3 Sheets--Sheet 1.

I. HAHN.

Machine for Making Hollow Beams and Tubes.

No. 165,094. Patented June 29, 1875.

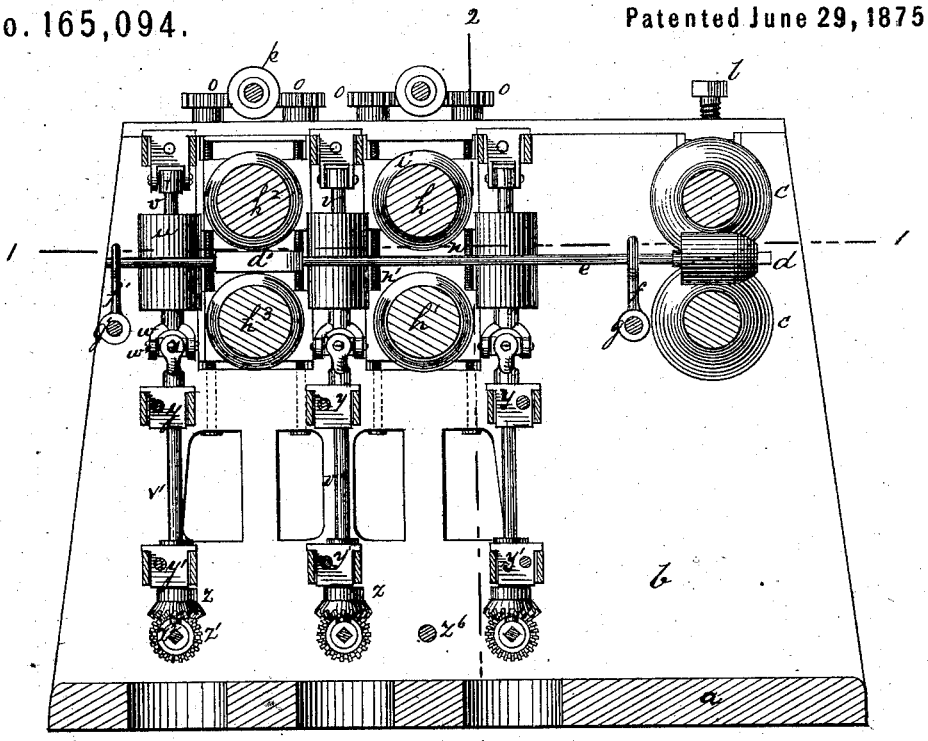

Fig. 1

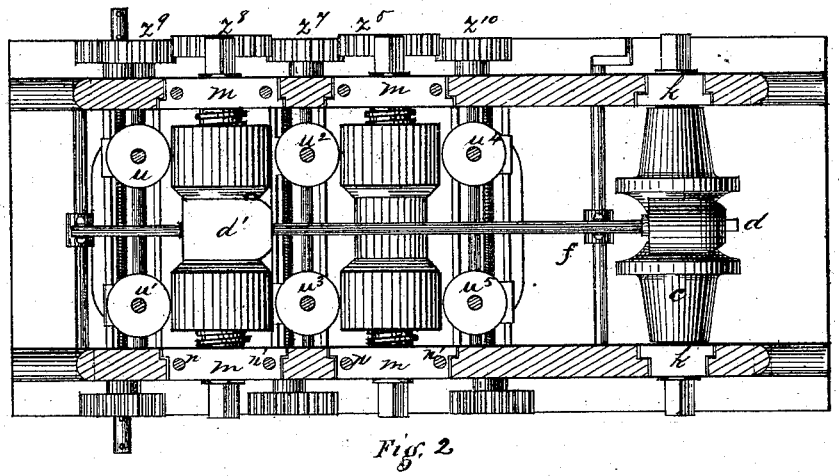

Fig. 2

