(No Model.) 2 Sheets—Sheet 1.

C. F. WASHBURN & F. H. DANIELS.

APPARATUS FOR MAKING WIRE RODS FROM FLUID METAL.

No. 362,688. Patented May 10, 1887.

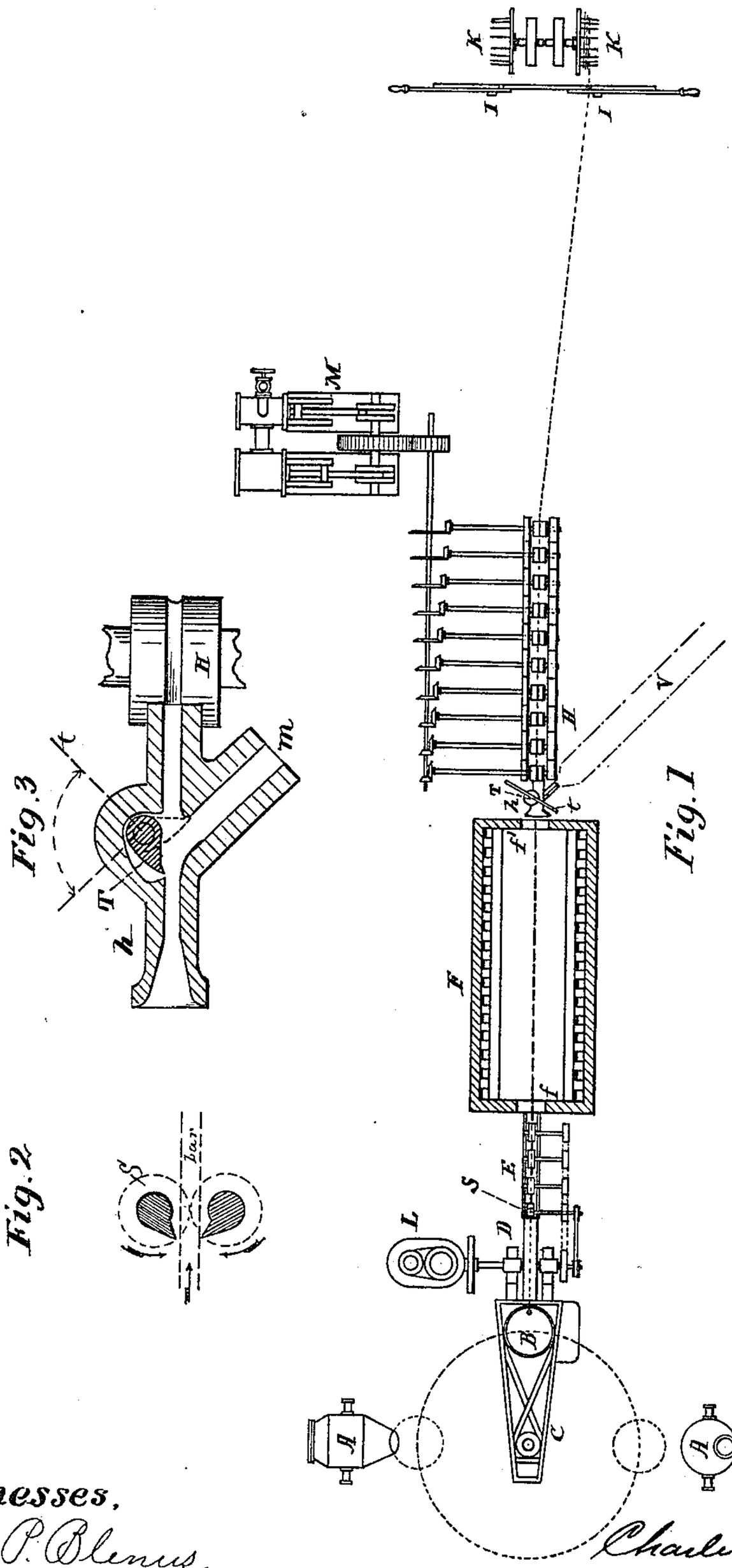

Fig. 3

Fig. 2

Fig. 1

Witnesses,
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2 Sheets—Sheet 2.

F. WASHBURN & F. H. DANIELS.

IUS FOR MAKING WIRE RODS FROM FLUID METAL.

