Sept. 10, 1968 A. SIRANTOINE 3,400,567

METHOD AND APPARATUS FOR STRAIGHTENING AND UNTWISTING ELONGATED METAL SECTIONS

Filed Oct. 18, 1966 2 Sheets-Sheet 1

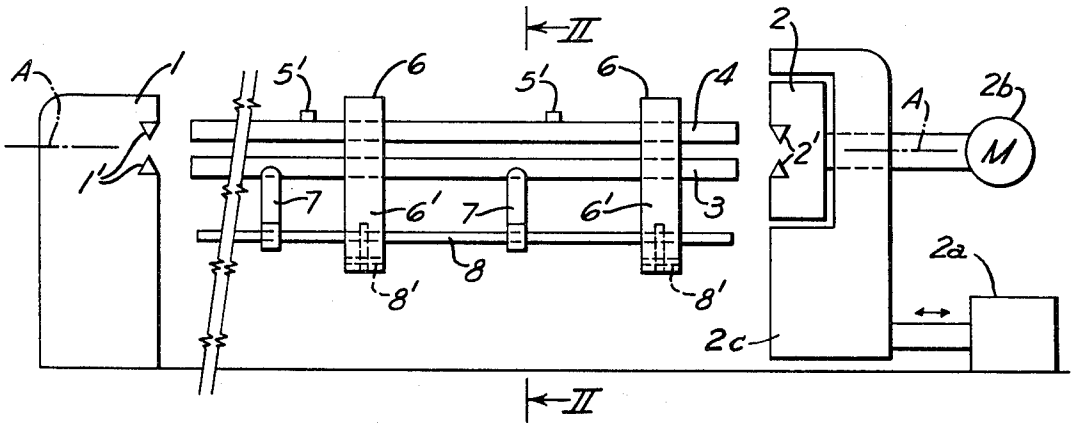

Fig. 1

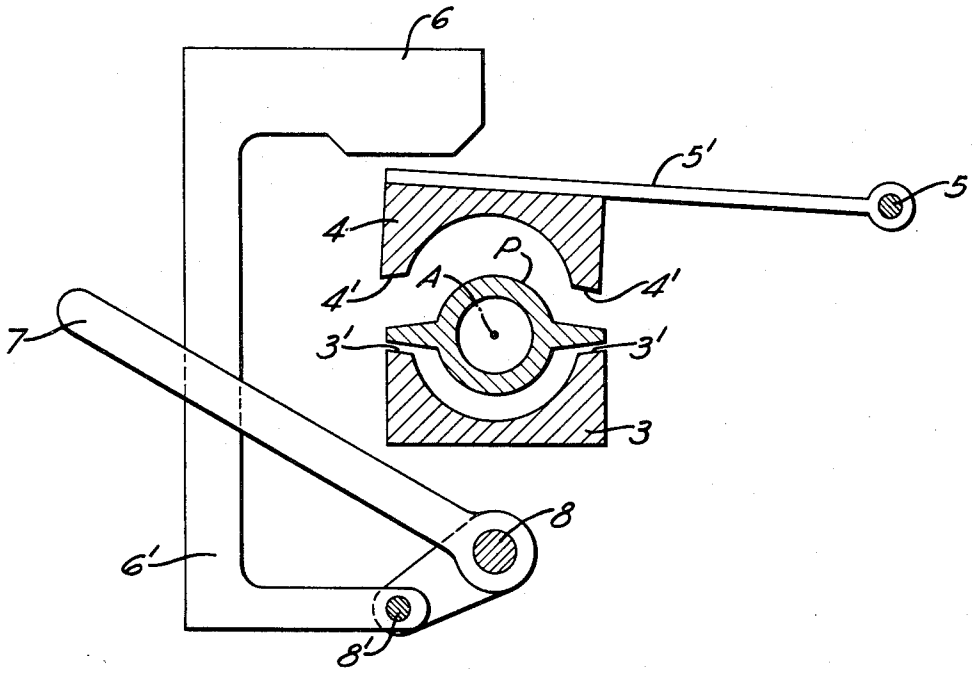

Fig. 2

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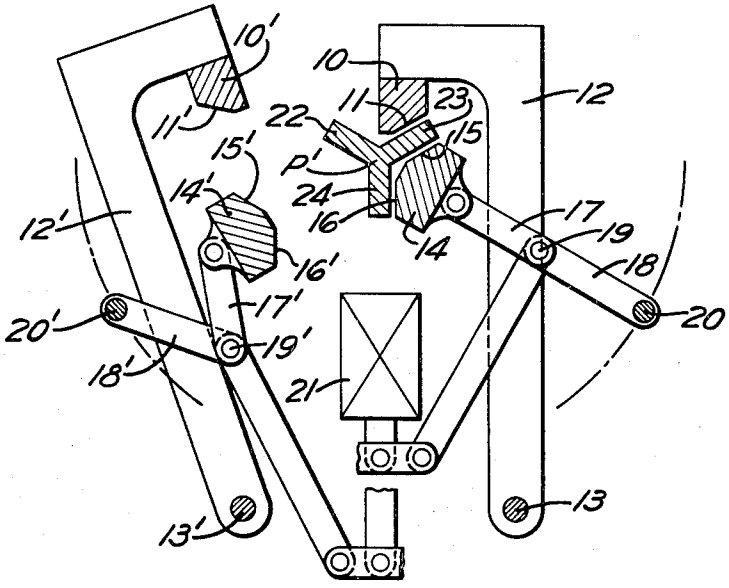

Fig. 3

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METHOD AND APPARATUS FOR STRAIGHTENING AND UNTWISTING ELONGATED METAL SECTIONS

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5 Claims. (Cl. 72—299)

This invention relates to straightening and untwisting elongated metal sections such as extrusions, rolled products and forged products.

The straightening and untwisting of solid or hollow metal or alloy sections are performed by straightening machines equipped with rollers. These machines, however, require sets of expensive rollers so that these straightening machines are limited to mass-produced articles such as those fabricated on merchant or finishing steel and iron rolling mills.

For smaller quantities, or for sections whose shape is not appropriate for a roller straightening machine, more primitive methods are employed, for example straightening in mechanical or hydraulic presses, or even manual straightening and untwisting.

For steel sections of complex shape, ordered in small quantities and most frequently produced on an extrusion press, the straightening and untwisting operations by a straightening bench have been developed considerably. The method comprises "chucking" the extremities of the section in the jaws of two heads mounted on a hydraulic straightening bench, of which at least one is rotary. The section is first stretched by pulling the two heads apart, and one of them then turns in a direction to align the corresponding points of the two ends of the section parallel to the axis of the bench. An elongation of the bar generally less than 6% is then performed. A straight product whose quality is usually adequate for its sale, is thus obtained in a single operation.

Certain applications, however, require stricter tolerances in respect to sagging and twist for which the foregoing method is inadequate. Although the twist is more effectively removed by application of twisting forces at several points along the section, either manually or by mechanical devices, a method of this kind, which moreover takes considerable time, is not perfect.

This invention efficiently and quickly achieves straightening and untwisting of the metal sections so that the strict tolerances are satisfied. It relates to:

(1) A method of straightening and untwisting elongated metal sections which comprises gripping the ends of the section between the jaws of the heads of a straightening bench under a slight tension and rotating at least one end to bring the two ends into a position parallel to each other, surrounding the section with at least two dies which have a length slightly less than the distance between the heads of the straightening bench and which have along their lengths surfaces which match specific, generally protruding parts of the section, elongating the section by an amount above its minimum permanent elongation, but generally below 6% and, simultaneously forcing the dies to come closer to each other.

