April 26, 1960 R. R. SNOW 2,933,956

AUTOMATIC SCREWDOWN-CONTROL SYSTEM FOR ROD MILL

Filed Jan. 30, 1958 3 Sheets-Sheet 1

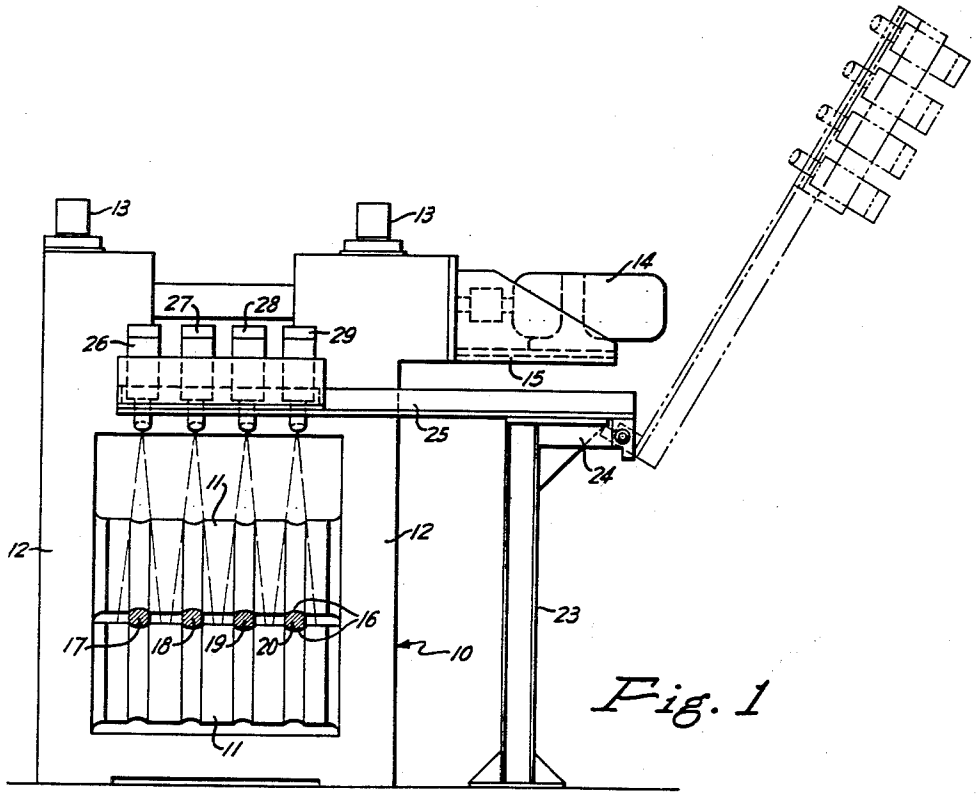



Fig. 1

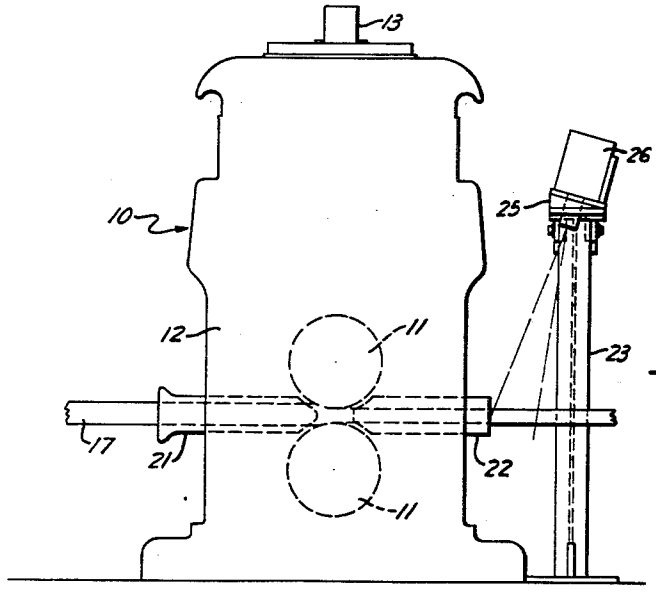



Fig. 2