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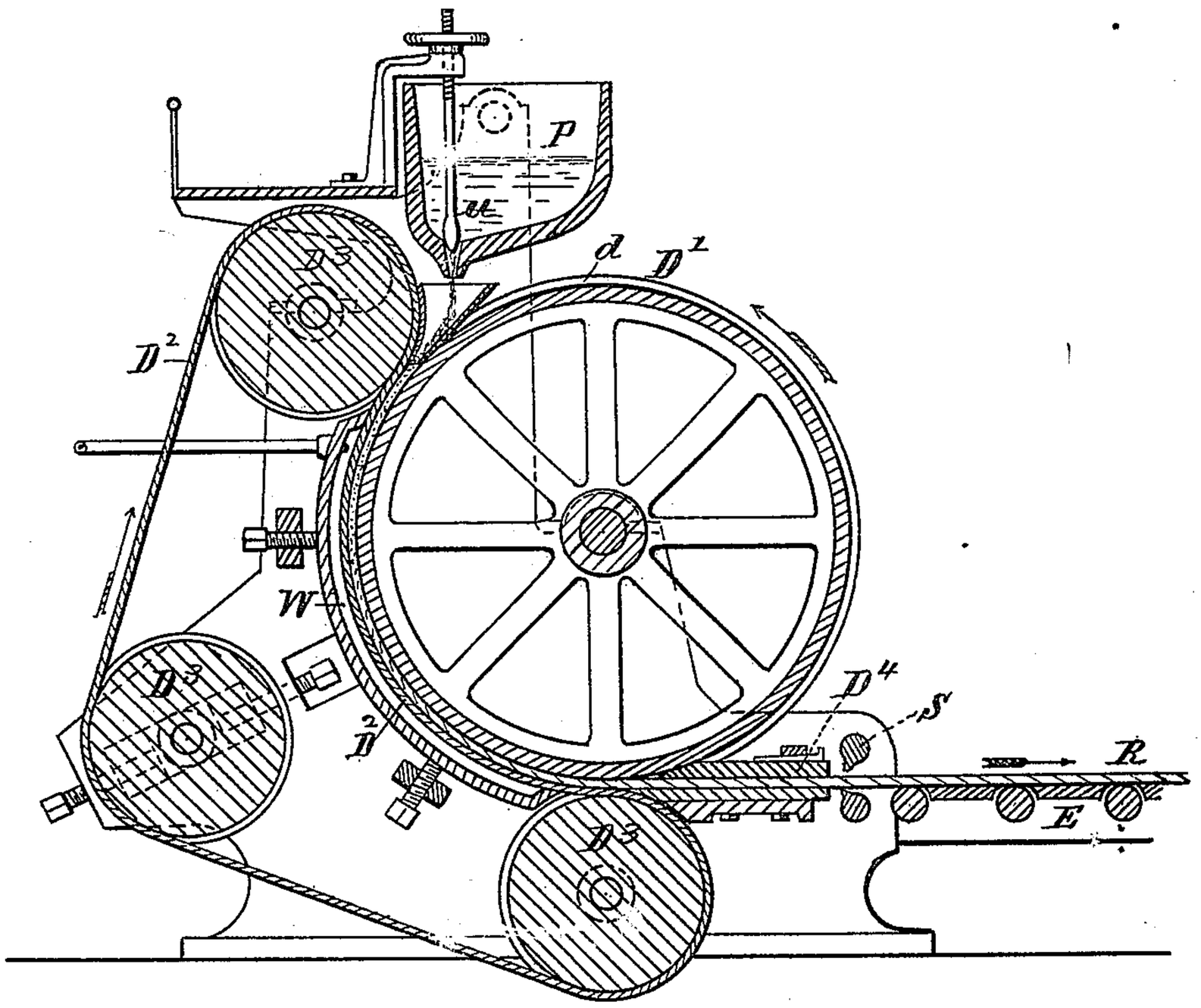

Fig. 4

sses.

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UNITED STATES PATENT OFFICE.

CHARLES F. WASHBURN AND FRED H. DANIELS, OF WORCESTER, MASS.

APPARATUS FOR MAKING WIRE RODS FROM FLUID METAL.

SPECIFICATION forming part of Letters Patent No. 362,688, dated May 10, 1887.

Application filed June 10, 1886. Serial No. 204,703. (No model.)

To all whom it may concern:

Be it known that we, CHARLES F. WASHBURN and FRED H. DANIELS, both citizens of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for and the Method of Making Wire Rods, &c., from Fluid Metal, of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

The object of this our present invention is to provide an apparatus and afford a method whereby small rods, wires, bands, or shapes can be produced from fluid metal direct in a continuous manner, separated into sections of the desired length, and reeled into coils; also, to provide means for soaking, mellowing, or equalizing the heat and condition of the metal as it passes from the ingot-producing mechanism to the rolling or reducing mechanism; also, to provide means for severing the rough ends from the ingot at the start or finish of the casting; also, to provide means for cutting off the ingot or bar and directing it to one side in front of the rolling-train, in case the rolls become choked or a "cobble" occurs at any part of the rolling. We attain these objects by means and process substantially such as hereinafter explained, the particular subject-matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 is a plan view illustrating the arrangement of a plant for carrying out our improved method of making rods, wire, or bands from fluid metal. Fig. 2 indicates a sectional view of a shear for cutting off the ingot near the point of delivery from the mold, and Fig. 3 is a horizontal section illustrating the cut-off and side-switching guide which may be employed in front of the rolling-train. Fig. 4 is a vertical sectional view of ingot-forming mechanism by which fluid metal is congealed and shaped to be delivered in a continuous bar or ingot.

