(No Model.)

P. L. KIMBERLY.

ROLLING MILL.

No. 483,929. Patented Oct. 4, 1892.

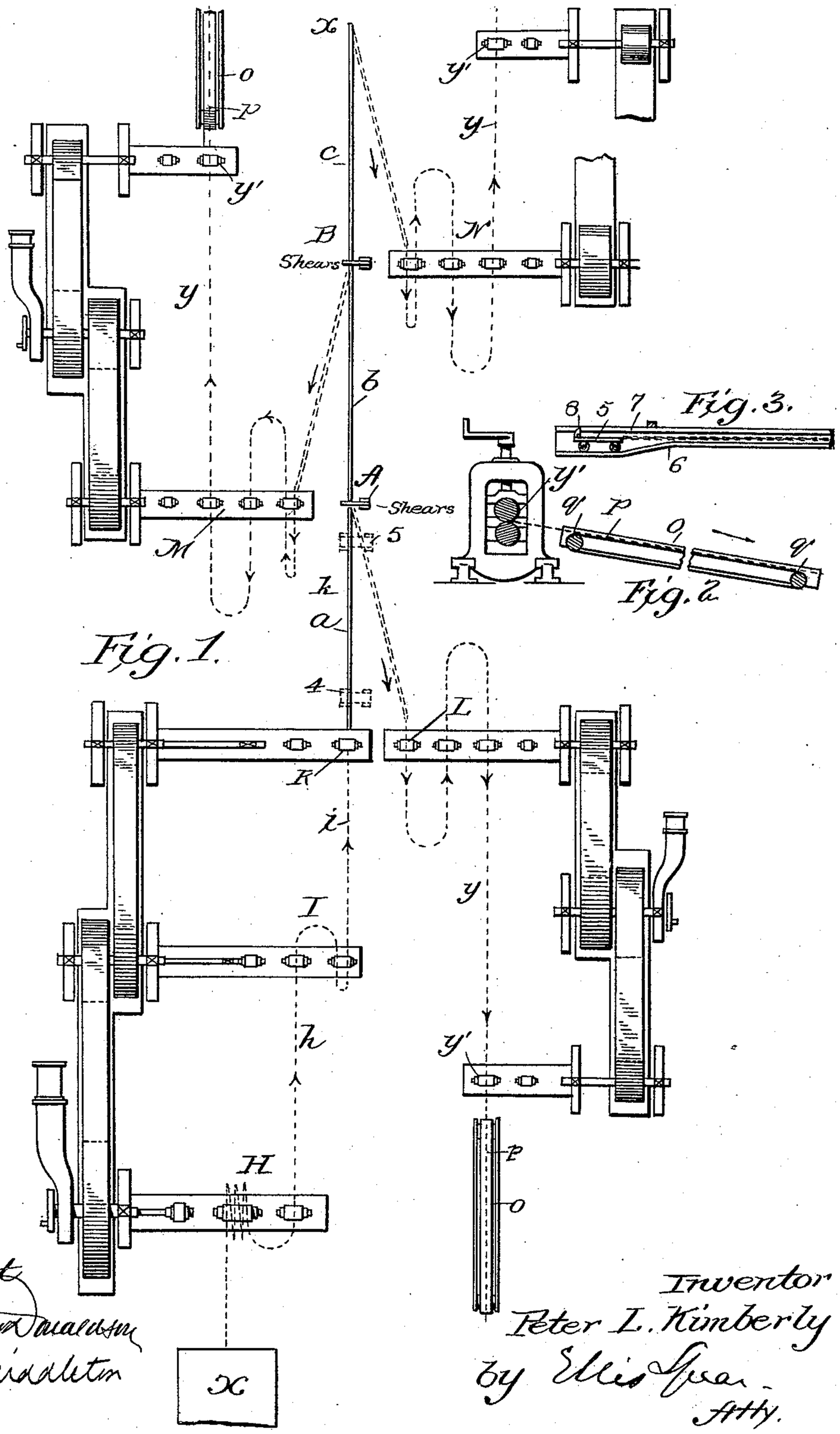

Fig. 1.

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ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 483,929, dated October 4, 1892.

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To all whom it may concern:

Be it known that I, PETER L. KIMBERLY, a citizen of the United States of America, residing at Sharon, in the county of Mercer and State of Pennsylvania, have invented certain new and useful Improvements in Rolling-Mills, of which the following is a specification.

My invention relates to improvements in machinery and methods of rolling iron, steel, and other like materials; and it consists of an improved arrangement of the reducing and finishing rolls, in connection with cutting mechanism for severing the bar at points intermediate in the train of mechanisms.

