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[54] WIRE MILL IN BLOCK FORM

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **72/235**
[51] **Int. Cl.** **B21b 13/12**
[58] **Field of Search** 72/249, 235

[56] **References Cited**

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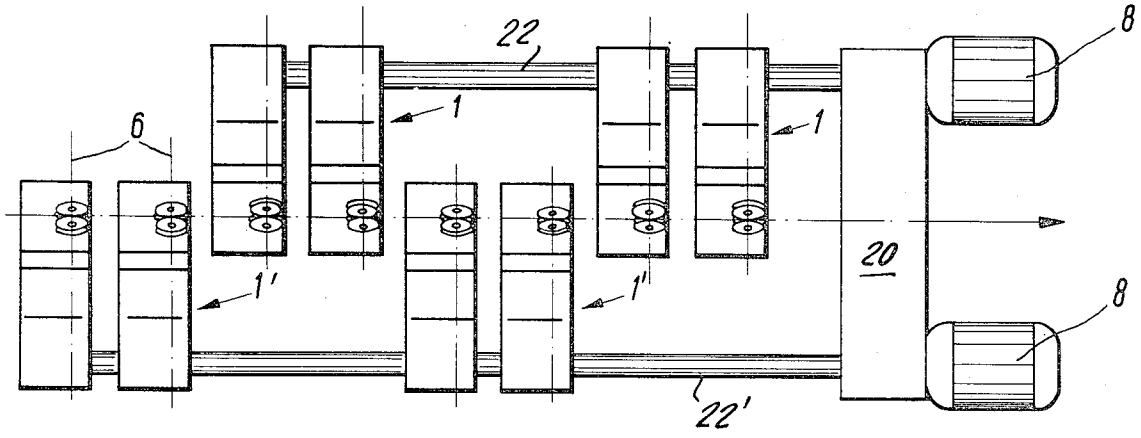
[57] **ABSTRACT**

Several substantially identical rolling heads or stands are arranged in series along a wire rolling line with each head having a driving unit carrying a pair of rotatable rolling disks cooperable with each other to exert a rolling force on the wire, the axes of rotation of the disks of each pair extending parallel to each other at an angle of 45° to the horizontal. The disk axes of one set of rolling heads extend at 90° to those of the other set of rolling heads relative to a transverse plane through the rolling line. The respective pairs of disk axes of at least two rolling heads immediately succeeding each other along the rolling line extend parallel to each other, and these two or more rolling heads are followed by rolling heads having the respective pairs of disk axes extending at right angles to those of the at least two rolling heads. The rolling heads of each set may be driven by a respective driving shaft and the two driving shafts may be driven by associated motors operated in synchronism with each other or otherwise coupled to operate synchronously. Each driving shaft is connected to the driving unit of each head or stand of the associated set.

6 Claims, 5 Drawing Figures



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SHEET 1 OF 2

Fig. 1
(PRIOR ART)

