

Nov. 28, 1933.

J. T. LEECH

1,936,679

WIRE STRAIGHTENING MECHANISM

Filed July 2, 1930

4 Sheets-Sheet 1

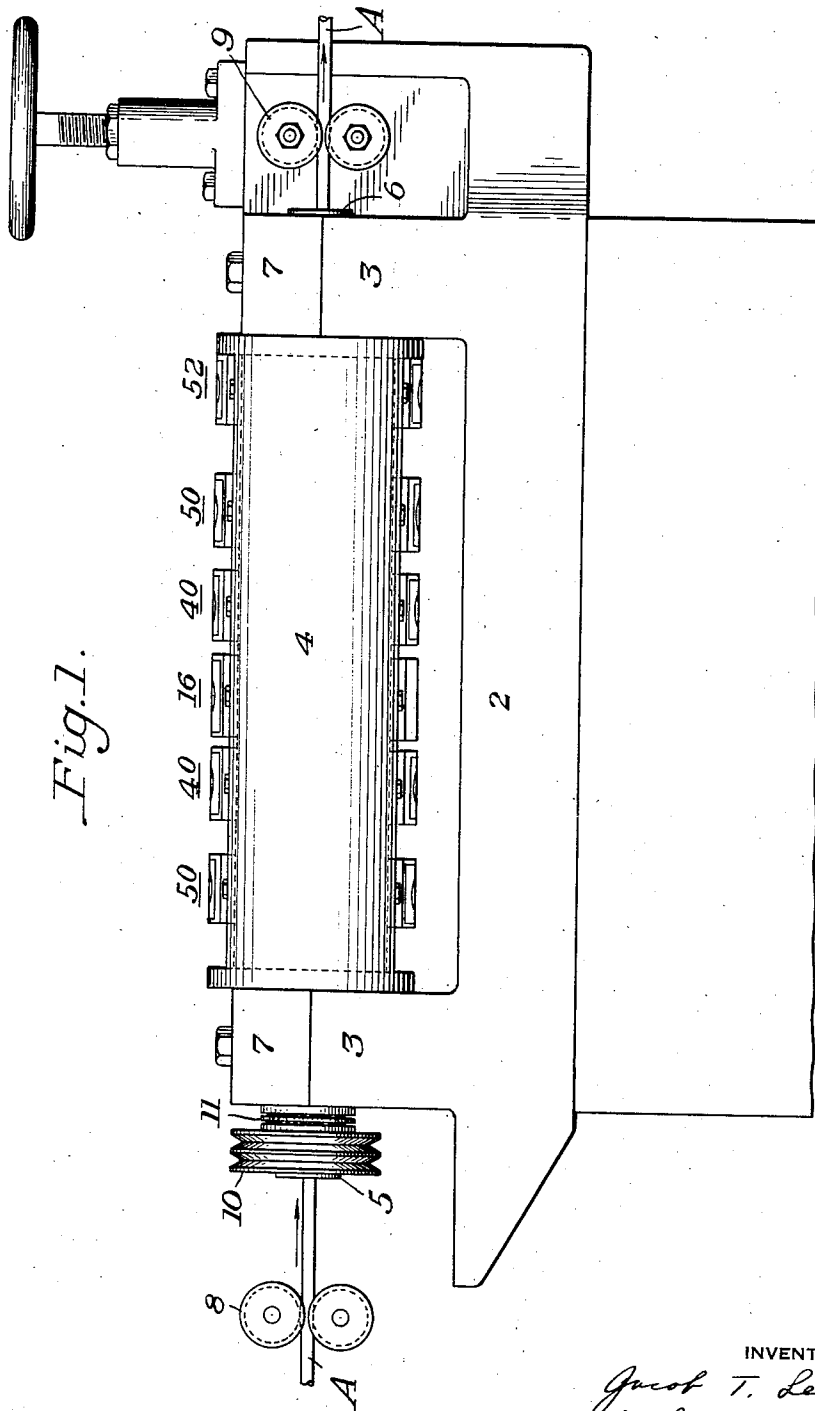


Fig. 1.