(2) Apparatus for straightening and untwisting elongated metal sections which comprises a straightening bench with two spaced apart heads with jaws for gripping the ends of the section, with at least one of the heads operatively connected to power means for moving it away from the other head and rotating its jaws. At least two rigid dies surrounding the section and extending nearly the whole distance between the jaws. These dies are substantially equally distributed round the axis of the section and have along their lengths plane surfaces which match with specific parts of the section, and they are connected to hand or power means which can force them to come closer to each other, thus transversely applying pressure to a specific part of the section.

We have found that the transverse deformations imposed on the section by operation of the dies are permanent in nature although only a very slight force is applied, provided that, during their action, an axial pull exceeding the limit of elasticity of the method is applied to the section.

The movement of the dies towards each other is advantageously effected by a set of levers and/or a set of jacks placed at intervals along the full length of these dies.

In the accompanying drawings, I have shown two preferred embodiments of my invention in which:

FIGURE 1 is a schematic side elevation view of an apparatus adapted to straightening and untwisting two-finned tubes, wherein the movement of the dies is controlled by a set of levers.

FIGURE 2 is a section view along the line II—II of FIGURE 1; and

FIGURE 3 is a section view similar to FIGURE 2 but showing an apparatus adapted to a Y-shaped bar, wherein the dies are moved by a set of jacks.

The apparatus of FIGURES 1 and 2 comprises two heads **1** and **2**, each equipped with a set of jaws **1'** and **2'** which grip the opposite ends of an elongated metal section P. The head **2** is mounted on a carriage **2***c* which permits travel parallel to the axis AA of the sets of jaws, and which permits rotation about this axis for untwisting the section P. A motor **2***a* connected to the carriage **2***c* advances the head **2** toward and away from the head **1** along a path of travel parallel to the axis AA. A motor **2***b* attached to the head **2** imparts the required rotation to the head for untwisting the section P.

A die **3** (FIGURES 1 and 2) has a lentgh substantially that of the part of section P extending between the jaws **1'** and **2'**. The die comprises two surfaces **3'** formed so that each corresponds to one of the faces of one of the projections or fins of the two-finned tubular section (for example the lower faces of the fins).

A die **4** which has the same length as the die **3** and is equipped with bearing surfaces **4'**, is arranged to be brought into engagement with the section P or to be withdrawn from same. As shown, engagement with and disengagement from the section P is by rotation about a shaft **5** to which the die **4** is connected by bars **5'** spaced apart at intervals of approximately three feet along its length. The shaft **5** is supported by the frame of the apparatus.

When the die **4** is advanced into engagement with the section P, the bearing surfaces **3'** and **4'** of the dies engage the upper and lower faces of the fins of the section P. To achieve this, clamps **6** are arranged at intervals of approximately three feet along the full length of the die **4** and are applied to the upper face of the die **4** by levers **7**. These levers are mounted on a single shaft **8** attached to a support (not shown) which also supports die **3**. The levers cause the clamps **6** to lower onto the die **4** through shafts **8'** and angles **6'** connected to the clamps **6**.

The mode of operation of the apparatus of FIGURES 1 and 2 comprises:

Swinging the die **4** aside and introducing the extremities of a bent and twisted section P between the sets of jaws **1'** and **2'** which are then tightened to grip the section. The displaceable head **2** is moved to the right viewing FIGURE 1 to subject the section to a tension smaller than the yield strength of the section. By rotation of this head **2**, the extremity of the section adjacent to jaws **2'** is

untwisted relative to its extremity at the opposite end to bring the two ends into a position parallel to each other. This is done so that the die **4** can be easily brought into engagement with the section P.

The displacement of the movable head **2** in a longitudinal direction and to the right viewing FIGURE 1 is startd, and the levers **7** are simultaneously lowered. The head **2** is stopped when a predetermined amount of elongation of the section P, smaller than 6%, is achieved. The levers **7** are raised again, the jaws **1'** and **2'** are then loosened, the die **4** is swung away, and the section is removed from the apparatus.

Upon removal of the section from the apparatus, it will be found to have been perfectly straightened and untwisted. It will also be found that in spite of the transverse force applied by the dies no additional force is required to elongate the section than would be required in the absence of the force of the dies.