In referring to parts, A indicates Bessemer converters or other suitable melting or steel-producing apparatus.

B indicates a ladle mounted upon a suitable crane, C, and adapted for receiving the contents or charge of steel from the converters, and for transferring and delivering it to the ingot-forming mechanism or traveling mold D, wherein it is congealed, and from which it is delivered in solid form upon the guiding or feeding roll-bed E, which directs it into and through a furnace, F, and into a set or train of rolls, H, whereby it is reduced to a rod, band, or wire of the required size. The ingot, passing direct from the forming-mold through the furnace and roll, passes in continuous order, or so long as the fluid metal is fed to the ingot-forming mold D.

I indicates shears for severing the rod into sections of any required length, and K K indicate reels for coiling or winding up alternate sections of the finished rod or band.

The ingot-forming mill or mechanism D may be constructed substantially as indicated in Fig. 4, the mold or matrix for receiving and shaping the metal being a groove or channel, *d*, formed in the circle of a large revoluble wheel, D′, which operates in conjunction with a traveling band, D^2, carried by guide-pulleys D^3, and held to the surface of the wheel in such manner as to confine the metal within the groove or matrix for a distance of about one-third of the circumference, more or less. A ladle, P, having a suitable stopper device, *u*, is arranged above the traveling mold, which receives the supply of fluid metal from the furnaces or converters, and from which it is delivered through a suitable spout into the space between the band or cover D^2 and the wheel D′. A cooling-chamber, W, for water or other refrigerant, is located along the back of the band D^2, and the partial cooling or congealing of the metal is effected as the mold passes to the point of delivery, where guides D^4 are arranged for receiving and straightening the formed metal and directing it outward along the roller-bed E, as indicated at R. The forward movement of the mold being continuous and the supply of metal from the ladle P being controlled to correspond to the forward movement of the mold, the ingot or bar R will be ejected in a continuously-increasing length so long as the fluid metal is supplied to the machine.

The machine can be operated by an engine,

L, or in other suitable manner. The particular construction of this ingot-mill in detail is described in a separate application for Letters Patent by F. H. Daniels, Serial No. 204,115, filed June 4, 1886.

The ingot-forming mill, when used as herein described, is provided with a cut-off mechanism or shear, S, whereby the rough or imperfect ends of the ingot can be severed and removed before entering it to the furnace and subsequent reducing operations.

We do not desire to confine our invention to the particular construction and arrangement of ingot-mill shown, as other forms of mechanism capable of producing a continuous ingot or bar from fluid metal and delivering it for further treatment in substantially similar manner could be employed in lieu of the style shown, if desired.

The furnace F is preferably a reverberatory furnace fired by gas on the regenerative system, having doors at either end, and made of a sufficient length to heat the metal to the desired degree as it passes through.

The bottom of the furnace is so constructed that the end of the ingot will shoot directly through from the entrance-door *f* to the exit-door *f'*, and thence into the guide *h*, which enters it into the pass of the leading pair of rolls in the rolling-train H.

The guide *h* may, if desired, be a plain straight guide. We prefer, however, to construct it, as indicated in Fig. 3, with a side issue passage, *m*, and a cutting-off tongue or shearing device, T, operated by a hand-lever, *t*, or other suitable means, and to be brought into action as desired.

The cut-off tongue is so constructed and disposed that when in normal position the bar can pass direct or straight through the guide into the pass of the roll without interruption; but when the tongue is swung down its point enters the rod and cuts it off. At the same time the mechanism directs or switches the severed end out through the side issue passage *m*. Thus, when a cobbble or derangement occurs in the rolling-train, the bar, instead of being permitted to run forward and choke the rolling-mill, can be severed and turned to one side, so as to run out upon a suitable table or platform at V until such time as the ingot D can be stopped or discharged, the bar being cut up into lengths and saved to be worked or reduced by the old process of rolling, thus avoiding waste in the operation.

The rolling-train H is preferably constructed as a continuous rolling-mill, with guides, housings, and operating-gearing disposed in the usual well-known manner. Said rolling-mill should be driven by the engine M at a speed which will enable the first pair of rolls to receive the bar and draw it into the rolling-mill as fast as it is delivered from the ingot-forming mechanism, or so as to reduce the ingot to a rod, wire, or band in continuous order as rapidly as it is produced.