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Fig. 6.

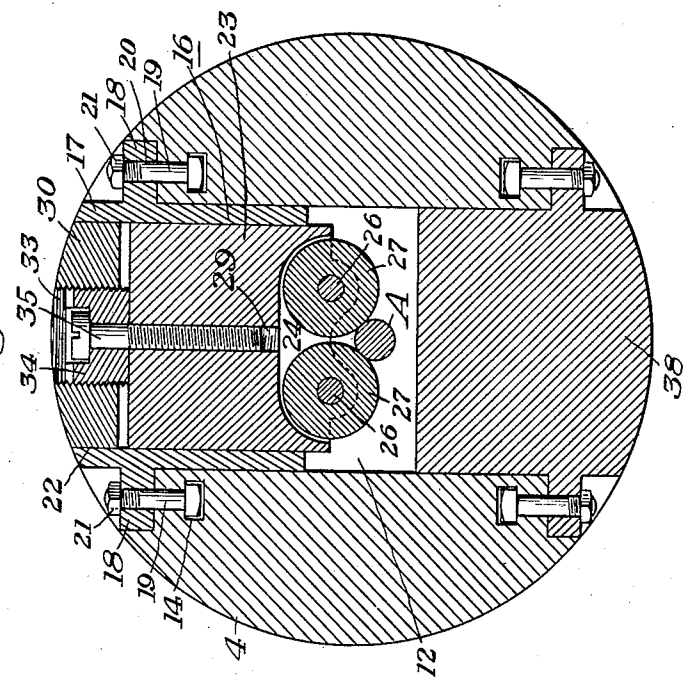
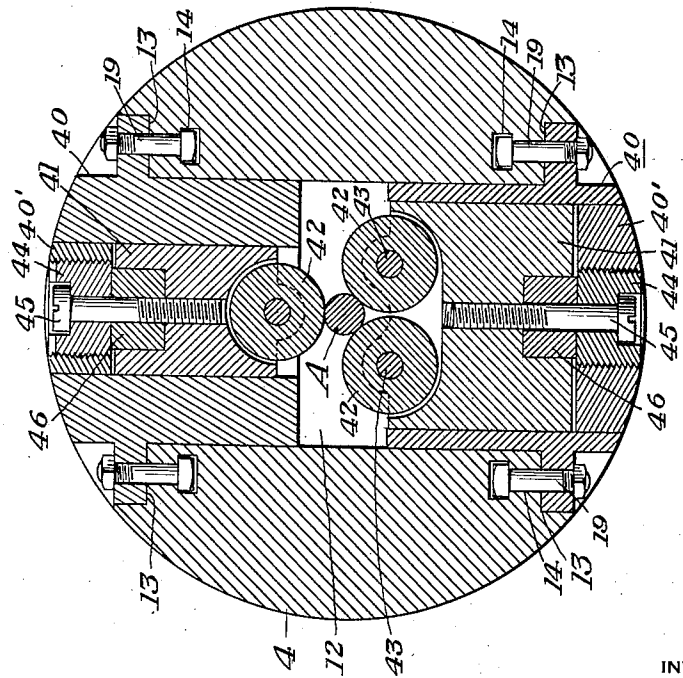


Fig. 5.



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Fig. 7.

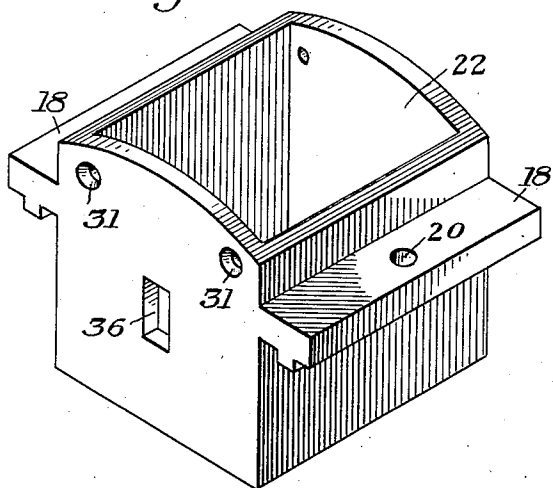


Fig. 8.

