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CONTINUOUS METHOD FOR CONDITIONING WIRE

George W. Bell, Sterling, Ill., assignor to Northwestern Steel & Wire Co., Sterling, Ill., a corporation of Illinois

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3 Claims. (Cl. 117—49)

The present invention relates to a method and apparatus for making rods in a continuous operation.

More particularly, this invention relates to a method and apparatus for continuous manufacture of welding rod stock including an improved method of lubricating the raw stock immediately following a vigorous abrasion and polishing of the surface thereof to remove all scale therefrom.

Raw metal wire stock as received from the mill is coated with impurities and oxide scale. As the scale is extremely hard and brittle, feeding of contaminate raw stock through drawing dies not only abrades the dies to cause excessive wear and consequent short life but interferes with the quality of the finished wire as well.

Heretofore, raw wire stock has been subjected to reverse bending and the action of cascading steel balls which are more or less effective in peening away scale from the stock, and has then been passed through powdered lime and soap, the lime precipitating the soap, so it will adhere to the wire and lubricate the wire for drawing.

While these prior processes are useful, the raw stock is not as effectively and efficiently cleaned and lubricated as desirable, particularly when the rate of travel of the wire stock through the prior art reverse bending and ball-mill cleaning apparatus is stepped up to surpass competitive production.

It is a principal object of this invention, therefore, to provide an improved means of conditioning by cleaning, brightening and lubricating essentially continuous elongated raw metal stock for drawing.

More specifically it is an object of this invention to provide a process and an apparatus for continuously descaling, cleaning and lubricating raw metal stock in preparation for additional drawing of said raw stock into finished metal articles.

Still another object of the invention is to provide a series of operations and apparatus essential to maximum rates of continuous production of finished wire rod of standard length.

These and other objects of the invention will become apparent as the description of the invention is hereinafter developed in greater detail.

Stated briefly, the invention comprises in combination a rotary chamber, tubular journalled means rotatably supporting said chamber, means to rotate said chamber, tension means to feed metal stock linearly through and along the center of rotation of said chamber and support means within said chamber and rotated thereby adapted to secure at least one replaceable abrasive means in positive tangential contact with the periphery of metal stock fed therethrough. The replaceable abrasive means are preferably in the form of metal file blocks, but other abrasive products including sintered particulate aluminum oxide or silicon carbide fragments in block form may be selected for this end.

Additionally, it is preferred to provide the rotary chamber with a plurality of compartments, the first entered of which is provided with abrasive means as indicated and immediately adjacent thereto one or more compartments providing continuous contact of the freshly abraded metal surfaces with wire-drawing compounds, for example, lime, lime rock, powdered lime, and to then pass the wire through a lime slurry and bake the lime thereto, prior to passing through powdered soap for lubricating the wire prior to drawing. A particular advantage accrues in contacting a freshly abraded bright metal surface immediately upon formation with metal drawing compounds and then baking the compounds thereon, as there appears to be a greater affinity of the metal for the lubricants when the metal surface is in a pristine state and has had the lime baked thereon, leading to an increased film of lubricant and consequent advantages in die life, rate of drawing, etc.

Other objects and features of the present invention will be apparent as greater detail of a preferred embodiment of the invention is described in conjunction with the attached drawings.

Referring to the drawings:

Figure 1 is a side elevational schematic view of the apparatus broken away at the left end, and

Figure 2 is a continuation of Figure 1 as broken, extending further to the left.

Figure 3 is an enlarged side elevational schematic view of a portion of the apparatus of principal interest as seen from the side opposite to that illustrated in Figure 1.

Figure 4 is aa enlarged vertical sectional view along and through the axis of rotation of the rotary chamber shown in Figure 3 with supporting parts broken away and removed.

Figure 5 is an enlarged cross sectional view taken along the line V—V of Figure 4.

Figure 6 is an enlarged cross sectional view taken along the line VI—VI of Figure 4.

Figure 7 is a enlarged side elevation of the first entered compartment of Figure 4 with the outer cylindrical shell removed.

Figure 8 is a cross sectional view taken along the line VIII—VIII of Figure 7.

