May 13, 1930. B. P. HAZELTINE 1,758,699

STRAIGHTENING MACHINE

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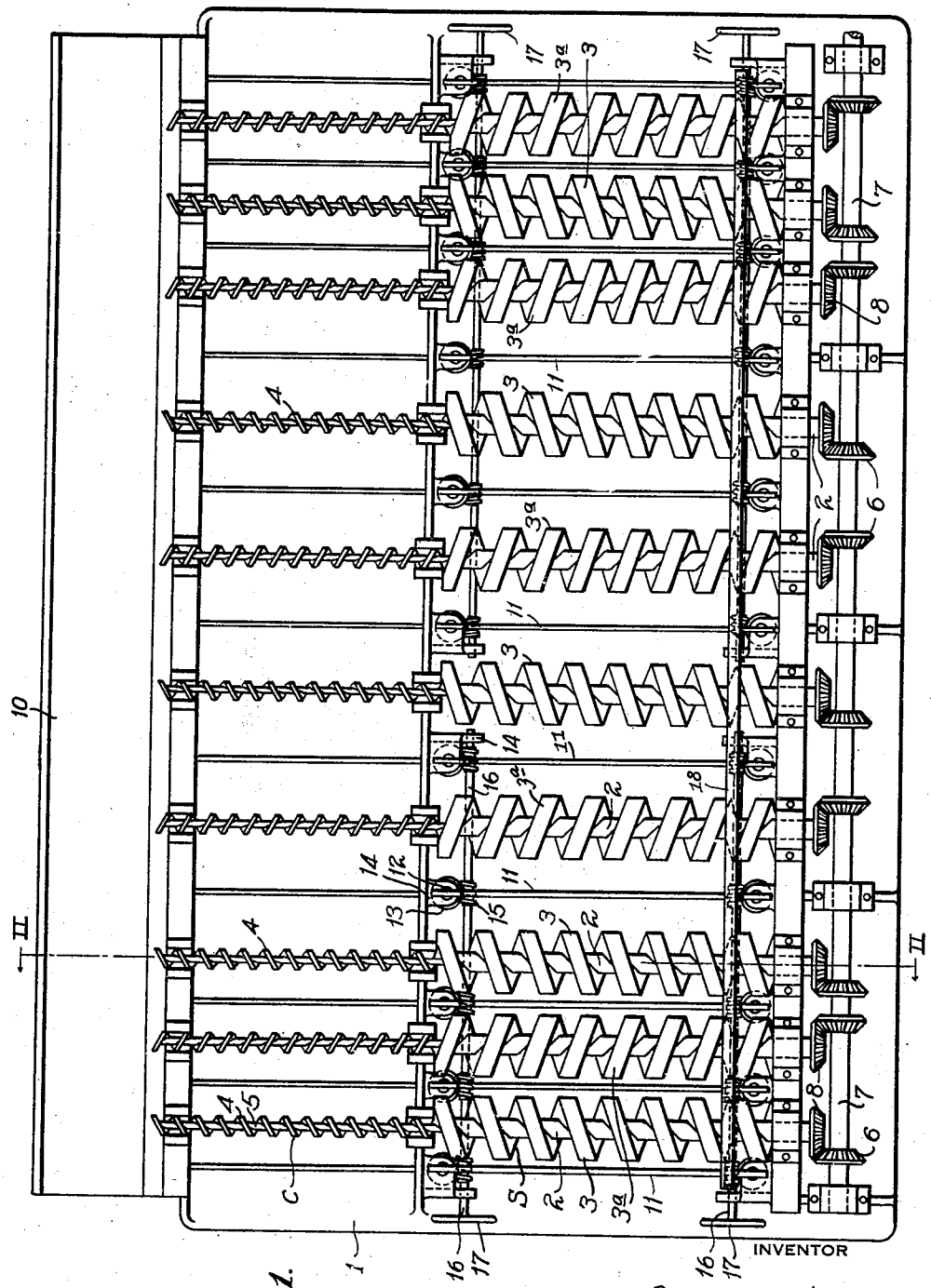


FIG. 1.

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Fig. 2.