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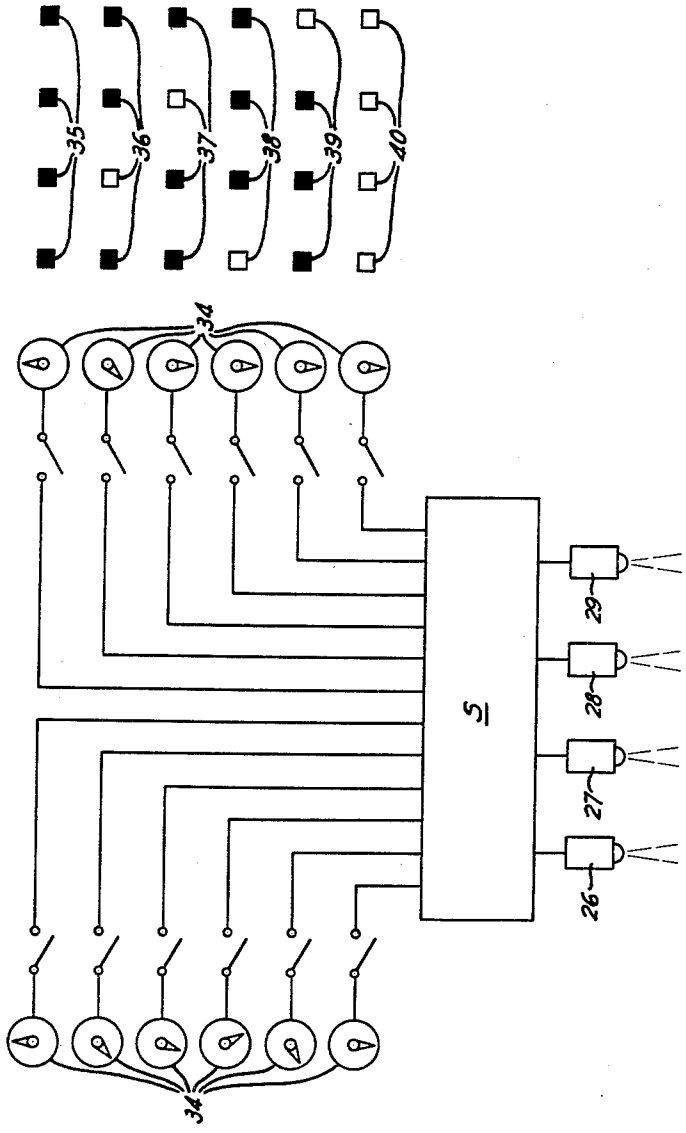



Fig. 3

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AUTOMATIC SCREWDOWN-CONTROL SYSTEM FOR ROD MILL

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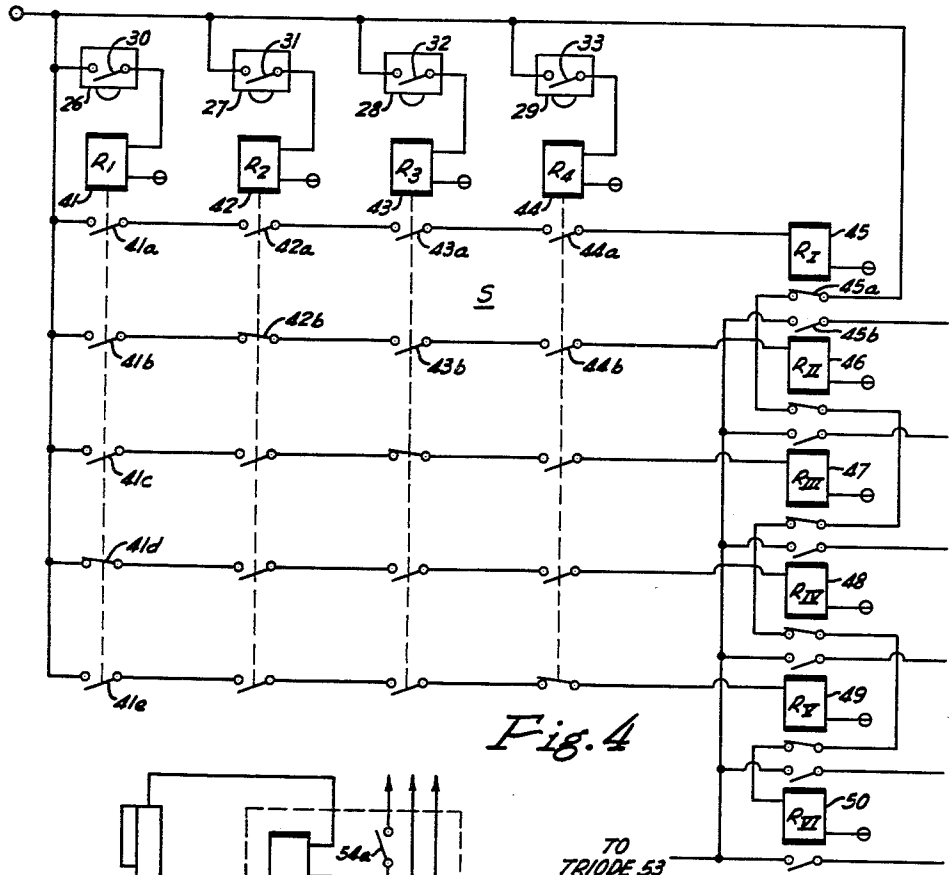