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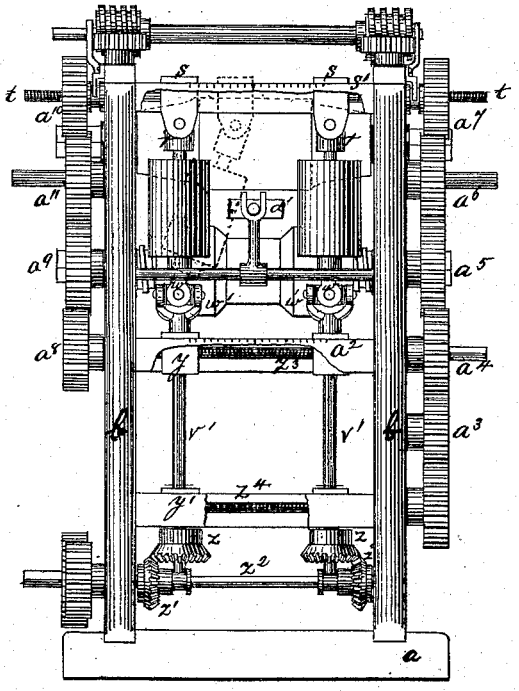

Fig. 3

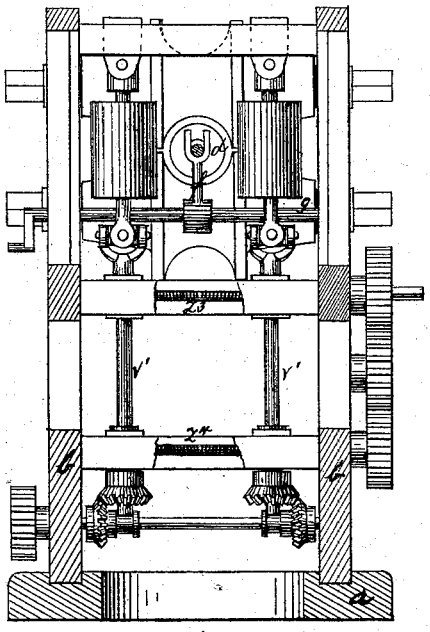

Fig. 4

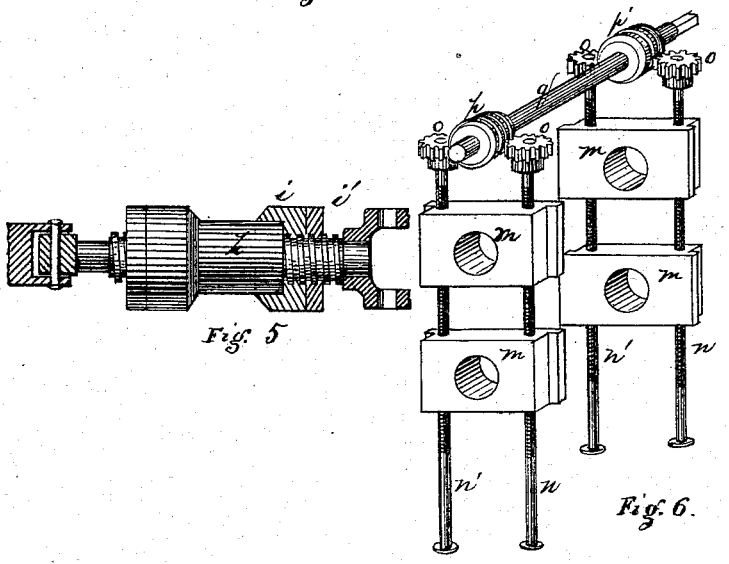

Fig. 5

Fig. 6.