Referring now specifically to Figures 1 and 2 of the drawings and generally to the apparatus and method, black iron wire or raw elongated metal stock 1 is drawn through the apparatus by driven wheel 45, take-up reels 53 and 61 and drum 65 to pinch rolls 76, 77, through an initial set of straightening rolls 80, pinch rolls 82, and straightening rolls 85 to be fed to a flying shear 86 where the stock is cut to length to fall upon a conveyor belt 90 of a conveyor 95, where a retarder element 96 retards the conditioned rods projected by the shear and aligns the same. The aligned rods are then continuously fed by the conveyor belt 90 to a vibrating table 98 where the rods are vibrated into densest packing arrangement and boxed.

Considering the inventive combination in greater detail, the imperfect or raw metal stock 1 enters the right hand (Fig. 1) side of the machine through fixed guide 2 and is trained horizontally about sheave 3 rotatable about a vertical axis and is then reversed and trained about sheave 5 rotatable about a horizontal axis. The initial bending serves to crack and to remove the worst of the embrittled, more readily removed scale.

The partially descaled raw metal stock then passes through a hollow trunnion 7 of a main polishing and lubricating chamber 8, shown in Figure 4 as being in the form of a cylinder and having opposite end walls 9 and 10. The hollow trunnion 7 is shown as being secured to and extending outwardly from the end wall 9 and as forming support therefore, while a hollow trunnion 35 is shown as being secured and extending outwardly from the end wall 10. The end walls 9 and 10 are also apertured in alinement with the hollow interior of the hollow trunnions

7 and 35 to accommodate the wire to pass into the drum 8, through an apertured intermediate plate 12 dividing the main chamber 8 into a polishing chamber 11 and a treating chamber 20.

The stock passes from the treating chamber 20 through the hollow interior of the trunnion 35 to the tensioning pulley 45. The hollow trunnions 7 and 35 are rotatably supported on a frame 36 for the descaling and polishing apparatus in spaced pillow boxes 37 and 38 respectively. The chamber or cylinder 8 is shown as being rotatably driven by a motor 40, supported on a shelf 41 extending inwardly from the support legs of the frame 36. The drive to the cylinder 8 from the motor 40 is shown as being a V belt drive of a well known form and indicated generally by reference character 39.

The descaled, polished and treated wire stock passes from the trunnion 35 around the tensioning pulley 45, driven by the motor 40 through a V belt drive 41, driving a counter shaft 42, a V-belt drive 43 driving a shaft 44, and a beveled gear drive 46 driven from the shaft 44 and driving a shaft 47 on which the tensioning pulley 45 is keyed or otherwise secured.

The tensioning pulley 45 is shown as rotating in a tank 48 containing an aqueous slurry of lime, borax or any other suitable material for coating the wire stock and assisting the soap to pick up on the wire stock as a lubricant during the wire drawing operations.

The freshly polished and coated stock leaving the tank 48 passes upwardly over horizontally spaced sheaves 49 and 50 having electrical conductors 49*a* and 50*a* respectively electrically connected thereto. The electrical conductors 49*a* and 50*a* are diagrammatically shown as being connected with a transformer 50*b*, putting out an E.M.F. dependent in part upon a gage of the wire stock, but sufficient to maintain a flow of between 15 to 40 amperes in the wire stock as it passes over the sheaves 49 and 50 and heat the wire by resistance heating as it passes between said sheaves. The heating of the wire serves to bake on to the surface of the wire, the lime and other compounds essential to the subsequent drawing operations.

From the sheave 50, the wire stock having the drawing compound baked thereon is fed downwardly and under an idler 51 on a support 51*a* of the frame 36 through a box 52 containing powdered soap or a like lubricant. The wire stock is then trained to and about the driving reel 53 and upwardly from said driving reel over a vertically spaced take up pulley 54, and back about a large diameter guide 55 of said first driving reel 53 and forwardly to and through a drawing die 60. From the drawing die 60 the wire passes around a second driving reel 61 and upwardly therefrom over a take up pulley 62 and downwardly therefrom around an enlarged diameter guide 63 of the second driving reel 61 through a second drawing die 64 to a terminal tension drum or reel 65.

The drawing apparatus just described is of a well known form similar to that shown and described in the Dillon Patent Number 1,917,219, so need not herein be shown or described in further detail.

