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LENGTHS OF ELONGATED MATERIAL
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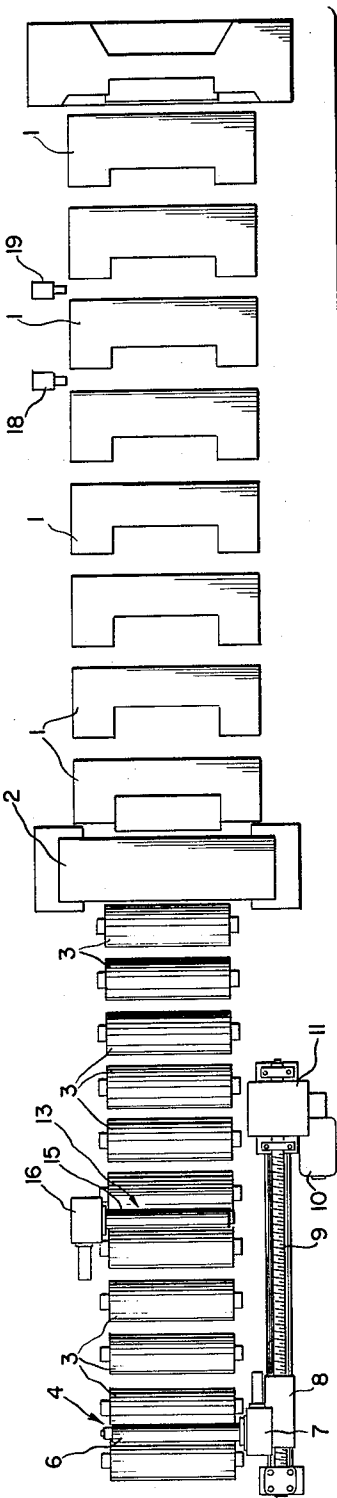


Fig. 1

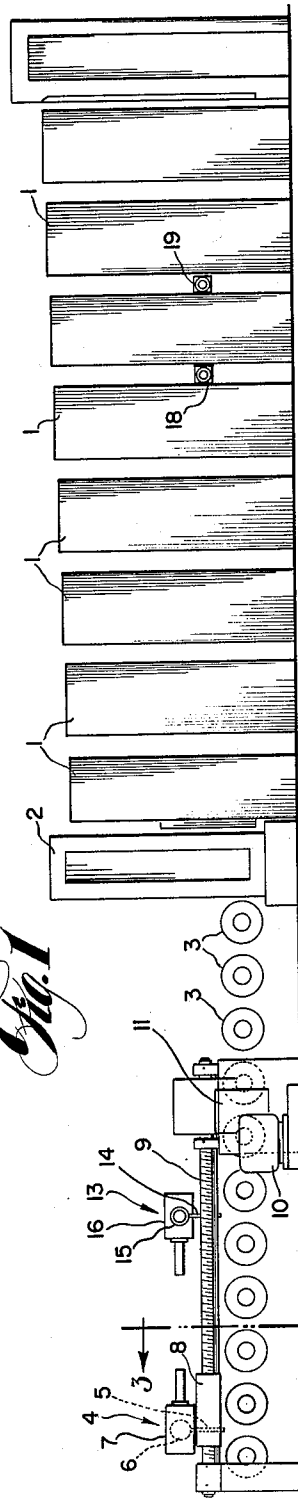


Fig. 2

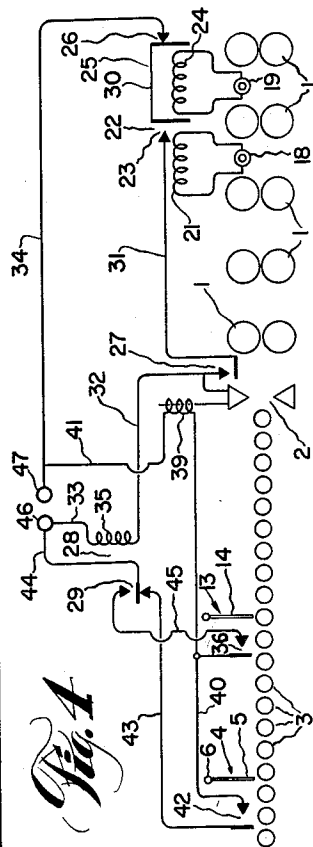


Fig. 3

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APPARATUS FOR CONTROLLING SHEARED LENGTHS OF ELONGATED MATERIAL

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4 Claims. (Cl. 80—3)

This invention relates to apparatus for automatically positioning a continuous length of material, such as a rolled metal billet or bar, for shearing into multiples of a desired length. It is more particularly concerned with apparatus for automatically adjusting that positioning so that the last few multiples are of lesser length than the specified length but are of a length selected so as to minimize waste or discard material.