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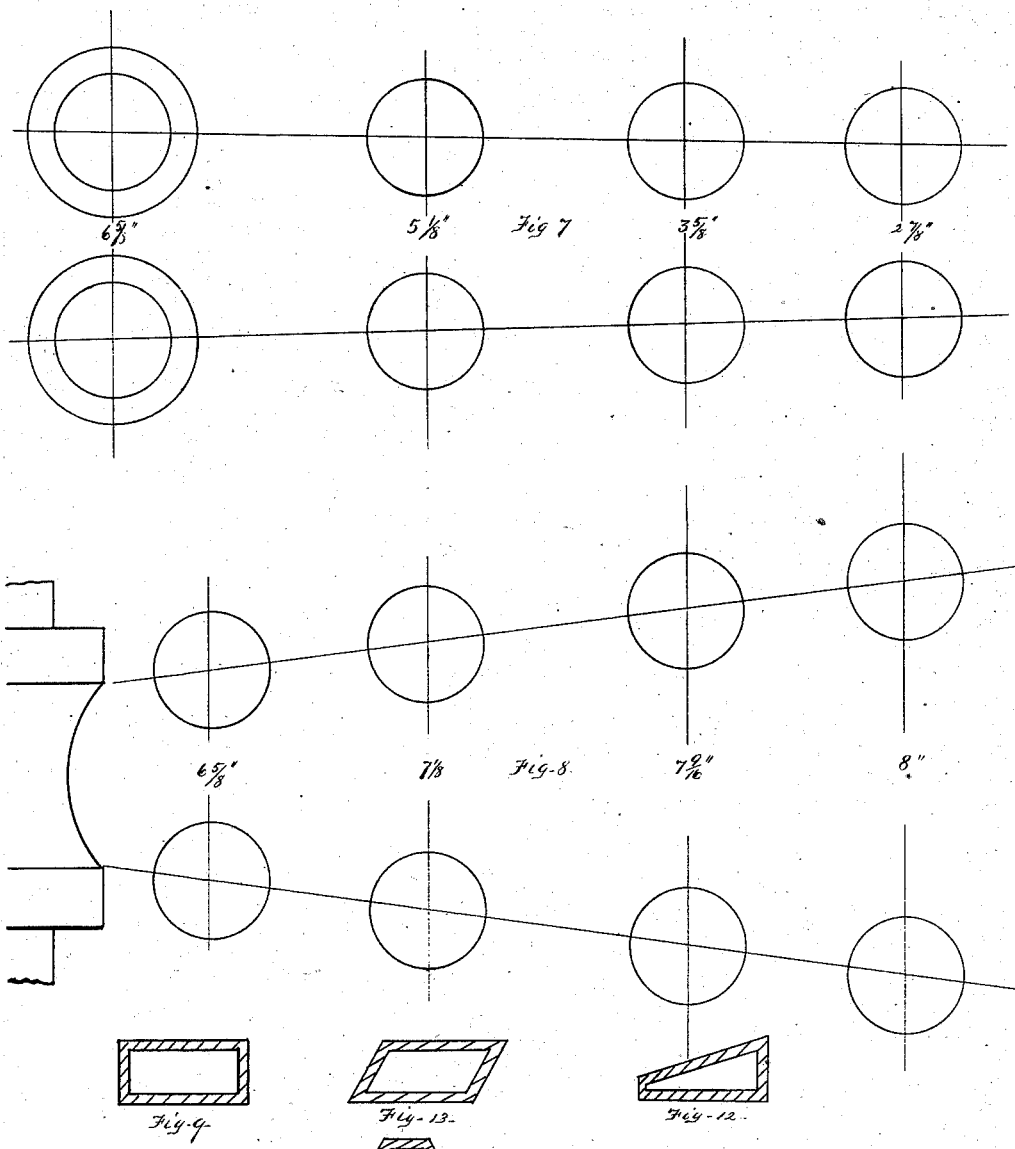

Fig-9

Fig-13

Fig-12

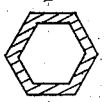
Fig-10


Fig-11

WITNESSES

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THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE.

IGNATIUS HAHN, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN MACHINES FOR MAKING HOLLOW BEAMS AND TUBES.

Specification forming part of Letters Patent No. **165,094**, dated June 29, 1875; application filed March 9, 1875.

To all whom it may concern:

Be it known that I, IGNATIUS HAHN, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Universal Mills; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, forming a part of this specification, in which—

Figure 1 is a vertical section of a mill embodying my invention. Fig. 2 is a horizontal section on the line 1 1, Fig. 1. Fig. 3 is a rear view. Fig. 4 is a vertical section on the line 2 2, Fig. 1, looking toward the welding-rolls. Fig. 5 is a view of one of the horizontal rolls. Fig. 6 is a view of devices for adjusting the horizontal rolls. Figs. 7 and 8 are diagrams illustrating the position of the horizontal and vertical rolls in producing an eight-inch hollow beam, and Figs. 9 to 13 are diagrams showing some of the forms of beams which may be rolled by the proper adjustment of the horizontal and vertical rolls.

Like letters refer to like parts wherever they occur.