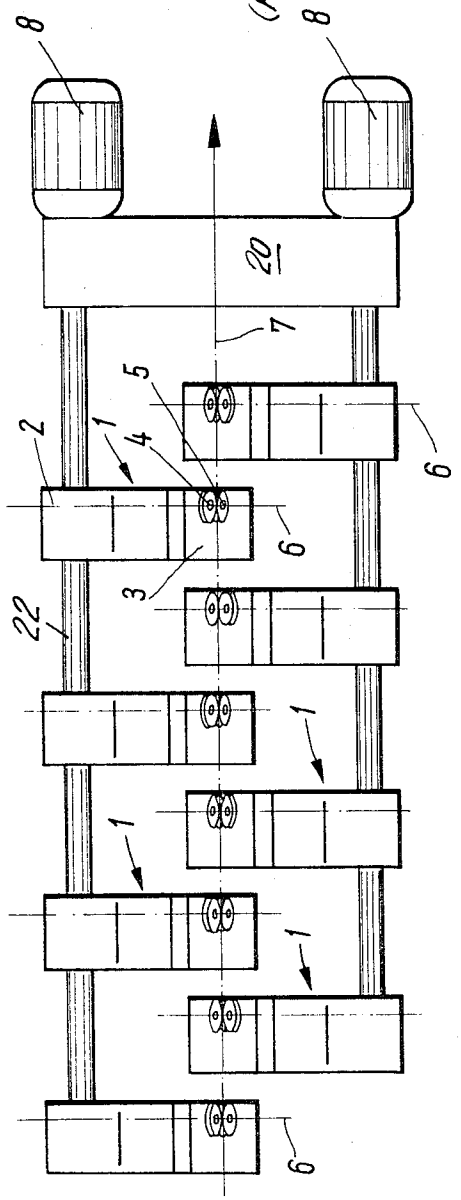

Fig. 2

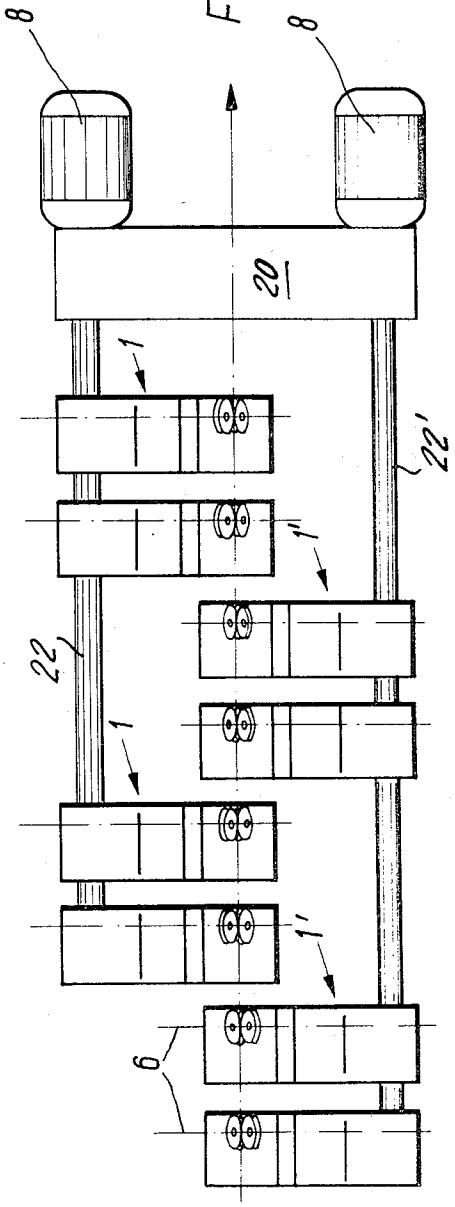

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Fig. 3

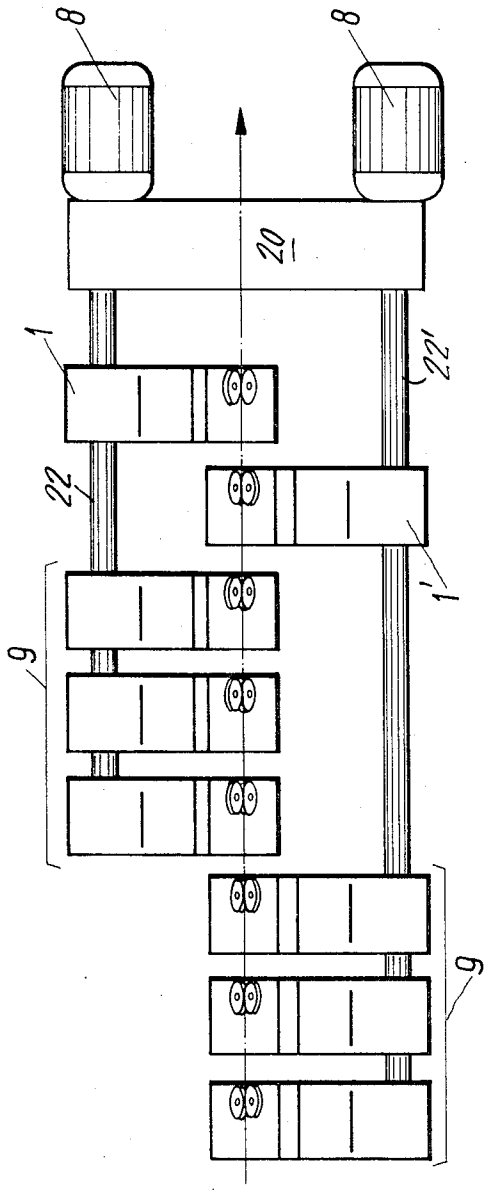


Fig. 5

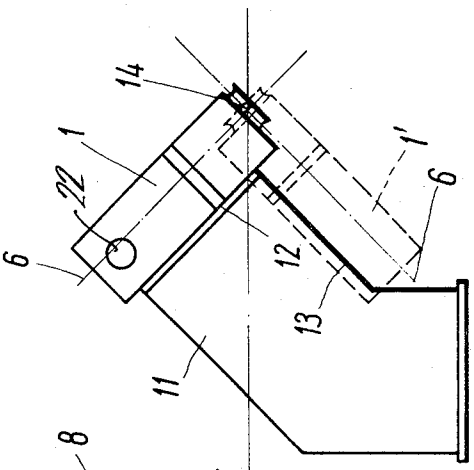
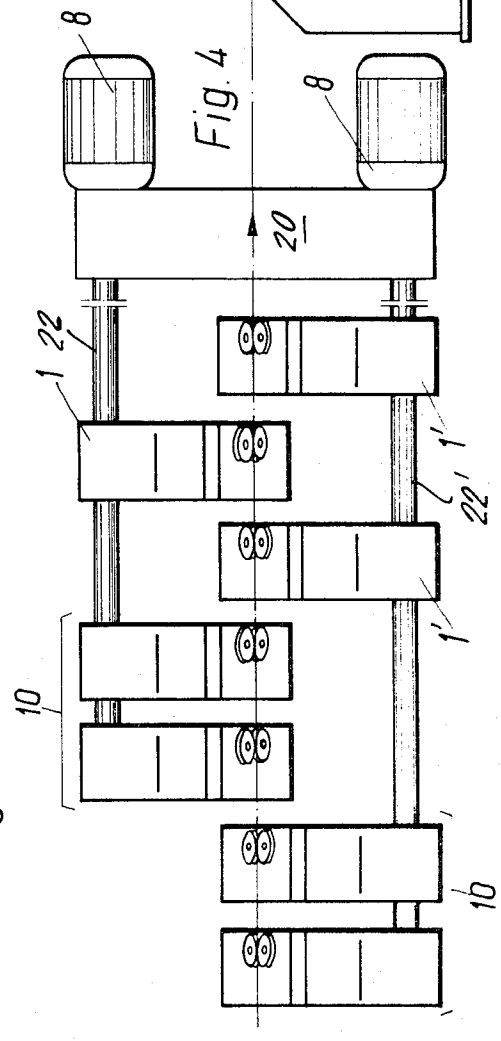


Fig. 4



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WIRE MILL IN BLOCK FORM

SUMMARY OF THE INVENTION

This invention relates in general to the construction of a wire forming mill and, in particular, to a new and useful arrangement of rolling heads or blocks along two spaced parallel shafts which have drive take-off shafts carrying rollers which extend at an angle of about 45° to the horizontal and which may be selectively arranged in groups along the respective shafts in the path in which the wire is moved as it is formed.