To straighten and untwist two-finned tubes 33 feet in length and having a tensile strength of 60 lb./sq. in., by conventional methods, it was necessary to perform two consecutive operations. The first operation comprised bench-straightening with rough or approximate untwisting at the rate of 12 tubes per hour, and the second operation was untwisting by the point by point method at the rate of 4 tubes per hour, after which the tensile strength of the metal reached 71–76 lb./sq. in. Application of the method of the invention straightened and untwisted the same tubes in a single operation at the rate of 25 tubes per hour, without any of these tubes retaining a twist exceeding .07 inch, or a tensile strength exceeding 67 lb./sq. in.

FIGURE 3 illustrates a mechanically more advanced embodiment of the invention for the straightening and untwisting of Y-shaped bars P'. FIGURE 3 is symmetrical relative to a vertical axis with its left-hand portion showing the apparatus in the open position for introduction or removal of the sections, and its right-hand portion showing the apparatus in the working position during straightening and untwisting. The upper die is formed by bringing together two bars **10** and **10'** and their working surfaces **11** and **11'**. These bars are mounted on supports **12** and **12'** distributed along their lengths at intervals of approximately three feet and adapted to pivot about two shafts **13** and **13'**.

The lower dies **14** and **14'** and their working surfaces **15**, **16**, **15'** and **16'** are constrained, by a device (not shown), for displacement parallel to themselves, each in a plane which passes through the axis defined by the working position **10** of the upper die and at right angles to this axis. They are supported and actuated by devices distributed along their length at intervals of approximately three feet and comprising toggle-action linkages **17–18** and **17'–18'** mounted on shafts **20** and **20'**. The devices are operated by jacks **21** which apply their force on the hinge points **19** and **19'** of the toggle-action linkages. The shafts **20–20'** are supported by transverse plates (not shown) which also support the shafts **13** and **13'** and the cylinders of jacks **21** so that they cannot move relative to each other.

As shown in FIGURE 3, the working surfaces of the upper and lower dies engage the outer faces of the three legs **22**, **23** and **24** of the Y-shaped bar P' during its elongation in the straightening operation.

While I have shown and described certain presently preferred embodiments of my invention, it may be otherwise embodied within the scope of the appended claims.

I claim:

1. A method of straightening and untwisting elongated metal sections which comprises gripping the ends of the section between the jaws of the heads of a straightening bench under a tension less than the yield strength of the section and rotating at least one end to bring the two ends into a position parallel to each other, surrounding the section with at least two dies which have a length slightly less than the distance between the heads of the straightening bench and which have along their lengths plane surfaces which match specific generally protruding parts of the section, elongating the section by an amount above its minimum permanent elongation but generally below 6% and, simultaneously forcing the dies to come closer to each other against the length of the section.

2. Apparatus for straightening and untwisting elongated metal sections which comprises a straightening bench with two spaced apart heads with jaws for gripping the ends of the section, with at least one of the heads operatively connected to power means for moving it away from the other head and rotating its jaws, at least two rigid dies surrounding the section, extending nearly the whole distance between the jaws, these dies being substantially equally distributed round the axis of the section and having along their lengths plane surfaces which match specific parts of the section, and means for forcing the dies to come closer to each other to apply transverse pressure to a specific part of the section.

3. The apparatus of claim **2** wherein the dies are forced to come closer to each other by means of a set of levers acting on all dies except one and wherein the apparatus has a frame for rotatably supporting said levers and for supporting the die not acted upon by the levers.

4. The apparatus of claim **2** wherein the dies are forced to come closer to each other by means of jacks acting on all dies except one, the cylinders of the jacks, the mounting points of the linkages and the die not acted upon by the jacks being supported so that they cannot move relative to each other.

5. The apparatus of claim **2** wherein one of the dies is made of two parts designed to separate from each other for permitting introduction and removal of the sections.

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