it represents a significant waste of water which adds to the expense of the product. The cost of processing water in a modern strip mill is more and more becoming an important economic factor.

It is a further object of the present invention to provide a coolant-diverting apparatus for quickly and selectively controlling coolant delivered from a plurality of devices that operate on a siphon principle, a pressure principle or the like and, more particularly, wherein the flow of the coolant with respect to the strip may be commenced and discontinued almost instantaneously.

According to one form of the present invention, there is provided an apparatus to selectively and instantaneously divert liquid coolant discharged from a siphon coolant system or the like employed for cooling workpieces being conveyed thereunder, comprising a coolant container arranged at a spaced superimposed distance from the workpieces to be cooled, said container having associated therewith a discrete input coolant means and a discrete output

coolant means for discharging coolant from said container onto workpieces, coolant-diverting means selectively positionable between the discharge portion of said container and the workpieces, power means connected to said diverting means for positioning said diverting means into and out of a coolant-diverting position, whereby the delivery of coolant onto said workpiece or its interruption in instantaneously controlled.

These objects, as well as other features and advantages of the invention, will become apparent when the following description is read in conjunction with the accompanying drawings of which:

FIGURE 1 is an elevational view of a diverter employed in conjunction with a hot strip coolant device, and

FIGURE 2 is an elevational view taken along lines II—II of FIGURE 1.

With reference to the drawings, there is illustrated in FIGURE 1 one of the rollers **11** that makes up a hot run-out table employed for conveying a hot metallic strip S. The roller **11** is supported at each end by anti-friction bearing block assemblies **12**. These assemblies are mounted on a structural support **13** that is secured to the foundation in a usual manner. The roller **11** is connected to an electrical motor **14** mounted at one side of the table. Conventional strip side guards **15** and **16**, shown in phantom, are arranged at the outer ends of the roller to prevent the strip from accidentally traveling off the roller.

A vertical support beam **17** is mounted on the foundation at the motor side of the roller **11**. Pivotally connected by a pin **18** to the top of this beam is a fabricated water box **19** which includes a bottom plate **21**. It will be appreciated in referring to FIGURE 2 that is a plurality of water boxes **19** are provided, being arranged in a side-by-side relationship along the roller table. Since the boxes are similarly constructed, reference will only be made to one of them. The water box is provided with vertical baffle plates **22** and **23** which form a water reservoir **24** that extends the full length of the water box **19**. A water input pipe **20** (shown only in FIGURE 1) supplies water to this reservoir. Passing through each of the baffle plates **22** and **23** are a plurality of inverted U shaped pipes **25**, **26**, **27** and **28**. It will be noted with respect to each of these pipes that their lower ends, located in the reservoir **24**, are slightly raised above the bottom plate **21**. The other ends of the pipes pass through the plate **21** for discharging water from the resevoir. It is to be appreciated that water is discharged from the pipes **25**, **26**, **27** and **28** as a result of the siphoning action established by raising the water level in the reservoir above the U shaped bend in the pipes.

With particular reference now to FIGURE 2 and to the diverter apparatus, there are provided a plurality of elongated U shaped coolant-diverting pans **36** longitudinally arranged at the underside of the plates **21** for operative communication with the discharge ends of the U shaped pipes. These pans are enclosed at one end by end platen **36*a*** and open at the other end so that coolant can pass from the diverter pan into a suitable drain, not shown in the drawings. Each diverter is secured to an elongated shaft **37** which is rotatably received at each end by mounting blocks **38** and **39** that are secured to the plate **21**. A lever arm **41** is affixed to the outboard end of shaft **37** adjacent the block **38**. This lever arm is connected to the rod end of a piston cylinder assembly **42** which is mounted on the outer vertical surface of the water box **19**. It will be noted, by referring to FIGURE 2, that each diverter pan **36** is positioned so as to communicate with and receive coolant discharged from the pipes **27** and **28** of one water box and pipes **25** and **26** of the succeeding water box.