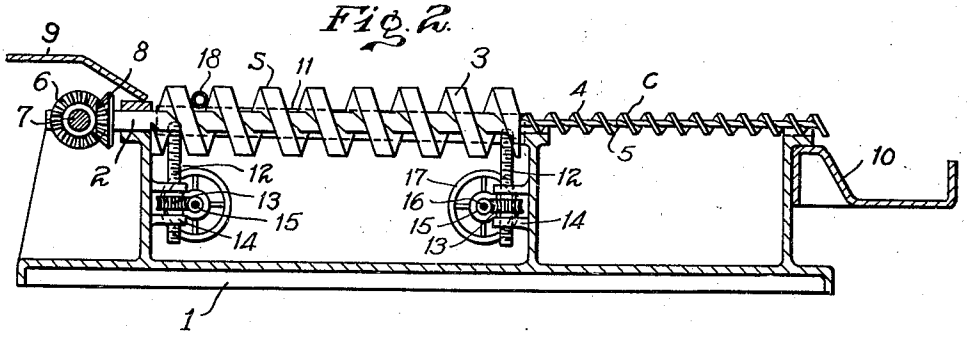
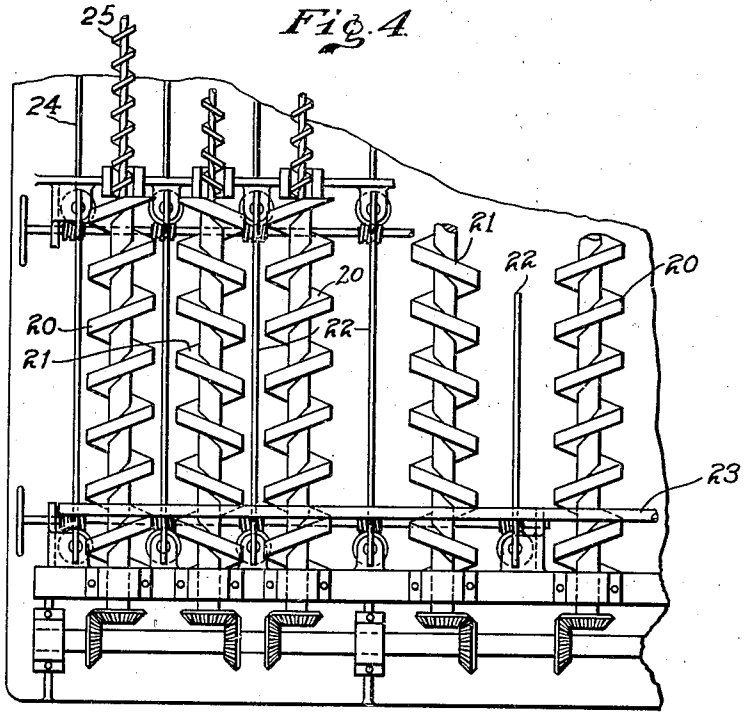


Fig. 4.