My invention relates to the construction of universal mills for rolling polygonal shapes, more especially adapted for the production of hollow welded beams and columns, certain parts of said apparatus being equally applicable to metal-rolling mills in general; and it consists, first, in a series of two high horizontal plain rolls, and one or more pairs of vertical plain rolls, arranged in line and combined with a pair of welding-rolls, whereby the skelp is welded into tubular form and transformed into the shape required; second, in providing the rolls with a universal coupling, the coupling-spindles whereof are retained in a parallel relation to each other by suitable devices, whereby the rolls may be set and driven at any required angle; third, in providing the rolls with adjustable collars and jam-nuts or equivalents, whereby the length of the operative faces of the rolls may be increased or diminished at pleasure.

I will now proceed to describe my invention, so that others skilled in the art may apply the same.

The elements of the machine are horizontal and vertical forming-rolls and welding-rolls, the combination of which, to produce certain results not heretofore attained, constitutes one point of invention, and is typified or illustrated in Fig. 1, though the number of rolls may be increased or diminished without evading the spirit of the invention. The manner of coupling the several horizontal rolls, as well as vertical rolls, so as to cant them when irregular forms are to be rolled, is shown applied to vertical rolls in Fig. 3. The manner of reducing the working-faces of the rolls by collars and jam-nuts is shown in Fig. 5, and the manner of adjusting the boxes in Fig. 6; and it is here specifically stated that the construction of the several rolls, &c., as illustrated in Figs. 3, 5, and 6, is to be understood as applying to all the forming-rolls of the series.

In the drawings, *a* represents the bed-plate, secured to a suitable foundation, and *b* housings, of one or more pieces, according to circumstances or location. *c c* are a pair of welding-rolls, the grooves of which will of course correspond to the size of the work to be done. These rolls are journaled in boxes *k*, those for the lower rolls resting upon or in the housings *b*, while the upper boxes are adjustable by means of the usual set-screws *l*. h h^1 h^2 h^3 are horizontal rolls, journaled in boxes *m*, supported in the housings *b*, and controlled by a series of right-and-left-hand screws. These horizontal rolls (shown clearly in Fig. 5) are provided at each end with a collar, *i*, part of the inner surface of which is threaded to correspond with a thread upon the shaft of the roll, so that both collars may be moved forward or backward, to increase or diminish the working-faces of the rolls, said collars being also beveled, as shown, where octagonal and similar figures are to be rolled.

In order that the collar *i* may retain its position it is secured by a jam-nut or second collar, *i'*, on the roll-shaft, outside of collar *i*. These rolls h^1 h^3 can be, and in general are, coupled by universal joints to that portion of the shaft journaled in boxes *m*, and for the manner of coupling reference is made to the description of the vertical rolls hereinafter

given. *m* are the boxes in which the horizontal rolls are journaled. These boxes all hang on rods or bolts *n n'*, provided with right and left hand threads, working through threads in the boxes. At the upper end of each of the bolts *n n'* is a worm-wheel, *o*, firmly secured to the bolt, and gearing with worms *p p*, of which there are always two on one common shaft, power being applied to one or both ends of the shaft, according to circumstances. By these devices the horizontal rolls can at pleasure be caused to recede from or approach each other, in such manner and at such rate that the circumference of both upper and lower rolls are constantly equidistant from an imaginary horizontal plane drawn through the point of contact of the welding-rolls, and this no matter what space intervenes between the upper and lower rolls. The horizontal rolls *h* h^2, as well as the welding-rolls *c c*, are driven direct by breaking-spindles and coupling-boxes from gearing placed at the sides of the machine, or by properly-arranged belting, care being had that the circumferential speed of the welding-rolls and vertical rolls corresponds with that of the horizontal rolls. Alternating with the horizontal rolls are one or more sets of vertical rolls, *u* u^1 u^2 u^3 u^4 u^5, having oscillating boxes *r r*, (see Fig. 3,) secured in outer boxes *s s*, which move in transverse ways *s'*, each outer box *s* being acted upon by an independent screw, *t t*. The lower ends of the shafts *v* of the vertical rolls are provided with one-half, *w*, of a universal joint or coupling, the other half being fastened to the lower shafts *v'*, which are kept in line by guide-boxes *y y'*, also moving in transverse ways. At the lower ends of shafts *v'* are beveled wheels *z*, driven by beveled wheels z^1, the latter revolved by shafts z^2, along which they slide on feather-keys (or the shaft may be square or angular, as shown) responsive to the movements of shafts *v'*, the lower ends of which take into grooves on the hubs of the beveled wheels z^1. The guide-boxes *y y'* on shafts *v'* are acted on by right-and-left-hand screws z^3 z^4, causing the vertical rolls to approach or recede at their lower points; and as the beveled wheels z^1 slide on their power or driving shafts z^2, preserving their relations to bevel-wheels *z*, it follows that the vertical rolls may be as readily driven in one position as another.