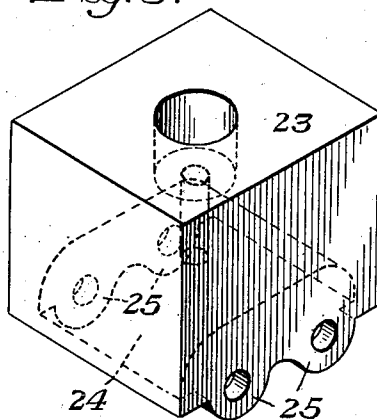


Fig. 9.

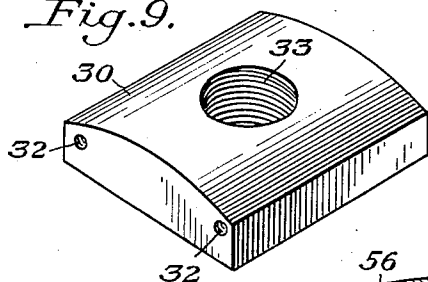


Fig. 10.

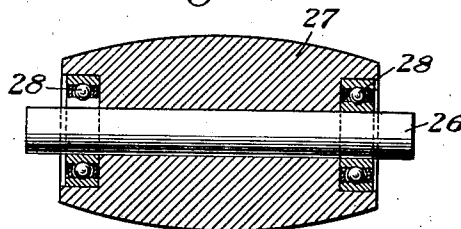
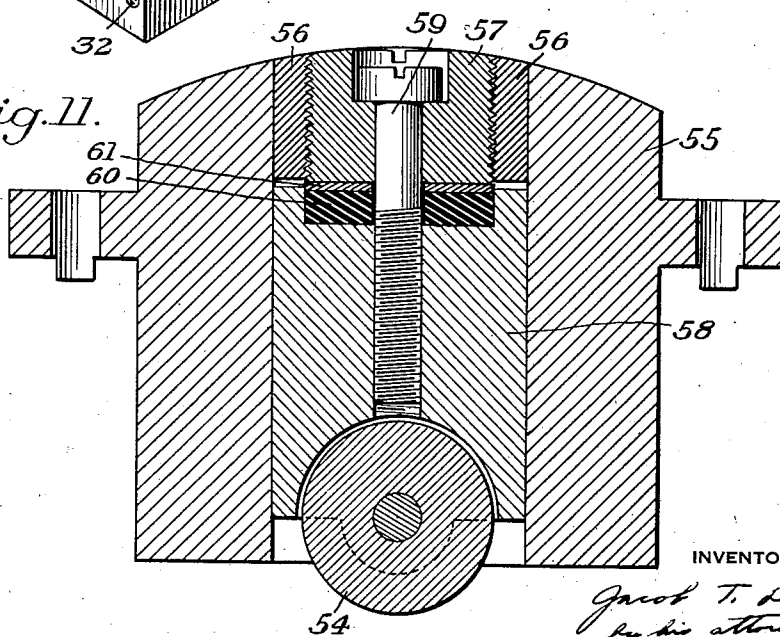


Fig. 11.



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UNITED STATES PATENT OFFICE

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WIRE STRAIGHTENING MECHANISM

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14 Claims. (Cl. 153—37)

This invention is for an improvement in wire straightening mechanism, and relates particularly to that type of straightening machine wherein the wire is fed longitudinally through an elongated revolving head which rotates about the wire to be straightened and which is provided with contact members that travel around on the surface of the rod or wire, one of these contact members depressing the wire out of line with its normal axis. Since the head carrying the wire depressing contact rotates about the wire it will be seen that the wire is flexed out of alinement in every direction with a rotation of the head.