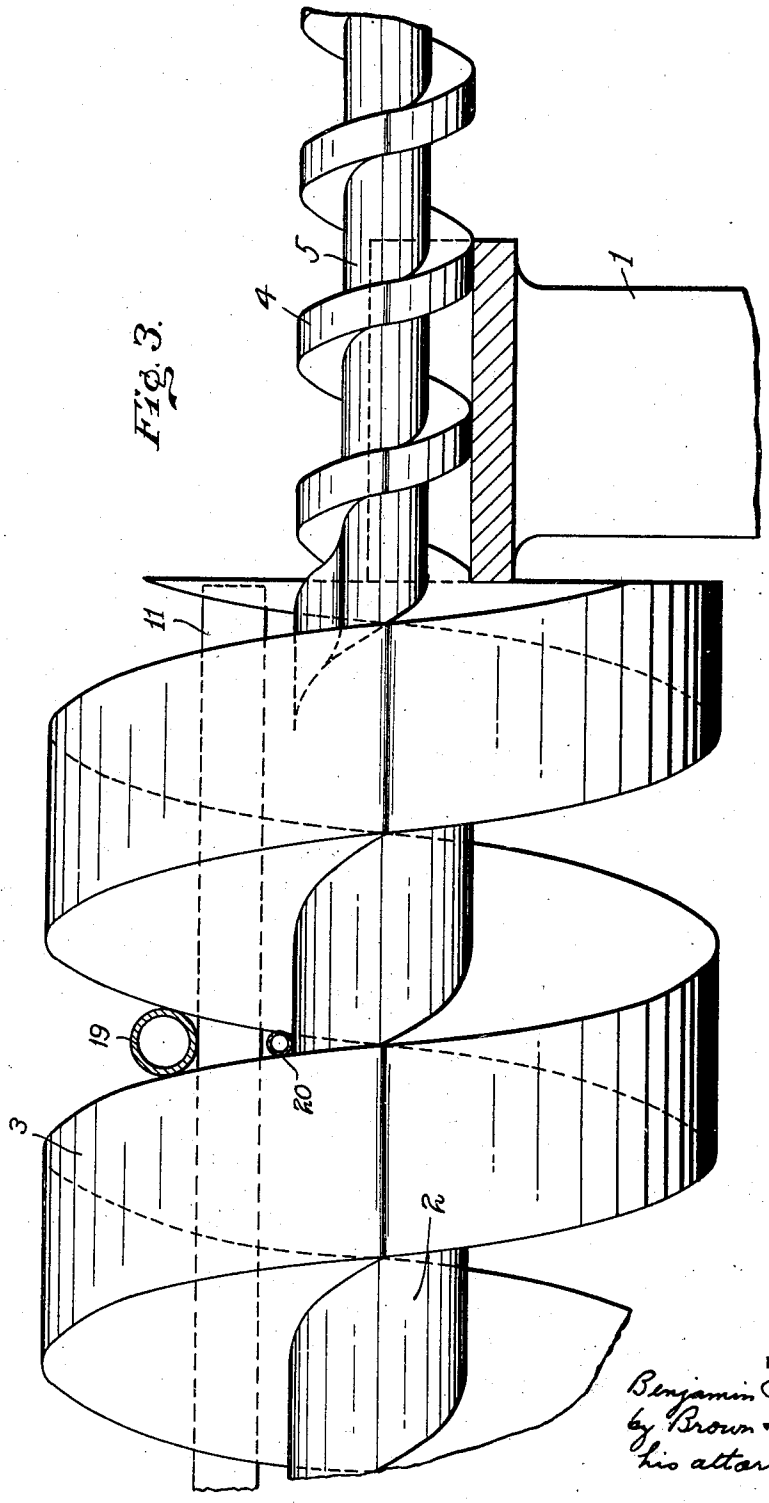
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Fig. 3.



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UNITED STATES PATENT OFFICE

BENJAMIN P. HAZELTINE, OF BALTIMORE, MARYLAND

STRAIGHTENING MACHINE

Application filed December 8, 1928. Serial No. 324,623.

This invention relates to apparatus for straightening cylindrical blanks such as tubing, rods, and like articles of circular cross section, and especially to apparatus of the type in which the article is rotated during the straightening operation, and it applies particularly to hot straightening such blanks.

An object of the invention is to provide apparatus for straightening cylindrical blanks which is of simple construction, strong, easily operated, capable of operating upon blanks of varying diameter, and in which rotation of the blank is produced by the action of the straightening element.

Another object is to provide an apparatus of the type referred to in which the straightening action is produced by movement of the blank through screw flights, in which means are provided for varying the initial stress upon the blanks and to prevent them from binding in the threads, and in which blanks may be moved and straightened without end play.

It is among other objects of the invention to provide a screw-flight cylindrical-blank straightening machine with means for removing straightened blanks from it.

One embodiment of the invention is shown in the accompanying drawings, in which Fig. 1 is a plan view of the apparatus; Fig. 2 a longitudinal section taken on line II—II, Fig. 1; Fig. 3 an enlarged fragmentary side view of the junction of the straightening screw and conveyor worm flights, Fig. 2; and Fig. 4 a fragmentary plan view of a modification of the apparatus shown in Figs. 1 to 3.