In the event it is desired to clear the area above the strip S, such as may be required for maintenance or to remove a cobbled strip from the table, there is provided a piston cylinder assembly **29**, shown only in FIGURE 1, mounted on the support beam **17** and having its rod end connected to an arm **31** which is, in turn, connected to the plate **21**. A counterbalance **32** also is secured to the plate **21** to balance the overhung weight of the water box assembly. A combination stop and leveling adjustment is provided to assure that each water box is level and the water level will not vary along the length of each box. This level adjustment consists of a threaded bolt **33** received in a plate **34** which is connected to an upright beam **35** secured to the foundation. Operation of the piston cylinder **29** will pivot the water box **19** about the pin **18** to a position where it will not obstruct access to the roller which is shown in FIGURE 1 by dot and dash lines.

A brief description of the operation of the invention will now be given. The above-described water discharge device is initially placed in operation preparatory to actual strip cooling. This is accomplished, as heretofore mentioned, by raising the water level in the reservoir **24** slightly above the U shaped bend in the siphon pipes. When this occurs, a siphon action is established in the pipes which discharge the water from the reservoir through the bottom plate **21**. As the water emerges from the delivery end of each pipe, it will either fall into the diverter pans or into the strip. Should the water pass directly into the diverter pans **36**, it will be collected and directed to the motor side of the roller table and pass into a suitable drain, which may be connected to the coolant water supply tank, not shown in the drawings. At this point it will be noted, however that the siphon action in the water boxes **19** has been established. Consequently, when it is desired to apply the water coolant onto the strip S which is conveyed by the rollers **11**, the piston cylinder assemblies **42** are operated to quickly rotate the diverter pans **36** about the shafts **37** to a position shown by phantom lines in FIGURE 2. This instantaneously allows the coolant water to fall onto the strip.

The present invention also provides a quickly responsive strip coolant control such as may be employed during the acceleration of the strip where the number of cooling devices is quickly and sequentially increased for maintaining uniform strip temperature. In this respect the number of coolant devices employed may be quickly increased by exerting the desired control over the operation of the piston cylinder assemblies **42**, to position the diverting pans **36** into the desired position Thus, the present invention not only provides a quickly responsive coolant control, but also a dependable and predictable control.

According to the provisions of the patent statutes, we have explained the principle and operation of our invention and have illustrated and described what we consider to represent the best embodiment thereof. However, we

desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. An apparatus for controlling the application of coolant onto a passing workpiece by diverting its direction of flow, comprising:

coolant discharge means positioned at a spaced distance from the workpiece for delivering coolant onto the workpiece,

coolant supply means for deliverying coolant to said discharge means,

a U shaped coolant diverter pan selectively positionable intermediate said discharge means and the workpiece and adjacent to said discharge means for diverting coolant delivered from said discharge means so as not to allow the coolant to contact the workpiece,

said coolant diverter pan having its open side arranged to receive coolant from said discharge means and having one of its ends closed so as not to allow coolant to escape from the closed end thereof, and

power means connected to said coolant diverting pan for quickly positioning said diverter pan in a first position in which coolant delivered from said discharge means will flow into said diverter pan, and in a second position in which the coolant delivered from said coolant discharge means will flow onto said workpiece.

2. An apparatus according to claim **1** wherein said coolant discharge means includes,

a plurality of coolant reservoirs arranged in a side-by-side relationship and transversely positioned above a workpiece,

said reservoirs containing a plurality of U shaped coolant delivery pipes, each having coolant receiving ends positioned in said reservoirs and coolant discharge ends for delivering coolant from said reservoir onto a workpiece,

said coolant diverter pan being pivotally secured to said coolant discharge means and arranged to communicate with the discharge ends of said delivery pipes, and

said power means including a piston cylinder assembly operatively connected to said diverter pan.

References Cited by the Examiner

UNITED STATES PATENTS

1,916,269	7/1933	Kingsbury	134—72
2,633,992	4/1953	Hock	134—72 X
3,025,865	3/1962	Adcock	134—122
3,224,914	12/1965	Benton et al.	134—183 X

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