The present invention is particularly applicable to a rolling mill of a type which may be used as a finishing roll mill for wire. The wire passes through the wire train comprising several stands or blocks of rollers and emerges from the finish rolling machine which is arranged at the end. The wire finishing blocks work at a substantially higher speed than in previously employed finishing lines in which they are arranged at greater distances from each other. However, the degree of deformation in wire mills of block form is relatively low. The wire finishing block enhances the tolerances which may be maintained during the treatment of the wire but only for a type of material that is comprised under the term "mass structural steel."

The present invention provides a wire finishing block having a construction which permits the rolling of refined steels also. Refined steels present particular difficulties because of their different deformation properties compared to mass structural steels. Alloyed and unalloyed refined steels, stainless steels, acid-resistant and heat resistant steels, anti-friction bearing steels, tool steels and high speed steels have such a greater strength that the course of the deformation cannot be derived from that of mass structural steel. The rolling mill engineer tries to produce small and large lots of wire quantities of certain material quality economically. The variation of the wire dimensions requires a great flexibility of the wire mills employed. Wire trains which comprise individual strands require special quick change devices to obtain good flexibility. Finishing wire blocks have therefore been used only for surface refining at the end of these wire trains. The flexibility of the finishing wire block is limited to the exchangeability of the roll disks in order to accommodate different wire diameters. With respect to the rest of the wire train, the wire finishing block is therefore not very flexible and has been used only for the production of wire from mass structural steel.

The present invention provides a method of making wire blocks of known design more flexible to permit a changeover to a new wire dimension and to different material qualities. The known wire mills in block form depend very rigidly upon the crossing shafts axes of two successive rolling heads for a certain broadening behavior of the material. This rigidity is eliminated according to the invention which provides, within one row of the shaft axes which have varying directions of slope, at least two successive rolling heads of the same direction of slope of the shaft axes. In refined steels of the above-mentioned types, it is possible to considerably increase the broadening of the material in successive passes. This effect permits surprisingly the use of the wire blocks not only as wire finishing blocks but also for roughening and intermediate trains. The new wire mill is therefore suitable for effecting a shortening of the wire trains to a considerable extent. The diameter range of the wire produced can be selected to be relatively wide, that is up to approximately 12 millimeters.

In a particularly advantageous embodiment of the wire mill according to the invention, the rolling heads are arranged in pairs with the roll shaft axes of the heads of each pair extending parallel to each other and those of adjacent pairs extending at right angles to each other.

It is recommended that correspondingly greater broadening ratios be provided in the planning of the tape and tape sequences and also a change of speed. Experience has shown that each rolling head with its driving unit is connected to a driving branch of the main drive working with a rigidly set speed ratio and a separately adjustable superimposed drive can be connected between the rolling head driving unit and the driving branch. The superimposed drive which is provided for each rolling head permits the adaption thereof to speeds hitherto unachieved for the deformation process.

In order to improve the adaptability to an economical rolling program it must be possible to change the rolling heads quickly. To this end the block frame is provided with shiftable rolling head guides whose guide axes intersect in the plane of the roll-pass cross section.

Accordingly, it is an object of the invention to provide an improved wire mill arrangement which includes two spaced parallel main drive shafts with a plurality of block stands connected thereto with drive take-offs from rollers which are arranged at an angle of 45° to the horizontal and wherein the stands may be selectively arranged to arrange two or more blocks in a row on each shaft.

A further object of the invention is to provide a wire mill which is simple in design, rugged in construction, and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference should be had to the accompanying drawing and descriptive matter in which there are illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a schematic representation of the known arrangement of rolling heads in a known wire finishing block;

FIG. 2 is a view similar to FIG. 1 of an arrangement of rolling heads according to the invention;

FIG. 3 is a view similar to FIG. 2 of another embodiment of the invention; and

FIG. 4 is a view similar to FIG. 2 of still another embodiment of the invention; and

FIG. 5 is a side view of a wire mill according to the invention in block form with the block frame and the rolling heads being shown;