The manner of securing the oscillating boxes *r r* to the outer boxes *s s*, to permit the canting of the vertical rolls, will be the same when applied to the horizontal rolls, and is what was referred to in describing the horizontal rolls.

The power for driving the vertical rolls *u* u^5 is first communicated to pulleys or gear-wheel z^5 on shaft z^6, (see Figs. 1 and 2,) and thence, by pinions z^7 z^8 z^9 z^{10}, transmitted to the various shafts z^2. These rolls are so arranged that when standing plumb they are always equidistant from a vertical plane drawn through the center of the welding-rolls; and in many instances the first set of vertical rolls will act as little more than guides to receive the tube.

In conjunction with the welding and forming rolls I employ two or more mandrels, *d d'*, (see Fig. 1,) the first, *d*, being loosely connected to rod *e*, and located within the bite of the welding-rolls, for the purpose of insuring the thorough welding of the tube, and the second, *d'*, or succeeding mandrels, if more are used, being finishing-mandrels, intended to preserve the opening of the hollow beam or other article, are also placed loosely upon rod *e*, and held in place by collars or shoulders upon the rod. The rod *e* is supported centrally of the series of horizontal and vertical rolls by forked levers *f f'*, which are fastened to rods *g g'*, capable of turning in their bearings to permit the fall of forked levers *f f'*.

In order to describe the operation of these devices in the production of hollow welded beam, &c., I shall now refer to diagram, Figs. 7 and 8, which illustrate, respectively, the position given to the horizontal and vertical rolls for an eighth-inch beam, and in which three pairs horizontal, and four pairs vertical, rolls are supposed to be used. The circumference of such a beam would be between nineteen and twenty inches, corresponding to the circumference of a six-inch pipe; therefore the welding-rolls *c c* will be of a size adapted to produce such a tube, and will be provided with a corresponding mandrel. The reduction will be made by the horizontal rolls, Fig. 7, the first pair *h* h^1 of which I adjust, by means of the worms and worm-wheels *o p* and right-and-left-hand-threaded bolts *n n'*, until the distance between the faces of the rolls, as indicated by a gage on the housings and other suitable fixed place, is, say, five and one-eighth inches apart. The second pair of horizontal rolls h^2 h^3 are adjusted by like means to the distance of three and five-eighth inches apart, and the third set to two and one-eighth inches. Of the vertical rolls, Fig. 8, the pair next to the welding-rolls mostly act simply as guide-rolls to steady the tube in its passage to the first pair of horizontal rolls, and are set by means of right-and-left-hand screw-bolts z^3 z^4, pinions a^3 a^4, and screw-bolts *t t* at a distance of six and five-eighth inches apart. The second set, by similar means, are adjusted so as to stand at about seven and one-eighth inches apart, the third set at seven and nine-sixteenth inches, and the last or outer pair at eight inches, delivering the finished beam. The vertical and horizontal rolls having been set as explained, bar *e* is shifted forward, and the oblong mandrel *d'* of about seven and one-fourth by one and three-eighth inches—that is, a little smaller than the interior opening of the finished beam—is slipped upon the mandrel, the bar pushed forward until its end is near the welding-rolls, when the round mandrel *d* is placed loosely on the forward end.