My invention is particularly applicable to the shearing of rolled metal billets and will be described hereinafter in that connection but is not limited to metal billets. In the rolling of metal billets, particularly steel billets from blooms, a bloom of a given weight may be rolled into a continuous billet of smaller cross section which is many times the length of the original bloom. The continuous billet is sheared into lengths which are suitable for further rolling into bars or the like. It is commercially impossible to control the amount of metal in the bloom so closely that the bloom can be rolled into an integral number of multiples of the desired billet length. The overage may be only a foot or two or may be a billet only a few feet less than the desired length. If the last sheared billet is only slightly shorter than the desired length, it can be further processed without too significant a penalty, but if it is much shorter than the desired length, it cannot readily be further processed and becomes scrap.

Rolling mills for the production of billets usually comprise a number of roll stands in tandem for the progressive reduction of a bloom to the desired billet size, followed by a shear for cutting the continuous rolled material to proper lengths. The shear is followed by a run-out table which is equipped with a stop or target against which the forward end of the billet engages to position the billet for shearing. This target is adjustable over a certain distance to permit shearing of billets to different specified lengths. With apparatus of this conventional type the length of billet left over after shearing the last full length is scrapped if it is shorter than the minimum short length which can be accepted for further processing.

It is an object of my invention to provide apparatus which automatically senses or determines the approximate length of billet which will be rolled from a bloom and automatically adjusts the length of the last billet or last few billets sheared from a continuous length so as to minimize scrap loss. It is another object of my invention to provide apparatus as above-described which is adapted for use with conventional rolling and shearing facilities. Other objects of my invention will appear in the course of the following description and explanation thereof.

A present preferred embodiment of my invention is illustrated in the attached figures to which reference is now made.

Fig. 1 is a plan view of a tandem mill for rolling a bloom into elongated billet material together with a

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shear, a run-out table and target means for positioning billets for shearing.

Fig. 2 is an elevation of the apparatus of Fig. 1.

Fig. 3 is a vertical cross section taken on the plane 3—3 of Fig. 2 showing in more detail the construction of a target.

Fig. 4 is a schematic wiring diagram of a control circuit adapted to the apparatus of Figs. 1, 2 and 3.

A conventional billet mill, such as is shown in Figs. 1 and 2, comprises a plurality of roll stands 1 arranged in tandem. These stands in themselves form no part of my invention and so are shown in outline only. Those skilled in the art of rolling know that each stand is provided with a pair of rolls for progressively reducing the material, and with means for driving those rolls. The last roll stand 1 is followed by a shear 2 which may be of any conventional type for cutting the continuously rolled material into lengths. The rolled material issuing from the last stand 1 is caused to move out on a runout table comprising a plurality of level, horizontally mounted rollers 3. The run-out table is provided with a target 4. Target 4 is a rectangular plate of metal 5 which is mounted on a horizontal shaft 6. The horizontal shaft 6 is rotatable about its axis and is journaled in a mounting 7 positioned at one side of the run-out table. The mounting 7 is supported by a carriage 8 which is movable along a track parallel to the run-out table by a screw 9 which is, in turn, rotated by motor 10 and gear box 11.

My apparatus is provided with a second target 13 which is similar in construction to target 4, previously described, and comprises a rectangular plate 14 mounted on a horizontal shaft 15 which is rotatable about its axis and is journaled in housing 16. My apparatus also includes a pair of photocells or other means for sensing the presence of rolled material, designated 18 and 19. These photocell means are spaced from each other and from shear 2, and are conveniently mounted between roll stands of the rolling mill.

As I have mentioned, target 4 is movable along the run-out table a distance which is determined by the length of screw 9. Photocells 18 and 19 are spaced apart a distance which is proportional to the distance between the maximum and minimum spacings of target 4 from shear 2 or integral multiples of this distance. The spacing between photocells 18 and 19 is not equal to the range of travel of target 4 because the partially reduced billet which is sensed by photocells 18 and 19, is further elongated as it is rolled in the stands following photocell 18. By the term "proportional" I mean that photocells 18 and 19 are separated by a distance such that a partially reduced billet of that length at that position in the mill will be rolled into a final length equal to the spacing between maximum and minimum positions of target 4 from shear 2 or integral multiples of this distance. Photocell 18 is positioned ahead of shear 2 a distance proportional to an integral multiple of the shortest acceptable length of billet. The term "proportional" which I use here has the same significance as I have previously explained. Auxiliary target 13 is positioned from shear 2 a distance equal to the shortest acceptable length of billet.

The control circuit for my apparatus is illustrated in Fig. 4. Photocell 18 is connected to energizing coil 21 of relay 22 which is provided with a pair of normally open contacts 23. Photocell 19 is connected to energizing coil 24 of relay 25 which is provided with a pair of normally closed contacts 26. Shear 2 is provided with a pair of contacts 27 which are open when the shear is raised and closed when the shear is lowered to shear a bar. One of the pair of contacts 23 is connected to one of the pair of contacts 26 by a conductor 30. The other contact of pair 23 is connected to one of the

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pair of contacts 27 by a conductor 31. The other contact of pair 27 is connected to one terminal of coil 35 of latching relay 28 by conductor 32. The other terminal of coil 35 is connected to one terminal 46 of a voltage source by conductor 33. The other contact of pair 26 is connected to the other terminal 47 of the same voltage source by conductor 34.