Fig. 4

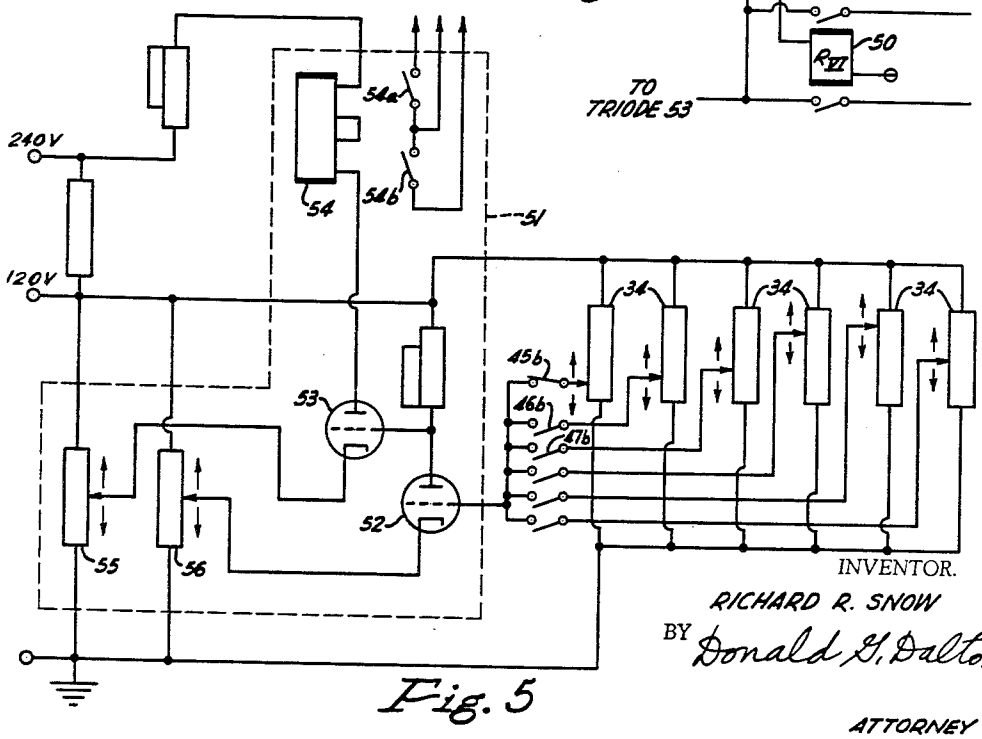



Fig. 5

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2,933,956

# AUTOMATIC SCREWDOWN-CONTROL SYSTEM FOR ROD MILL

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Application January 30, 1958, Serial No. 712,222

3 Claims. (Cl. 80—56)

This invention relates to mills for hot rolling a plurality of billets simultaneously, such as those used in converting billets to wire rod. In particular, it concerns a system for adjusting the mill screwdowns in accordance with the particular passes of the mill in which billets are actually present.