From the terminal tension drum or reel 65, the wire stock passes toward the entering end of the drawing machine through a trough or pipe 70 containing a coolant such as water to cool the rapidly traveling wire stock. The wire then passes to and around an idler sheave 71 at the entering end of the wire drawing machine and upwardly therefrom to and around an idler sheave 72. From thence the wire passes along the machine to and through a guide 75 to and through the pinch rolls 76 and 77. The pinch rolls 76 and 77 are well known forms of pinch rolls suitably driven by power, and serve to pull the wire from the tensioning drum 65 and maintain tension thereon, and push the wire to the straightening rolls 80. The wire passes from the straightening rolls 80 through a guide 81 to and through a set of pinch rolls 82, which are also driven by power, and pull the wire

through the straightening rolls 80. From thence the wire passes through a guide 83 through lesser radius final straightening rolls 85, to the rotary shear 86, where the drawn and straightened wire is cut to welding rod length by the shear 86, as it travels therethrough.

The shear 86 may be of a well known form and is shown generally as including two power driven rolls 87 and 88 through which the straightened wire passes and having registering knives projecting therefrom for shearing the wire to length as it passes between said rolls, as is well known to those skilled in the art. As herein shown knives 87*a* are shown as projecting from the roll 87 and register with corresponding knives (not shown) projecting from the roll 88.

The flying shear 86 projects the sheared wire along a guide 89 on to the traveling belt 90 of the conveyor 95, where the finished rods are retarded by retarder 96. The retarder 96 is shown as being in the form of an inclined belt retarder, and may be a heavy belt supported between the side walls of the conveyor 95 and inclined in the direction of travel of the conveyor, and spaced sufficiently close to the conveyor belt to be engaged by the rapidly traveling rods and restrain forward movement thereof and also drag the rods into parallel relation with one another for discharge on to the reciprocating or shaking table 98.

The reciprocating table 98 may be reciprocably driven in a direction transverse to the direction of travel of the conveyor belt 90, by means of a motor 99 and reciprocating drive mechanism indicated generally by reference character 100, driven therefrom. The reciprocating drive mechanism may be of any well known form and is no part of my present invention so need not herein be shown or described further. The reciprocating table 88 serves to progress the rods toward the discharge end of said table by the reciprocating motion thereof and to discharge the same into shipping boxes or the like (not shown) in densest packing arrangement.

Referring now in particular to the descaling and coating apparatus and process as illustrated in Figures 3 through 8, the wire stock in the form of black wire enters the cylinder or chamber 8 through a guide 2 and passes therefrom about the vertical axis sheave 3 changing the direction of the wire and then reverses its direction about the horizontal axis sheave 5 and enters the polishing chamber 11 of the rotary chamber or cylinder 8 through the hollow trunnion 7 as has previously been described.

The reversing of the wire prior to entering the polishing chamber 11 spalls off the more brittle scale as the softer stock is reversed in direction about the sheaves 3 and 5.

The compartment 11 of the chamber 8 is shown in Figure 5 as having two parallel spaced chordal plates 13, 13 connected between the walls 9 and 12 and spaced on opposite sides of the center of rotation of said chamber and the apertured portions in the walls 9 and 12, through which the wire passes for treatment. The chordal plates 13, 13 abut the inner cylindrical wall of the chamber 11 at one of their ends, and are open at their opposite ends to receive a plurality of abrasive bars 15, 15, and herein shown as being four in number and spaced on opposite sides of the line of travel of the wire through the chamber 11, and so arranged as to have tangential engagement with the wire stock as the chamber 8 is rotating.

The open end of the space between the chordal plates 13, 13 carrying the abrasive bars 15, 15 is shown as being closed by a retainer or door 28 slidably guided in gibbed guides 29 extending at right angles to the chordal plates 15, 15 and spaced in advance of the ends thereof.

The abrasive bars 13, 13 may be metal files, sintered abrasives including those of the silicon carbide aluminum oxide class, and are herein shown as being tapered files oppositely arranged to be held in position by the taper thereof. The abrasive bars or files 15, 15 are shown as being spaced from the walls 9 and 12 by spacer

bars or blocks 16, 16 having tapered inner faces conforming to the taper of the abrasive bars 15, 15 to hold the same in position when the door or retainer 28 is closed.

It should here be understood that while the files are shown as being oppositely arranged, to have interengagement with each other, that the tapers of the file may be so formed that the files will all cut in the same direction and effect final scale removal and polishing of the wire prior to treatment in the chamber 20.