The apparatus provided by the invention comprises a plurality of blank-straightening screw flights rotatably mounted in a horizontal, or substantially horizontal, parallel series, and adapted when a blank is laid transversely thereof to engage it on opposite sides at longitudinally spaced points, and in the preferred embodiment the screw flights are arranged to engage a blank between opposed surfaces of adjacent threads of each screw. The screws are preferably of constant diameter type and they may be driven by any suitable means. The engagement of the blank on opposite sides by the screws creates a forward thrust due to the rear threads which is opposed by the reaction of the forward threads, and because the blank is supported at a plurality of longitudinally spaced points, its behavior corresponds to that of a continuous beam. Also, its engagement on opposite sides by revolving screw threads causes the blank to rotate while moving in the direction of thread travel, so that the thrust acting upon longitudinally spaced points along the blank is applied progressively to the periphery. A hot straight blank moving through the threads will be subjected to no bending stresses, because the thrust will be uniform at each point of support. In the case of a hot bent or kinked blank, however, there will be created unevenly distributed stresses, due to the tendency for the points of support to be out of line, and as the blank rotates the increased stresses applied to the bent portions act around the blank to bring it into line.

The screws may be all right-hand, or all left-hand, in either of which cases there will usually be a tendency for the blank to move endwise as it moves along the screws, which tendency may be overcome by providing a suitable stop at one side. It is preferred, however, to use a combination of right and left-hand screws, and to rotate all of the screws in common direction of travel, which substantially eliminates end travel of the blank as it traverses the screws.

Means may be, and preferably are, associated with the apparatus for conveying straightened blanks from the operating screws, and for this purpose it is preferred to use worm conveyors, this type of conveyor being preferred because substantially no adjustment is necessary, and it can be driven from the operating screws, thus being simpler in construction and operation, so far as the invention is concerned, than other types of conveyor. The worms may be mounted in any suitable manner and driven in various ways, but for simplicity of construction it is preferred to form them as extensions of the straightening flights, and most suitably the worm takes the form of a flat band helically wound on a shaft to form threads of small

diameter and large pitch which engage but one side of the blank to advance it.

The pitch of the screw and the diameter of the cylindrical blank govern the distance to which the blank sinks between adjacent threads, and the straightening stresses are at a maximum when the blank has approached as closely as possible to the center line of the screw shaft. Because the straightened blanks may tend to bind in the threads if permitted to drop fully therebetween, and also because it may at times be desirable to vary the application of the straightening stresses, the invention contemplates the provision of means to regulate the position of the blank in the threads. In the preferred embodiment such means comprise adjustable guides adapted to permit the blank to approach closely enough to the center line to produce straightening without binding.

Referring now to the drawings, the embodiment shown in Figs. 1 to 3 comprises a plurality of straightening screw flights S and worm conveyors C formed as extensions thereof, journalled in a suitable framework 1. The screw flights each comprise a shaft 2 and a square thread of relatively large diameter, although other styles of thread may be used. The shafts are shown as being provided alternately with right-hand threads 3 and left-hand threads 3^a to prevent substantial end travel of the blanks. The worm conveyors comprise a flat band 4 wound helically on an extension 5 of shaft 2, the conveyor threads being of small diameter and also alternately right and left hand. Bevel pinions 6 mounted on a common shaft 7 drive the screws and worms through bevel gears 8 keyed on shafts 2, shaft 7 being driven in any suitable manner, not shown, and the pinions being appropriately disposed, as shown in Fig. 1, to give a common direction of travel to all the screws.

In general a blank is satisfactorily straightened after traversing a few threads, and in the case of screws adapted to operate on blanks from $\frac{3}{8}$ to $1\frac{1}{2}$ inches in diameter, there may be used a screw four feet in length having eight threads six inches in diameter. It is preferred to arrange three screws as close together as possible at each end of the apparatus, the others being uniformly spaced therebetween, for example at 24-inch intervals in the case of the screws described above. Any suitable blank feeding device such as a trough whose bottom 9 delivers blanks to the apparatus may be disposed at its forward end as shown in Fig. 2, and a receiving trough 10 may be bolted or otherwise connected to the frame to catch the blanks as they are delivered from the conveyors.