In hot-rolling billets into wire rod, a roll setting appropriate for the condition in which all the mill passes are occupied by billets will not be proper if some of the passes are empty. That is to say, if the mill screws are properly set for rolling four billets simultaneously, for example, and one billet is dropped because of a cobble or any other reason, the resulting reduction of the roll spring will cause the remaining billets to be overreduced. This necessitates a slight backing off of the screws to cause the mill to effect only the proper reduction and no more. Such compensating adjustment is customarily made manually but is too slow for rapid changes and is therefore made only when a change continues for a substantial period. It is the object of my invention to provide automatic means responsive to the presence of billets in the mill passes, for effecting this adjustment.

In a present preferred embodiment of the invention, I employ radiation-responsive means directed at the paths of heated billets traversing the several passes of a mill stand. I also provide manually settable means effective when operative, to bring the mill screws to predetermined positions through operation of a conventional screwdown motor and controller. Selector relays controlled by the radiation-responsive means in accord with the billets traversing the mill, serve to connect the proper manually settable means in circuit to operate the screwdown-motor controller to effect the necessary adjustment.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred embodiment. In the drawings:

Figure 1 is a diagrammatic side elevation of a mill showing the radiation-responsive means in position thereon;

Figure 2 is an end elevation corresponding to Figure 1;

Figure 3 is a diagrammatic showing of the relationship between the radiation-responsive means, the manually settable means and the selector relays as a group;

Figure 4 is a circuit diagram of the radiation-responsive means and the selector relays; and

Figure 5 is a circuit diagram of the controller for one screwdown, along with the manually settable means.

Referring now in detail to the drawings and, for the present, particularly to Figures 1 and 2, a stand **10** of a continuous rod-mill, preferably the first stand thereof, includes rolls **11** journaled in spaced housings **12** provided with screws **13** for adjusting the roll setting. Motors **14** mounted on brackets **15** drive the screws individually. Rolls **11** have several matching pairs of grooves **16** therein, each cooperating pair defining a pass



for reducing a billet. The billets in the several passes illustrated are designated **17**, **18**, **19** and **20**. Entry and exit guides **21** and **22** direct the billets into and out of the several passes.

A post **23** adjacent stand **10** but spaced to one side thereof has a lateral arm **24** at its upper end to which is pivoted a tiltable arm **25**. Arm **25** is normally disposed in the horizontal position shown in solid lines in Figure 1, overhanging the pass line between the rolls **11**. It may, however, be uptilted to the chain-line position so as to be out of the way. Sensing devices **26**, **27**, **28**, **29** responsive to infra-red radiation are spaced along arm **25** in locations such that, when the arm is in the illustrated position, the devices will receive radiation from heated billets traversing the passes of the mill stand **10**. Devices such as **26** are well known per se and are available commercially. They are provided with contacts **30**, **31**, **32** and **33**, respectively (see Figure 4) which are normally open but are closed when infra-red radiation of predetermined intensity impinges thereon.

Figure 3 shows the control system of my invention schematically. For each screwdown of the stand **10**, I provide a plurality of manually settable devices, e.g., potentiometers, **34**, one potentiometer of each set corresponding to a predetermined condition in respect to the presence of billets in the several mill passes or their absence therefrom, as illustrated in the chart at the right of Figure 3. More specifically, the uppermost potentiometers **34** are manually preset to bring about the proper setting of the two mill screws (through means to be described hereafter) for rolling billets in all four passes simultaneously to the desired size, as indicated in the chart by blocks **35**. Similarly, the next potentiometers in the row are set for the roll setting appropriate for rolling three billets when the second one from the left has been dropped, as shown at **36**. The remaining potentiometers are set for the other conditions as indicated respectively, by blocks **37**, **38**, **39** and **40**, viz., third billet dropped, first billet dropped, fourth billet dropped and no billets in the mill.

As will be further explained by reference to Figure 4, the existence of one or the other of the conditions illustrated schematically in Figure 3 at **35**, **36**, **37**, **38**, **39** and **40**, will bring the corresponding potentiometers in to play to effect a setting of each of the mill screws appropriate to the condition "observed" by devices **26** through **29**. This is accomplished by a selector S, the circuit of which is shown in Figure 4, and a controller shown in Figure 5, actuated by the selector. Referring now to Figure 4, the contacts **30**, **31**, **32** and **33** of devices **26**, **27**, **28** and **29**, when closed, energize relays **41**, **42**, **43** and **44**, respectively. Each of these relays actuates a plurality of contacts **41***a*, **41***b*, **41***c*, **41***d* and **41***e*, for example, some normally open and some normally closed as shown.