Target 13 is provided with a pair of normally open contacts 36 which are closed when plate 14 is caused to swing about shaft 15 by the advancing end of a billet. Target 4 is provided with a pair of similarly disposed normally open contacts 42. Latching relay 28 is provided with a set of transfer contacts 29, the center contact of which is connected by conductor 44 to terminal 46 of the voltage source previously mentioned. The upper contact of contacts 29 is connected by conductor 45 to one of the pair of contacts 36. The lower contact of contacts 29 is connected by conductor 43 to one of the pair of contacts 42. The transfer contacts 29 normally connect conductor 44 to conductor 43 but when coil 35 is energized, conductor 44 is connected with conductor 45. Shear 2 is operated by means controlled by solenoid valve 39. The other contact of pair 36 is connected to conductor 40 which also connects together one terminal of solenoid valve 39 and the other contact of pair 42. The other contact of solenoid valve 39 is connected to terminal 47 of the voltage source by conductor 41.

The operation of my apparatus will now be explained, also by reference to the attached figures and foregoing description. As I have mentioned, auxiliary target 13 is set at a distance from shear 2 corresponding to the shortest length of billet which it is economical to process. Target 4 is set at a distance equal to the desired billet length. It will be assumed that shear 2 is raised, and that the target plates 5 and 14 are hanging in the path of the billet. Under these conditions a hot bloom is introduced into the entry end of my mill and proceeds through successive roll stands 1—1. When it comes opposite photocell 19, the light radiating from the hot bloom falling on photocell 19 generates a current in coil 24 of relay 25 which operates and opens contacts 26. When the leading end of the hot metal comes opposite photocell 18, a like action in that photocell closes contacts 23 of relay 22. The hot billet proceeds through the successive mill stands and through raised shear 2 and out on the run-out table. Its leading end there passes over rolls 3—3 and causes target plate 14 to swing about shaft 15 and in so doing closes contacts 36, but the circuit through contacts 36 is broken by transfer contacts 29. When the billet leading end engages plate 5 of target 4 and swings it about shaft 6, contacts 42 are closed, solenoid valve 39 is connected across the voltage source through transfer relay 29, and shear 2 is actuated, cutting off the billet at the length determined by the position of target 4. When shear 2 closes, it closes contacts 27, but as long as hot material is before both photocells 18 and 19, the circuit from the power source through coil 35 of relay 28 is open so that contacts 36 carried by target 13 are not in circuit with solenoid valve 39. Successive lengths of billets are sheared in the same way as has previously been described.

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When the trailing end of the hot metal in the mill passes photocell 19, the current through relay coil 24 drops to zero and contacts 26 close. As long as the trailing end of the bar actuates photocell 18 but not photocell 19, the circuit through coil 35 of relay 28 is set up and operates through contacts 27 upon the closing of shear 2 to energize relay 28 and transfer the control of solenoid valve 39 to contacts 36 of target plate 14. The next bar to be sheared, therefore, is of a length determined by the position of auxiliary target 13 and not by principal target 4, and this condition holds for the remainder of the rolled material until the latch of latching relay 28 is released. The maximum amount of scrap or waste bar will thus be that corresponding to the partially rolled material between photocells 18 and 19.

I have mentioned that photocell 18 is positioned from shear 2 a distance equivalent to an integral number of the shortest bar lengths which can be further processed. The greater the number of such integral lengths, the less the scrap loss will be, but the integer is, of course, limited by the number of short lengths which can be accepted.

I claim:

1. In apparatus comprising, in tandem, a plurality of roll stands, a shear, a run-out table, a primary target adjustably positioned from the shear on the run-out table in the path of rolled material so as to be moved by the leading end of that rolled material, means to operate the shear, and primary control means actuated by movement of the primary target to initiate operation of the shear-operating means, the improvement comprising a first signal device and a second signal device for indicating the presence or absence of rolled material, the first signal device being positioned between roll stands in advance of the shear and the second signal device being positioned between roll stands in advance of the first signal device, an auxiliary target positioned intermediate the shear and the primary target, auxiliary control means actuated by movement of the auxiliary target to initiate operation of the shear-operating means, and means interconnected with the first signal device and second signal device to transfer control of the shear-operating means from the primary control means to the auxiliary control means only when the second signal device indicates the absence of rolled material and the first signal device indicates the presence of rolled material.

2. Apparatus of claim 1 in which the first signal device is spaced from the second signal device a distance proportional to the distance between the maximum and minimum positions of the primary target from the shear.

3. Apparatus of claim 1 in which the first signal device is spaced from the second signal device a distance proportional to an integral multiple of the distance between the maximum and minimum positions of the primary target from the shear.

4. Apparatus of claim 1 in which the first signal device is spaced from the shear a distance proportional to an integral multiple of the distance between the shear and the auxiliary target.

No references cited.