The blank-supporting means comprise guide bars 11 mounted between adjacent screws and alongside of the outer screws for vertical adjustment, this being accomplished in the embodiment shown by connecting the ends of each bar to elevating screws 12 whose threads run in interiorly threaded worm wheels 13 mounted in threaded brackets 14 carried by frame 1. The worm wheels are actuated to elevate or lower the screws 12 by means of worms 15 on shafts 16 rotatable by hand wheels 17, the shafts and worms being suitably supported by the frame.

In the use of this apparatus, blanks 18 delivered from trough 9 transversely of the screws are engaged by adjacent threads of each screw on opposite sides of a vertical plane passing longitudinally through the blank. With the screws rotating, the blanks are rotated and simultaneously advanced, and the resultant thrust progressively applied to the periphery of the blank straightens it in the manner previously explained. With guide bar 11 in the slanting position shown in Fig. 2, blank 18 at first can not assume its closest approach to the center line of the screw shaft, that position being assumed only after the blank has been partially straightened by traversing one or more threads, and consequently sudden straightening is prevented. Thus, by means of this guide arrangement binding is prevented, the adjustment provides for proper operation of the apparatus in cold straightening of blanks, as will be understood by those skilled in the art. When the blanks have reached the end of the straightening flights, they pass to the worm conveyors, which engage only the rear side of the blank, and thus do not create any stresses therein.

The guide bar may also be used in horizontal position to accommodate blanks of various size without binding. As shown in Fig. 3, guide bar 11 is horiontal and supports a blank 19 of large diameter, the adjustment being such as to permit the blank to approach closely enough to the shaft center line to produce straightening without binding. For still larger blanks the guide may be raised, and for small blanks 20 it may be partially or fully depressed. In such cases the blank traverses the threads at about the same level. By adjusting the guide for a given size of blank and elevating the front end, as in Fig. 2, the stresses will be gradually applied and the blank will be properly supported at each point in its travel. Should a blank fail to align properly when entering the screws, it will tend to climb over the threads until it lies wholly in aligned threads, thus automatically starting the blanks properly.

In the embodiment just described the blanks are engaged on opposite sides by opposed surfaces of adjacent threads of each screw flight. The blanks may be engaged on opposite sides in other manners also. For example, in the modification shown in Fig. 4, right and left hand screw flights 20 and 21 having guide bars 22 arranged therebetween

receive blanks 23 as before. The threads are so arranged that the blanks are engaged on opposite sides at longitudinally spaced points by opposed surfaces of alternate screws. That is, screws 20 engage one side of the blank and the opposite side is engaged by flights 21. As in the preceding modification, fixed guide bars 24 are preferably arranged between the worm conveyors 25.

In this modification the guide bars 22 may be, and preferably are stationary, adjustment being made by shifting alternate flights longitudinally in any suitable manner, this adjustment varying the distance between the blank-engaging faces of adjacent flights for accommodation of different sizes of blanks. The rest of the apparatus and its operation are similar to that described in the preceding embodiment.

Although not limited thereto, the apparatus is especially adapted to hot straightening, and when so used, the conveyors conveniently act also as a cooling table. The blanks are quickly and easily straightened, the apparatus being adjustable to prevent damage to the blanks by sudden severe straining, and the apparatus and operation costs are low.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider to be its best embodiment. However, I desire to have it understood that, within the scope of the appended claims the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A machine for straightening cylindrical blanks, comprising a plurality of parallel rotatably mounted screw flights arranged to receive a blank transversely thereof and having deep threads formed to engage it substantially on its diametrically opposite sides at longitudinally spaced points, and means to rotate said screws to rotate and straighten the blank while conveying it longitudinally of said screws.

2. A machine for straightening cylindrical blanks, comprising blank-straightening means including a plurality of parallel rotatably mounted screw flights arranged to receive a blank transversely thereof and having deep threads formed to engage it substantially on its diametrically opposite sides at longitudinally spaced points, blank-supporting means disposed between said screw flights, one of said means being adjustable to vary the engagement of a blank by said screws, and means to rotate said screws to rotate and straighten the blank while conveying it longitudinally of said screws.