In the present instance we have indicated a fork-reel for winding up the rod which is delivered from the rolling-train upon a floor or platform; but it will be understood that any suitable kind of reels may be employed in this connection, and that two or more such reels may be arranged for automatically receiving and coiling alternately sections of the rod.

Mechanism for severing the rod automatically may also be used when automatic reels are employed, together with automatic switching devices, so that the rod, after running out or onto one reel for a given distance, will be severed and directed to the other reel automatically or without attention from an attendant. This automatic reeling mechanism is not herein shown, as we do not claim the detail of its construction, and any suitable mechanism may be employed—as, for instance, that described in Letters Patent Nos. 224,942 and 224,839.

In the operation of our invention the metal is melted or prepared in the converters A, the contents of which are deposited in the ladle B, swung into position by the crane C, and poured into the traveling mold or the ingot-forming mill D, wherein the metal is congealed and delivered in a continuous ingot, which runs out on the roller-bed or guiding mechanism E.

The imperfect end at the commencement of the forming of the ingot is severed or cut off by the shears and removed, and the perfect portion is then permitted to run forward on the guiding mechanism E, passing into and through the furnace F, wherein it is subjected to proper heat for mellowing or giving to the metal a uniform consistency and heat throughout, passing out through the door *f'* and into guide *h*, which directs it into the pass of the leading-rolls. It then leads through the train of rolls operating in the manner of the continuous rolling-mill, and is thereby reduced to a rod, wire, or band of the desired size, accordingly as the passes of the rolls are made for imparting any particlar required shape. The end of this rod is then carried to one of the reels K, and so much of the rod as is desired is wound or coiled on said reel. When a sufficient amount of the rod has been coiled onto said first reel, the rod is severed by means of the shears I, and the severed end is taken to and entered upon the second reel, whereon another portion of the rod is coiled. During this time the coil may be removed from the first reel, preparatory to again receiving another coil of the rod, when the second reel is filled and the rod again severed, thus alternately coiling portions of the rod which is continuously being delivered from the ingot-mill and rolling-train to an indefinite length, the coils being made of such weight as to be conveniently handled and cared for in the subsequent operations to which the wire or bands are subjected.

In case of any derangement in the operation

of the rolling-train, the attendant brings into action the shear T, which instantly severs the bar and switches it out on the floor or table V, thus relieving the rolls and avoiding an increase of the difficulty, and also saving the following portion of the bar in a condition so that it can be utilized instead of wasted.

It will be understood that any suitable means may be employed for cutting up the bar run out upon the platform V, and that the rolls may be connected with said platform and cutting-up mechanism for drawing forward the bar in the ordinary manner.

What we claim as of our invention, and desire to secure by Letters Patent, is—

1. The improvement in the art of making wire rods, bars, or bands direct from fluid metal, which consists in producing a continuous or extending ingot by casting fluid metal in a continuous traveling mold, wherein it is congealed and delivered therefrom in an ingot of constantly-increasing length, projecting said continuous ingot directly and as fast as it is discharged from the forming-mold into and through a heating-furnace, and thence directly and continuously into and through a train of rolls, whereby the product is reduced to finished form and size for reeling or coiling, substantially as described.

2. The combination of a molding mechanism adapted for producing a continuous ingot from fluid metal and a heating-furnace into and through which said continuous ingot is projected in continuous order as it is discharged from said ingot-producing mechanism, substantially as set forth.

3. The combination of a steel-producing converter, a mechanism for forming ingots or bars from fluid metal by continuous operation, a reducing train of rolls and an intermediately-located furnace, and guiding or feeding devices for delivering the ingot as it is formed directly through said furnace and into the rolling-train, substantially as hereinbefore set forth.

4. The guide *h*, provided with a shear or cut-off, T, and the side issue-passage, substantially as and for the purpose set forth.

5. The combination, with mechanism for forming ingots from fluid metal, a train of reducing-rolls, and an intermediate heating-furnace arranged for operating in continuous order, of a shear mechanism adapted for cutting off and switching the bar to one side intermediate between said furnace and rolling-train, substantially as and for the purpose set forth.

6. The combination of converters A, transfer-ladle B, ingot-forming mill D, equalizing-furnace F, guiding or feeding devices E, rolling-train H, cut-off mechanisms T and S, shears I, and reels K, substantially as set forth.

Witness our hands this 1st day of June, A. D. 1886.

CHAS. F. WASHBURN.
FRED H. DANIELS.

Witnesses:
CHAS. H. BURLEIGH,
E. P. BLENUS.