The straightening effect of a machine of this kind requires that the wire be bent rather sharply in order to relieve strains in the metal and kinks. In the most successful machines of this type as heretofore constructed the wire engaging contacts have been in the form of shoes which bear against the wire. There are several pairs of oppositely positioned shoes in the rotating head and the depressing shoe which flexes the wire out of its normal alinement is positioned at the center. The wire must be pulled longitudinally through the head and while the head is revolving. There is considerable friction in this type of machine due to the fact that the wire is pulled longitudinally across the surface of the shoes and due to the fact that the shoes rotate around bearing against the surface of the wire.

In the operation of these machines the head should rotate at least three times for each inch of travel of the wire. If the speed at which the head is rotated is increased and the wire pulled through the head faster, the friction generates so much heat that the surface of the wire is marred, making it unfit for first class stock. The machine, therefore, has a limited operating speed above which it cannot be used to advantage.

Attempts have been made to improve these machines by providing rollers so arranged as to reduce the resistance to longitudinal movement of the wire through the rotating head, but where this has been done the rollers have been so arranged that a gradual curvature is provided for flexing the wire instead of a relatively short sharp curvature. This is not a highly satisfactory arrangement from a commercial standpoint because the wire to be straightened satisfactorily should be flexed rather sharply.

According to the present invention there is provided an improved straightening machine wherein rolling contacts are provided in place of the friction shoes heretofore most commonly

used, these rollers being so arranged as to permit the wire to be bent sharply. The rollers are arranged with their axes parallel to the axis of rotation of the head so that they roll on the surface of the wire as the head rotates. While this does not relieve the friction or reduce the resistance to the longitudinal movement of the wire through the rotating head, it substantially eliminates the friction between the revolving contact members and the periphery of the wire. Due to the elimination of this friction the machine can be operated at a much higher speed without excessively heating the wire or damaging the surface thereof.

The invention may be readily understood by reference to the accompanying drawings in which

Figure 1 represents a side elevation of that portion of a straightening machine involving my invention;

Figure 2 is a top plan view of the revolving head apart from the machine;

Figure 3 represents a longitudinal section through the revolving head;

Figure 4 is a schematic view showing the position of the rollers along the head;

Figure 5 is a transverse section through a point in the head, as for instance, a section in the plane of line V—V of Fig. 3;

Figure 6 is a similar section showing the wire depressing rollers, the section being in substantially the plane of line VI—VI of Fig. 3;

Figure 7 is a perspective view of one of the roller supporting guides;

Figure 8 is a perspective view of a roller carrying block which fits within the guide shown in Fig. 7;

Figure 9 is a perspective view of the cap or block which closes the top of the guide shown in Fig. 7;

Figure 10 is a longitudinal section on a large scale through one of the rollers, the particular roller shown being a depressing roller; and

Figure 11 is a transverse section on a larger scale showing an arrangement which is preferably used for one of the rollers on the head provided for the purpose of burnishing the straightening wire.

In the drawings, 2 designates the bed of a machine having uprights 3 at opposite ends thereof. The rotating straightening head 4 comprises an elongated cylindrical body having trunnions 5 and 6 thereon, these trunnions being received in bearings in the upright portions 3 on the bed.

On the tops of the standards or upright portions 3 are removable bearing caps 7.

The trunnions 5 and 6 have coaxial passages therethrough through which the wire, designated 5 A, is passed. The wire is moved in the direction of the arrow in Figure 1. Pinch rolls for feeding the wire to the machine are conventionally indicated at 8, and other pinch rolls for pulling the wire through the rotating head are conventionally indicated at 9.

The trunnion 5 projects entirely through the support 3 and is provided with a pulley 10 on the projecting end thereof. This pulley, which is fast on the trunnion, is engaged by belts, not shown, operated by a motor or other source of power. A thrust bearing 11 is provided on the trunnion 5 between the pulley 10 and the upright standard 3, the purpose of which is to take the endwise strain of the rotating head as the wire is pulled in the direction of the arrow.