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENTS

According to FIG. 1 which represents the prior art arrangement, a great number of rolling heads are provided. Each rolling head 1 carries a driving unit 2, and a bearing 3 for the pair of rolling disks 4 and 5. The

shaft axes 6 extend at an angle of 45° to the horizontal. The shaft axes 6 are arranged in series in respect to their application of rolling forces on the wire in perpendicular directions. The broadening of the material therefore manifests itself substantially transversely to the course of the rolling force. FIG. 1 shows also that the broadening of the material requires a corresponding behavior of the material because of the rolling forces acting constantly in alternating directions. The speed is transmitted here just as rigidly through a main driving motor 8 which, for example, may drive through a drive gearing 20 (or the two individual drives 8 which are connected electrically in synchronism).

In the inventive arrangement shown in FIG. 2, two rolling heads 1 with the same direction of the shaft axes are arranged in a row on one shaft axis 22 of the main drive and these two rolling heads form a group which substantially increases the broadening of the material. The other rolling heads 1' carried on the other shaft axis 22' are arranged to make the use of the principle of the broadening forces being reinforced in groups.

A considerably greater increase of the broadening forces is achieved in the embodiment of FIG. 3. Depending on the material to be rolled, the arrangement of FIG. 3 includes three block units 9 in a row on the shaft axis 22 and also on the opposite shaft take-off 22'. The rolling is continued finally with individual rolling heads in this arrangement. In the arrangement of FIG. 4, just as great a flexibility is obtained by arranging only two unit groups in series and then continuing and finishing the rolling with individual rolling heads 1 which are alternately arranged on the respective take-off shafts 22 and 22'. The drives for the individual rolling head 1 and the two unit groups 10 as shown in FIG. 4 or the three unit groups 9 of FIG. 3 is from separate motor drives 8,8 as in the prior art arrangement.

As shown in FIG. 5, each block frame 11 for the roll mill blocks 1 has a rolling head guide 12 and a rolling head guide 13 whose guide axes intersect. Depending on the rolling program either only one rolling head guide 12 or only one rolling head guide 13 is employed. Under certain circumstances, it is advisable to support the lower rolling head 1 with respect to the block frame 11 or with respect to a stationary point. The rolling heads 1 can be adjusted to the rolling line 14 by shifting them in the guides 12 and 13.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a wire mill arranged in block form and including several substantially identical rolling heads arranged in series along a rolling line with each head having a driving unit carrying a pair of rotatable rolling disks cooperable with each other to exert a rolling force on the wire, the axes of rotation of the disks of each pair extending parallel to each other and at an angle of 45° to the horizontal, and the disk axes of one set of rolling heads extending at 90° to those of the other set of rolling heads, relative to a transverse plane through the rolling line; the improvement comprising the respective pairs of disk axes of a group comprising at least two rolling heads immediately succeeding each other along the rolling line extending parallel to each other.

2. In a wire mill, the improvement claimed in claim 1, in which each of said sets of rolling heads includes at least one of said groups; the groups of one set alternating with the groups of the other set along the rolling line.

3. In a wire mill, the improvement claimed in claim 1, in which said group of rolling heads is followed, along the rolling line, by at least two further rolling heads including one rolling head of each said set.

4. In a wire mill, the improvement claimed in claim 2, in which there are at least two of said groups including at least one group of each of said sets; said groups being followed, along the rolling line, by at least two additional rolling heads including one rolling head of each of said sets.

5. In a wire mill, the improvement claimed in claim 1, including a pair of main drives each associated with the rolling heads of a respective one of said sets; respective take-off shafts connecting the driving unit of each set to its associated main drive; and a respective separately adjustable superimposed drive for each take-off shaft.

6. In a wire mill, the improvement claimed in claim 1, in which each rolling head comprises two driving unit guides extending at substantially right angles to each other and each extending at 45° to the horizontal; the respective shaft axes of driving units mounted on said guides intersecting at the rolling line.

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