The forked levers $f\,f'$ are then turned up to sustain the bar e centrally of the rolls, and the rear end of the bar is supported or arrested in the usual manner followed in pipe-mills. This adjustment of the rolls applies to beams such as illustrated (in section) in Fig. 9, excepting that the mandrels and distances of the rolls apart will, of course, vary with the different-sized beams to be produced. The power for driving the rolls is then applied, and the skelp which meanwhile has been brought to a proper heat, is shifted forward from the rear of the furnace until it is brought within the grasp of the welding-rolls, which seize it and pull it forward, welding it into a tubular form. In its forward motion the pipe first meets support f, knocks it down, and passes to the first pair of vertical rolls, which guide it to the first pair of horizontal rolls, which flatten it slightly, thence to the second vertical rolls, which square the corners, and so on from horizontal rolls which flatten to vertical rolls which again square the corners, until it has inclosed the second or succeeding mandrels d', knocked over the support f', and passed the entire series of rolls. As soon as the rear end of the beam has reached g', the beam is finished, and bar e is withdrawn, the mandrels $d\,d'$ fall off, the bar can be carried back, and the machine reset for rolling another beam.

This completes the operation of rolling a beam; but, as the machine is designed for rolling beams of various forms, it is here proper to state how the rolls may be adjusted to produce different shapes. The octagonal beam, Fig. 10, can readily be rolled by the vertical rolls, and a proper adjustment of the beveled collars i, Fig. 5, of the horizontal rolls. If, for instance, a triangular-shaped beam, Fig. 11, is to be produced, turn right-and-left-hand-threaded bolt z^3, Fig. 3, until the bases of the vertical rolls are the desired distance apart, which can be determined by the gage a^2; then disengage pinions a^6 and a^4 by sliding them along their respective journals, and turn each of the independent screws $t\,t$ until the boxes $s\,s$ of the rolls register on the gage, so as to indicate the desired angle; then throw a^6 and a^2 into gear again, to prevent $t\,t$ from turning, so as to disarrange the relation of the rolls.

If the horizontal rolls have been provided with oscillating boxes acted on by independent screws, as at $r\,r$, $s\,s$, and $t\,t$ of vertical rolls, Fig. 3, as above stated was the intention, shapes such as shown at Figs. 12 and 13 may be readily produced by adjusting the horizontal and vertical rolls at suitable angles, as specified, in regard to the vertical rolls.

In many cases I shall need but one or two sets of horizontal rolls with either a pair of vertical rolls at each side of the horizontal rolls, or else only a pair in front and last pair of horizontal rolls, or even a single pair of vertical rolls placed in front of the last pair of horizontal rolls; but this will be determined by the article to be rolled.

In order to utilize already existing machinery, and adapt the machine to certain localities, and to the general arrangement of pipe-works, I can build my machine without welding-rolls $c\,c$, having only that part shown to the left of the weld-rolls, Fig. 3, and can set the machine so constructed either in line with the welding-rolls or not, according as the circumstances of the case require. In the latter case one of each pair of the horizontal rolls may be kept in stationary bearings f, the other adjusted by but single-threaded housing screw.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A series of two high horizontal plain rolls, and one or more pairs of vertical plain rolls, arranged in line, and combined with a pair of welding-rolls, substantially as and for the purpose specified.

2. The combination of one or more pairs of horizontal rolls with one or more pairs of vertical rolls, any two or all of the rolls being provided with universal couplings, the coupling-spindles whereof are adjustable and provided with suitable devices, by which they are retained in a parallel position at all times, substantially as and for the purpose specified.

3. The combination of one or more pairs of two high horizontal plain rolls with one or more pairs of vertical plain rolls, and with a mandrel located centrally of the rolls, substantially as and for the purpose specified.

4. In a mill for rolling metals, the combination of two rolls, one or both of which are provided with universal couplings and coupling-spindles, the coupling-spindles being journaled in adjustable boxes, which preserve the parallelism of the coupling-spindles, substantially as and for the purpose specified.

5. In combination with the rolls having threaded shafts, the adjustable collars and jam-nuts, substantially as and for the purpose specified.

6. In combination with rolls having oscillating boxes $r\,r$ and universal couplings $w\,w'$, the right-and-left-hand-threaded bolt z^3 and independent screws $t\,t$, for the purpose specified.

7. The combination of two rolls, one or more of said rolls having universal couplings $w\,w'$ and oscillating boxes r, substantially as and for the purpose specified.

In testimony whereof I, the said IGNATIUS HAHN, have hereunto set my hand.

IGNATIUS HAHN.

Witnesses:

F. W. RITTER, Jr.,

JAMES I. KAY.