In the rotary head 4 is a longitudinal slot or window 12 which extends throughout the greater portion of the length of the head. As shown in Figs. 5 and 6, the sides of the slot are parallel and the slot is of uniform width throughout the major portion of the head. However, near the periphery of the head the slot is widened to provide longitudinally extending shoulders 13, which shoulders are parallel. Formed in each shoulder is a T-slot 14 the length of which is substantially coextensive with the length of the slot.

At one point in its length, as at 15 (Fig. 2), the T-slot is cut away to permit the insertion of bolts 19 such as those shown in Figs. 5 and 6, and which will be hereinafter more fully described.

Intermediate the ends of the slot is a depressing roll unit designated generally as 16 and which is best shown in Figs. 3 and 6 and in the detail views 7 to 10, inclusive. This unit comprises a rectangular frame 17 set into the slot. Projecting from each side of the guide member or frame 17 is an integral lug 18, these lugs engaging the shoulders 13 on the opposite sides of the slot. Bolts 19 in the T-slots 14 projecting through holes 20 in the lugs and provided with nuts 21 serve to adjustably clamp the frame member 17 in place. The bolts 19 with their nuts 21 not only serve to retain the rectangular frame 17 in the head against centrifugal force, but provide a means whereby the frame may be adjusted longitudinally along the slot according to operating requirements.

The rectangular member 17 has a rectangular opening 22 therein, as clearly shown in Fig. 7. Slidably received within this opening is a roll carrying block 23. The block 23 as shown in Fig. 6 has a recess 24 on the inner face thereof, and is provided at its inner end with two pairs of lugs or ears 25. These lugs or ears 25 support pins 26 on which are mounted rollers 27. Ball-bearings 28 provided between the rollers and pins enable the rollers to revolve freely at high speed. In the center of the block 23 is a threaded radial opening 29.

The outer end of the frame 17 is closed by a rectangular block 30, as shown in Fig. 9. This block or cap is retained in place by means of bolts which pass through the holes 31 in the member 17 into the holes 32 in the member 30. In the center of the block 30 is an enlarged opening 33. A screw plug 34 is entered in this opening. A bolt 35 passes through the screw plug 34 and is screwed into the hole 29 in the block 23. The inner end of the screw plug 34 bears

against the top of the block 23. By adjusting the plug 34 the rollers 27 may be moved toward or away from the center of rotation of the head. The bolt 35 serves to prevent the block 23 from dropping inwardly beyond the position to which it is adjusted. Viewing Fig. 6, for instance, after the wire A has passed from out of engagement with the rollers 27, the block 23 would be free to drop were it not for the bolt 35. As a further means for locking the block 23 against movement, the casing 17 is provided at one end with a slot 36. A clamping bolt 37 passes through this slot into the block 23. When the bolt 37 is tightened up it serves to clamp the block against relative movement in the casing 17.

In this depressing roller unit it will be noted that there are two rollers 27 for engaging the wire and that, as viewed in Fig. 6, the wire engages the periphery of both rollers and lies partially between them. As viewed in Fig. 10, it will be seen that the rollers are convexed longitudinally.

Opposite the depressing rollers 27 and the depressing roller unit is a solid metal block 38 retained within the slot for the purpose of balancing to a certain extent the depressing roller unit.