My improvements are adapted to the manufacture of all kinds of high-grade merchant iron, such as squares, hoops, ovals, rounds, and other shapes, but is more especially adapted to the manufacture of hoops and bands and the smaller sizes of guide iron or steel, and by the use of the said improvements any two or more sizes or shapes can be produced at the same time from the original pile or billet without the necessity of reheating the same and of a more accurate and uniform gage than can be produced by any other method now in use so far as known to me.

My improvements consist generally of one or more trains of "roughing-rolls" or reducing-mills, in combination with one or more trains of finishing rolls or mills so arranged that after the iron or steel pile or billet has passed through the roughing-rolls or has reached a certain stage in the process of finishing the bar thus produced is cut into two or more lengths by means of a series of shears or saws conveniently located at points on the line of the bar as it comes from the roughing or reducing rolls and so constructed as to be easily and quickly adjusted for cutting the iron or steel into any number of pieces and of any desired lengths. After the operation of cutting, which requires but an instant, the several lengths are immediately conveyed to separate finishing-mills, located as hereinafter described, by means of suitable carriages, as hereinafter described, or they may be carried to the desired points by hand. The advantages gained by cutting the iron into two or more lengths in the manner just described are that a pile or billet of much larger than ordinary size can be used than in the ordinary plants now in use and a hoop, band, or other desired finished product can be rolled and finished by my apparatus of much greater length and uniform gage than is practicable by the usual single-mill method, for the reason that by the single-mill method, consisting of roughing, strand and finishing rolls, in which a small-size pile or billet is used, the iron or steel, especially in hoops, bands, and the smaller sizes of other shapes, by the time it has passed through the various passes and reached the finishing-rolls has cooled to such an extent that in long lengths there is a very considerable difference in size between the opposite ends of the hoop or other finished product, the variation being from one to two or more gages, according to the length and temperature of the finished product. In my process, in which the large-sized pile or billet is used—for instance, a four inch by four inch as compared with a two-inch billet in the method in ordinary use—the billet retains its heat for a much longer time, and after having passed through the roughing process or in some cases through one or more stages of the finishing process is cut into two or more pieces of any desired length or weight and carried immediately to as many separate finishing-mills, where the different lengths are finished simultaneously into as many different sizes or shapes, all of which can be done while the iron retains the proper degree of heat to insure a product of uniform gage, thus overcoming a very serious objection to much of the iron and steel rolled in the usual manner.

By "rolling iron of greater length" I mean that the combined length of the several pieces into which the rolled pile or billet is cut prior to finishing greatly exceeds in length of finished product the finished product of the smaller billet used in the ordinary manner.

I am aware that the idea of severing a bar as it proceeds from the roughing-roll is not new.

Having thus described my invention in a general way, I will now refer to the several parts and explain their operation in detail.

In the drawings, Figure 1 is a diagram of the whole train. Fig. 2 is a detail view of the discharging-trough, and Fig. 3 is a detail view of the transfer-truck.

In Fig. 1, A B, &c., represent the shears or

saws by means of which the iron or steel is cut into as many pieces or lengths as may be desired, these being in line or substantially in line with the path of the reduced bar as it proceeds from the reducing-rolls.