3. A machine for straightening cylindrical blanks, comprising a plurality of parallel rotatably mounted right and left hand screw flights arranged to receive a blank transversely thereof and having deep threads formed to engage it substantially on its diametrically opposite sides at longitudinally spaced points, and means to rotate said screws to rotate and straighten the blank while conveying it longitudinally of said screws.

4. A machine for straightening cylindrical blanks, comprising blank-straightening means including a plurality of parallel rotatably mounted right and left hand screw flights arranged to receive a blank transversely thereof and having deep threads formed to engage it substantially on its diametrically opposite sides at longitudinally spaced points, blank-supporting means arranged between said screw flights, one of said means being adjustable to vary the engagement of a blank by said screw flights, means for rotating said screw flights to rotate and straighten the blank while conveying it longitudinally of the screws, and worm conveyors forming extensions of said screw flights.

5. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted screw flights adjacent threads of each of which engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, and means to rotate said screw to rotate and straighten the blank while conveying it longitudinally of said screws.

6. A machine for straightening cylindrical blanks comprising blank-straightening means including a plurality of parallel rotatably mounted screw flights adjacent threads of each of which engage opposite sides of a blank placed transversely thereof, blank-supporting means arranged between said screw flights, one of said means being adjustable to vary the vertical position of the blank in the threads of said screws, and means to rotate said screws to rotate and straighten the blank while moving it longitudinally of said screws.

7. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted screw flights arranged to receive a blank transversely thereof, adjacent threads of each screw engaging opposite sides of the blank, means to rotate the screws, and vertically adjustable means for varying the vertical position of the blank with respect to the threads.

8. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted right and left hand screw flights adjacent threads of each of which engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, and means to rotate said screws to rotate and straighten the blank while conveying it longitudinally of said screws.

9. A machine for straightening cylindrical

blanks comprising a plurality of parallel rotatably mounted right and left hand screw flights arranged to receive a blank transversely thereof, adjacent threads of each screw engaging opposite sides of the blank, means to rotate the screws, and vertically adjustable means for varying the vertical position of the blank with respect to the threads.

10. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted alternately arranged right and left hand screw flights adjacent threads of each of which engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, and means to rotate all of said screws in a common direction of thread travel to rotate and straighten the blank while conveying it longitudinally of said screws.

11. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted alternately arranged right and left hand screw flights, adjacent threads of each of said flights being formed to engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, means to rotate said screws to rotate and straighten the blank while moving it longitudinally of the screws, and conveyors disposed to receive the blank from the straightening screws.

12. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted blank-straightening right and left hand screw flights of large diameter arranged to receive a blank transversely thereof and to engage it on opposite sides at longitudinally disposed points by adjacent threads of each screw, means to rotate said screws, vertically adjustable blank guides for varying the engagement of the blank by the threads, and worm conveyors forming continuations of the straightening flights.

13. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted shafts each having portions formed of right and left hand screw flights adjacent threads of each being formed to engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, and worm conveyor portions for receiving and conveying straightened blanks without stressing engagement by the threads, and means to rotate all of said screws in a common direction of travel to rotate and straighten the blank.

14. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted shafts each having portions formed of right and left hand screw flights adjacent threads of each being formed to engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, vertically adjustable blank supporting means disposed between successive flights, and worm conveyor portions for receiving and conveying straightened blanks without stressing engagement by the threads, and means to rotate all of said screws in a common direction of travel to rotate and straighten the blank.

15. A machine for straightening cylindrical blanks comprising a plurality of parallel rotatably mounted right and left hand square thread screw flights of large diameter for straightening blanks disposed transversely thereof, and a plurality of right and left hand worm conveyors of small diameter arranged as extensions of said screw flights for conveying straightened blanks, and means for rotating said screws, the threads of said straightening screw flights being formed to cause adjacent threads of each screw to engage a blank placed transversely thereof on substantially its diametrically opposite sides at longitudinally spaced points, whereby rotation of the screws causes rotation and straightening of the blank while being moved longitudinally toward said worm conveyors.

In testimony whereof, I sign my name.

BENJAMIN P. HAZELTINE.