Positioned in the slot 12 at each side of the depressing roll unit are opposed guide roll units. The construction of the guide roll units corresponds generally to the construction of the depressing roll unit with the exception, however, that there are two rollers in one of the carrier blocks and only a single roller on the opposed carrier block. This is clearly shown in Fig. 5. In this figure, 40 is a casing similar to that shown in Fig. 7 secured in place by means of the bolts 19 whose heads are engaged in the T-slot 14. The end of the casing 40 is closed by a block 40' similar to that shown in Fig. 9. The carrier block 41 is generally similar to that shown in Fig. 8, and it is provided with two parallel rollers 42, the mounting of which is similar to that shown in Figs. 8 and 10, these rollers being carried on pins 43. In the block 40' is a screw plug 44, and passing through the screw plug is a bolt 45 similar to the bolt 35 described in connection with Fig. 6. The bolt threads into a central opening in the block 41. The construction is different from that previously described, however, in the fact that the carrier block 41 has a central recess around the bolt 45 in which is set a bushing or spacer 46. It will be seen from Fig. 5 that this spacer holds the end of the carrier block 41 out of contact with the screw plug 44.

Opposite the carrier having the two rollers 42 is a similar carrier having but a single roller 42. Inasmuch as the construction of this carrier is identical with the construction carrying two rollers, the same reference numerals have been used to designate the corresponding parts. The only difference between the two other than the provision of a single roller in place of the two rollers is that the casing 40 in one case has a greater wall thickness than in the other.

In the guide roll units it will be noted by reference to Fig. 3 that the rollers 42 are cylindrical at one end but are curved at that end which is nearest the depressing roller. The purpose of this is to more effectively support the wire as it is moved from its normal axial travel under the depressing or flexing rollers 27. At each side of the guide roll units just described are other guide roll units, designated generally as 50, the construction of which is in all respects similar to the construction just described, with the excep-

tion that the wire engaging rollers, designated 51, and corresponding to the rollers 42 previously described, are fully cylindrical throughout their length instead of being either fully con-

5 veyed as shown in Fig. 10, or cylindrical at one end only and convexed at the other, as are those rollers which are at each side of the depressing roller unit.

At the end of the slot 12 nearest the trunnion 10 6 and positioned where it engages the wire after it has been straightened is a burnishing unit 52. This unit comprises two rollers 53 opposite which there is a single roller 54. The two rollers 53 are mounted just the same as the rollers 51 and 42, 15 and corresponding reference numerals have been used to designate the corresponding elements in their mounting. The roller 54, however, is so supported that it engages the surface of the wire with a yieldable pressure. For providing a yield-

20 able pressure there is a supporting casing 55 (see Fig. 11) similar to that shown in Fig. 7, in the end of which is a fixed cap or block 56 similar to that shown in Fig. 9, and having a central screw plug 57 therein. Slidable within the cas-

25 ing 55 is a block 58 in which is mounted the single roller 54, the mounting for the roller being similar to that shown in Fig. 10.

A bolt 59 passes through the screw plug 57 and is threaded into an opening in the block 58. In 30 the top of the block 58 is a recess in which is a resilient member such as a rubber cushion 60. The rubber may be put under pressure by screwing down on the screw plug 57, the pressure being transmitted to the rubber through a wash-

35 er 61.

In setting up the machine for operation, the rollers are all adjusted for the diameter of the wire to be straightened. Adjustment for the rollers 42 and 51 can be made most readily by 40 substituting different lengths of spacing bushings 46 between the fixed blocks 40' and the roller carrying block 41. The finer adjustments in each case are made by the setting of the screw plug 44 and the operation of the bolt 45. In 45 Fig. 3 I have shown the parts adjusted to the position which they assume with the largest diameter of wire which would be operated upon. With a decrease in diameter of the wire, the bushings 46 would be longer so that the peripheries 50 of the opposed rollers would be closer together. The rollers 51 and 42, 53 and 54, are all adjusted to define a passageway for the wire which is coaxial with the axis of rotation of the revolving head. The idea is that the head will ro-

55 tate about the wire with the rollers 51 and 42 engaging the surface of the wire, thereby providing a support for the wire without, however, bending or flexing the wire in any way. The rollers 27, however, are adjusted as shown in 60 Fig. 3 to bend the wire eccentrically to its normal axis. As the head rotates the direction in which the wire is flexed by these rollers is constantly changed, but the degree of eccentricity remains the same.