In the drawings the heating-furnace is indicated at X. Next to this is located the roughing-rolls H, through which the billet is passed back and forth in the ordinary manner for roughly reducing it. Ordinarily about seven passes are given in these rolls, although this number is not material to my invention. From the last of the roughing-rolls the bar passes in a line indicated at *h* to the breaking-down rolls I, and preferably I give the three passes to the bar through these rolls, and from the last the bar passes on the line *i* to the strand-rolls K, where one pass may be sufficient. From this roll, which is the last in the reducing-train, the bar passes on the line *k* in any suitable support until it reaches the point, for example, shown at *x*. Intermediate of this last roll and the point *x* I have located a series of cutting mechanisms A B. Only two of these are shown, this number being sufficient to illustrate the invention. By these the bar is cut into three, preferably equal, parts, the cutting being practically simultaneous. The movement of the bar to the point *x* I call the "forward movement" to distinguish it from the backward movement of the sections, hereinafter described. On each side of the line of the cutters or shears and in alternate arrangement are the reducing-rolls L M N, these rolls being arranged, respectively, opposite or in rear of their cutters, using the term here in its relation to the forward movement of the bar as it emerges from the last reducing-roll. The finishing-roll L is thus arranged in rear of the shears A, being opposite the last reducing-roll. The section *a* is severed from the bar by the shears A, and the rear end of it is swung at once into line with the first of the finishing-rolls L. At the same time the rear end of the section *b* of the bar is swung to the other side to the reducing-rolls M. Its forward end has been severed from the rest of the bar at the same time, and the rear end of the remainder of the bar *c* is swung to the same side as the section *a* into line with the first row of the finishing-rolls N. These movements being performed substantially at the same time and the ends of the sections introduced into the bite of the rolls, the finishing-rolls simultaneously grasp and draw the sections backward, and they are given a sufficient number of passes in these finishing-rolls to properly finish them, and the main bar being thus divided into sections which are operated upon simultaneously the operation is quickly performed and in a uniform manner from beginning to end, since the ends of the sections do not have time materially to cool in passing through the finishing-rolls, notwithstanding their attenuated form. The location of the finishing-rolls opposite or in rear of the cutting mechanisms next to them economizes space, and the alternate arrangement facilitates the operation of the mechanism. From the last finishing-roll of each set the product is taken directly on the lines *y* to small rolls *y'*, technically known as the "bull-head," which give the final finish to the product. For the best effect I run the succeeding rolls at respectively higher rates of speed. For example, suppose the roughing-rolls run at ninety revolutions per minute, the reducing-rolls I at one hundred and forty revolutions per minute, and the strand-rolls K at three hundred and forty revolutions per minute. With this rate of revolution I am enabled to run the bull-head at four hundred and sixty revolutions per minute, which causes the finished product to move at the rate of twenty feet per second. This high rate of speed renders it difficult to guide the delivery of the product by hand, and I have provided, therefore, an automatic delivering mechanism. (Illustrated in Fig. 2.) This consists of a chute *o*, in which is an endless metallic band *p* running over rolls *q*. The hoop or whatever be the final form of the finished product emerges from the bull-heads into the chute and into contact with the metallic band, which moves in the direction of the arrow, and the inclined position of the chute, together with the movement of the band, which forms the bottom of it, carries along the finished product and assists the delivering in a straight and proper condition.

In order to organize the mill for the manufacture simultaneously of different finished products or for different sizes of the same product, as heretofore indicated, I provide finishing-rolls of different forms for the manufacture of different finished products. For example, the finishing-rolls L are formed for hoop-iron, the rolls M for iron oval in cross-section, and the rolls N for flat bar, the bar as it comes from the strand-rolls being suited for all these different forms of finished products.

The cutting mechanisms are made adjustable, so that they may be shifted for varying the lengths of the sections. The cut lengths are removed from the point where they are cut to the rolls in any suitable manner, but preferably by means of trucks 4 5, Figs. 1 and 3, which move on a track or way 6 beneath the table or platform 7, where the lengths are cut, the track being depressed beyond the position of the cut sections, so that the trucks can pass entirely beneath them. The trucks are provided with a pivoted projection 8 on one edge, which has a squared shoulder, and when it is desired to move the end of the section to the position of the rolls the truck is simply drawn laterally, and as it rises up the inclined track it slightly lifts the end of the section, the edge of which comes in contact with the projection, and it is thus drawn over to the position of the rolls and passes through the same. The truck is then moved back into

position for another section, and as the projection is pivoted it is depressed by contact with the next section, allowing the truck to pass beneath the sections into position to repeat the operation.

I claim as my invention—

1. A rolling-mill consisting of a series of roughing or reducing rolls arranged in proper relation to a heating-furnace, a series of cutting mechanisms arranged substantially in line with the last of the series of reducing-rolls and adapted to act simultaneously to sever the reduced bar at different points, and a series of finishing-rolls arranged alternately on the right and left of the line of cutting mechanisms, as set forth.

2. A rolling-mill consisting of a series of roughing or reducing rolls in proper relation to a heating-furnace, a series of cutting mechanisms substantially in line with the last of the series of reducing-rolls, and a series of finishing-rolls arranged alternately on the right and left of the line of cutting mechanisms and in rear, respectively, of the points of severance of the bar, whereby the sections of the bar are drawn backward in finishing, as set forth.

3. A rolling-mill plant consisting of a series of roughing or reducing rolls, a series of cutting mechanisms adapted to operate simultaneously on the reduced bar, a series of finishing-rolls, and a chute at the end of each of the finishing series, combined with an endless traveling band arranged in the chute, substantially as described.

4. In a rolling-mill plant having a series of roughing or reducing rolls and a series of cutting mechanisms substantially in line with the last of the reducing-rolls, a series of finishing-rolls of different forms, whereby different products may be made simultaneously from the same bloom, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

PETER L. KIMBERLY.

Witnesses:

A. W. WILLIAMS,

ROBERT GRAY.