The several contacts of the relays **41**, **42**, **43** and **44** constitute interlocks controlling condition-selector relays **45**, **46**, **47**, **48** and **49**. The arrangement of the contacts is such that when all of relays **41**, **42**, **43** and **44** are energized, relay **45** will be energized but the circuits for relays **46**, **47**, **48** and **49** will be open. Similarly, when relay **42** is deenergized, relays **41**, **43** and **44** remaining energized, the circuit for relay **46** will be closed but the circuits of relays **45**, **47**, **48** and **49** will be open. The remaining circuits for relays **47**, **48** and **49** are similar. The overall result is that one and only one of relays **45**, **46**, **47**, **48** and **49** will be energized for each of the conditions illustrated at **35**, **36**, **37**, **38** and **39** of Figure 3.

Each of relays **45**, **46**, **47**, **48** and **49** has a normally closed contact (e.g., **45***a*) and a normally open contact (e.g., **45***b*). The normally closed contacts of all the

relays are connected in series with a relay **50**. Thus, when all relays **41**, **42**, **43** and **44** are deenergized, a circuit is completed for relay **50**. It therefore corresponds to condition **40** as shown in Figure 3. The normally open contacts of relays **45** through **50** control the connection of potentiometers **34** to the controller **41***a* of Figure 5, next to be described.

Referring now to Figure 5, controller **51** includes an amplifier triode **52**, the grid of which is connectable to any one of potentiometers **34** by closure of one of contacts **45***b*, **46***b*, etc., as described above. The voltage applied to the grid by the particular potentiometer thus called into play is amplified and applied to the grid of a second amplifier triode **53**. The resulting output of the latter energizes a differential relay **54**. This relay has two normally open contacts **54***a* and **54***b* and functions to close **54***a* on an increase in current through triode **53** and contact **54***b* on a decrease in such current.

Contacts **54***a* and **54***b* control a reversing contactor panel for one of the screwdown motors **14**, causing upward or downward movement of the screw as called for by the setting of the potentiometer which is connected to triode **52**. Balancing potentiometers **55** and **56** are operated in accordance with the screw movement effective to produce the desired adjustment. As the adjustment is completed, these potentiometers reduce the voltages on the grids of triodes **52** and **53** to values such that no current flows through relay **54**. It will thus be apparent that the connection of any potentiometer **34** to triode **52** will cause a screw adjustment governed by the existing setting of that potentiometer.

The controller **51** is for one screwdown motor. A similar controller is provided for the other motor. Duplicate contacts on relays **45**, **46**, etc. like contacts **45***b*, **46***b*, etc. control the connection of potentiometers **34** for the other screw to the second control system.

The invention greatly reduces the rod-size variations previously occurring and minimizes the number of cobbles resulting from buckling by automatically compensating the setting of the rolls of the first stand of a rod mill in accord with the number of billets actually in the mill. As a result, the invention produces an increased yield and a better quality of product.



Although I have disclosed herein the preferred embodiment of my invention, I intend to cover as well any change or modification therein which may be made without departing from the spirit and scope of the invention.

I claim:

1. In a rolling mill including a pair of cooperating rolls having a plurality of sets of matching grooves defining several passes for reducing a plurality of billets simultaneously, roll-adjusting screws, a motor driving one of the screws and a controller for said motor, the combination therewith of a plurality of manually settable means adapted, respectively, to cause the controller to adjust the rolls to different settings, depending on which sets of grooves are occupied by billets undergoing reduction at a given time, and means responsive to the presence of billets in said sets of grooves, respectively, effective to connect a selected one of said manually settable means to said controller.

2. The combination defined in claim 1, characterized by said responsive means including a plurality of relays affected by radiation from hot bodies, each of said relays being positioned to receive radiation from a billet in one of said passes.

3. The combination defined in claim 2, characterized by a post standing adjacent said mill having an arm pivoted thereto adapted to extend as a cantilever beam over the mill, said radiation relays being spaced along said arm.

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