65 Thus in the operation of the machine the wire is pulled longitudinally through the head as the head is rotated and in this way it is progressively flexed and straightened. The operation of the last roller unit of the series, comprising 70 the rollers 53 and the resiliently backed roller 54, is to slightly burnish the wire by the resilient application of pressure to the surface thereof.

Any one of the guide blocks can be quickly removed from the machine merely by loosening 75 the nuts which retain them in place. Each roll-

er carrying block and guide member is provided with a clamping screw 37 similar to that specifically described so that the parts can be lifted out of the machine without likelihood of dis-

80 turbing the position to which they are adjusted. The provision of the longitudinally extending T-slots 14 permit the ready adjustment of the various units longitudinally with respect to the head so as to regulate the spacing in accordance with 85 the diameter of the wire being worked upon.

For the purpose of keeping the parts in proper balance, the arrangement of rollers as schematically illustrated in Fig. 4 is followed. Looking 90 at Fig. 4, it will be seen that the two rollers 42 in the second unit are in reverse arrangement to the two rollers of the first unit and that the same arrangement is followed throughout the length of the head. This alternation in the arrangement of the rollers substantially maintains the balance of the head. 95

Since the rollers 27, 42, 51, 53 and 54 are all arranged substantially coaxial of the direction of travel of the wire and roll on the surface of the wire when the head rotates, there is little friction developed between the wire and the rollers 100 due to the rotational movement of the head. The only resistance to the movement of the wire through the machine, therefore, is the resistance of the movement of the wires longitudinally of the rollers. Due to the fact that the rollers are 105 continuously revolving about the wire, the heat of friction is generated along no one particular point on the wire or on the rollers. This fact enables the wire to be pulled through the machine faster than it can be pulled through a machine wherein a fixed contact shoe rubs around on 110 the surface of the wire, all of the heat being localized at one point on the face of the contact shoe.

While I have specifically illustrated and de- 115 scribed one embodiment of my invention, it will be understood that the invention is not confined to the particular constructions and arrangement of parts, but may be otherwise embodied within the scope of the following claims. 120

I claim:

1. In a wire straightening machine, a rotatable elongated head, means for rotating the head, a plurality of cooperating opposed roller units positioned at intervals along the head and providing rollers which support the wire at several 125 points about its periphery, the rollers of the several units being radially adjustable, said rollers defining a wire receiving passage through the head coaxially thereof, and a depressing roller 130 unit intermediate two of the other roller units, the rollers of the depressing unit being out of line with the rollers of the other units, the other units being in line with each other.

2. In a wire straightening machine, a rotatable 135 straightening head having spaced wire guiding units therein, said units comprising cooperating rollers defining a central wire receiving passage and providing a centering support for the wire, a depressing roller unit between two guid- 140 ing roller units for flexing the wire eccentrically of its normal position, and means for rotating the head, all of the rollers of the several units having their axes parallel, the axes of the rollers being parallel with the axis of rotation of the straight- 145 ening head.

3. In a wire straightening machine, a rotatable straightening head having spaced wire guiding units therein, said units comprising cooperating rollers defining a central wire receiving passage, 150

- a depressing roller unit between two guiding roller units for flexing the wire eccentrically of its normal position, and means for rotating the head, said guide roller units being adjustable longitudinally of the depressing roller unit.
4. In a wire straightening machine, a rotatable straightening head having spaced wire guiding units therein, said units comprising cooperating rollers defining a central wire receiving passage, a depressing roller unit between two guiding roller units for flexing the wire eccentrically of its normal position, and means for rotating the head, said guide roller units being adjustable longitudinally of the depressing roller unit, all of said units being adjustable longitudinally of the head.
5. In a wire straightening machine, a rotary head through which the wire to be straightened is adapted to be moved, a single pair of depressing rollers in the head arranged side by side adapted to bear against the wire and bow it out of alinement with its normal axis, cooperating guide rollers at each side of the depressing rollers adapted to hold the axis of the wire coaxial with the axis of rotation of the head.
6. In a wire straightening machine, a rotary head through which the wire to be straightened is moved, a pair of depressing rollers in the head adapted to bear against the wire and bow it out of alinement with its normal axis, cooperating guide rollers at each side of the depressing rollers adapted to hold the axis of the wire coaxial with the axis of rotation of the head, and other guide rollers cooperating with the first ones, the depressing rollers having a fully convexed surface, the first-named guide rollers having the ends thereof adjacent the depressing rollers convexed and the other portion thereof cylindrical, the last-named guide rollers being fully cylindrical, the axes of all of said rollers being parallel with the axis of rotation of the head.
7. A wire straightening machine of the rotary head type comprising a rotary head, contact elements in the head for guiding and flexing the wire as it is pulled through the head, said contact elements constituting a series of rollers arranged along the head for supporting and flexing the wire, the rollers having their axes parallel with the axis of rotation of the head, a burnishing roller adapted to bear against the wire, and means for resiliently holding the burnishing roller in contact with the wire.
8. In a wire straightening machine, a rotatable head through which the wire to be straightened is pulled longitudinally, the normal axis of the wire coinciding with the axis of rotation of the head, a plurality of units along the head having rollers therein for supporting and guiding the wire, the axes of the rollers being parallel with the axis of the wire, a depressing roller unit intermediate two guiding roller units for bowing the wire out of its normal alinement, the rollers in the wire guiding units being arranged in groups of three, two rollers being on one side of the wire and one on the other side of the wire, the disposition of the rollers in one unit being reverse with respect to the disposition of the rollers in the adjacent units.
9. In a wire straightening machine, an elongated rotatable head having bearing portions at each end thereof and having a longitudinally slotted intermediate portion, parallel shoulders along each edge of the slot, said shoulders having T-slots therein, a series of units positioned in the slots adjustably and removably retained in place by means of the bolts in the T-slots, said units comprising rollers adapted to contact with the wire to be straightened, the rollers having their axes parallel with the axis of rotation of the head.
10. In a wire straightening machine, a rotatable head, a roller unit comprising a casing adapted to be secured in the head, a block within the casing, a screw plug in the top of the casing, a bolt passing through the screw plug threaded into said block, and a roller carried on the block.
11. In a wire straightening machine, a rotatable head, a roller unit comprising a casing adapted to be secured in the head, a block within the casing, a screw plug in the top of the casing, a bolt passing through the screw plug threaded into said block, a spacer interposed between the screw plug and the block, and a roller carried on the block.
12. In a wire straightening machine, a rotatable head, a roller unit comprising a casing adapted to be secured in the head, a block within the casing, a screw plug in the top of the casing, a bolt passing through the screw plug threaded into said block, a spacer of resilient material interposed between the screw plug and the block, and a roller carried on the block.
13. In a wire straightening machine, a rotatable head, a roller unit comprising a casing adapted to be secured in the head, a block within the casing, a screw plug in the top of the casing, a bolt passing through the screw plug threaded into said block, said casing having a slot in a side wall thereof, a clamping bolt passing through the slot screwed into the block, and a roller carried on the block.
14. A wire straightening machine comprising a rotary head through which the wire to be straightened may be passed in an axial direction, depressing rollers intermediate the ends of the head and so positioned as to bend the wire passing through the head out of axial position, said depressing rollers having an axially convexed surface, a guiding roller unit at each side of the depressing roller unit having cooperating rollers adapted to support the wire in a central position, the rollers of said guiding roller units being substantially straight on the side thereof away from the depressing roller unit and being convexed on the portion thereof adjacent the depressing roller unit to facilitate the bending of the wire by the depressing roller unit, and another roller unit in the head adjacent each of said guiding roller units providing a series of cooperating rollers adapted to maintain the wire in an axial position, the rollers of said last-named units being substantially flat across the full width.

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