The door 28 is shown as having a projection or ledge 30 extending outwardly therefrom toward an access opening 17 in the wall of the chamber 11. The ledge 30 is engaged by a tongue 27 projecting inwardly from an access door 25 for the chamber 8, for locking the door 28 in position to hold the abrasive bars 15, 15 in place between the chordal plates 13, 13. The access door 25 is shown as being pivotally connected to a hinge member 18 secured to the wall of the chamber 8 and extending outwardly therefrom. A pivot pin 19 is provided to pivotally connect the door 25 to the hinge member 18. A locking pin 22 extending through spaced lugs 23 and engaging the outer side of the access door 25 is provided to lock the door 25 closed and lock the retainer door 28 in position, to hold the abrasive bars or files 15, 15 in position between the chordal plates 13, 13, to have tangential engagement with the wire as it passes therethrough.

The treating compartment 20 contains a supply of drawing compounds such as powdered lime, which readily adheres to the abraded smooth-surfaced wire leaving the chamber 11. The compartment 20 is shown as having a plurality of lifter plates 21, 21 extending inwardly from the wall of the cylinder in chordal planes, to lift the drying compounds and cascade them to the center of rotation of the compartment 20 on to the scaled wire, as it passes therethrough.

Access to the compartment 20 to replace the drawing compounds is through a door 26 hinged to a hinge member 26*a* on a hinge pin 26*b*. A locking pin 26*c* passing through spaced lugs 26*d* is provided to lock the door 26 closed.

The wire passing from the treating compartment 20 leaves said compartment through the hollow trunnion 35, as has previously been described and is trained about the power driven tensioning pulley 45, which pulls the wire through the chamber 8 and immerses the same in a lime slurry in the tank 48, from which it is drawn by the drum 53 over the idler sheaves 49 and 50 where the wire acts as a resistor as it passes between said sheaves, and the lime is baked thereon by the resistance heat, to assure a more efficient precipitation of the soap on the wire, and thus increase the efficiency of the picking up of soap as a lubricant. From the sheave 50, the wire then passes under the sheave 51, through the soap box 52, for drawing cutting off and packing, as previously described.

The scaling, abrading or polishing and lime treating and baking operation thus more efficiently removes the dross from the wire and places the wire in condition for more effective application of the wire drawing compound thereto, and the baking of the wire by the application of heat by the electrical resistance, baking the compounds thereon increases the affinity of the soap to the wire, enabling the drawing operation to be greatly speeded up, and thus providing a faster and more efficient continuous rod making process than has heretofore been known.

As is well understood by those skilled in the metal forming art, various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts of my invention, as illustrated and described herein.

I claim as my invention:

1. A continuous method for conditioning wire for subsequent drawing which comprises feeding raw wire stock under tension along its axis, abrading the linearly moving raw wire stock by tangentially engaging opposite sides thereof with rigid abrading members rotatably moving about the traveling wire, and immediately thereafter successively treating said freshly abraded metal surface by cascading said freshly abraded metal surface with powdered lime, passing the powdered lime treated treated wire through a lime slurry, then baking the slurry to the wire and applying powdered soap thereto.

2. A continuous method for conditioning wire for subsequent drawing which comprises feeding raw wire stock under tension along its axis, abrading the linearly moving raw wire stock by tangentially engaging the moving stock with rigid abrading members rotatably moving about the traveling wire, immediately thereafter successively treating said freshly abraded raw wire stock by cascading powdered lime onto the stock, passing the powdered lime treated stock through a lime slurry, and then energizing the lime coated stock between two points with an electric current to bake the coating compound thereunto during continuous travel of the wire.

3. A continuous method for conditioning wire for subsequent drawing which comprises feeding raw wire stock under tension along its axis, abrading the linearly moving raw wire stock by tangentially engaging opposite sides thereof with rigid abrading members rotatably moving about the traveling wire, then immediately thereafter successively treating said freshly abraded wire stock by cascading powdered lime thereunto, passing the powdered lime treated wire stock through a lime slurry, then energizing the coated stock between two spaced apart points with an electric current during continuous travel of the wire to bake the coating compound thereunto and passing the baked stock through powdered soap.

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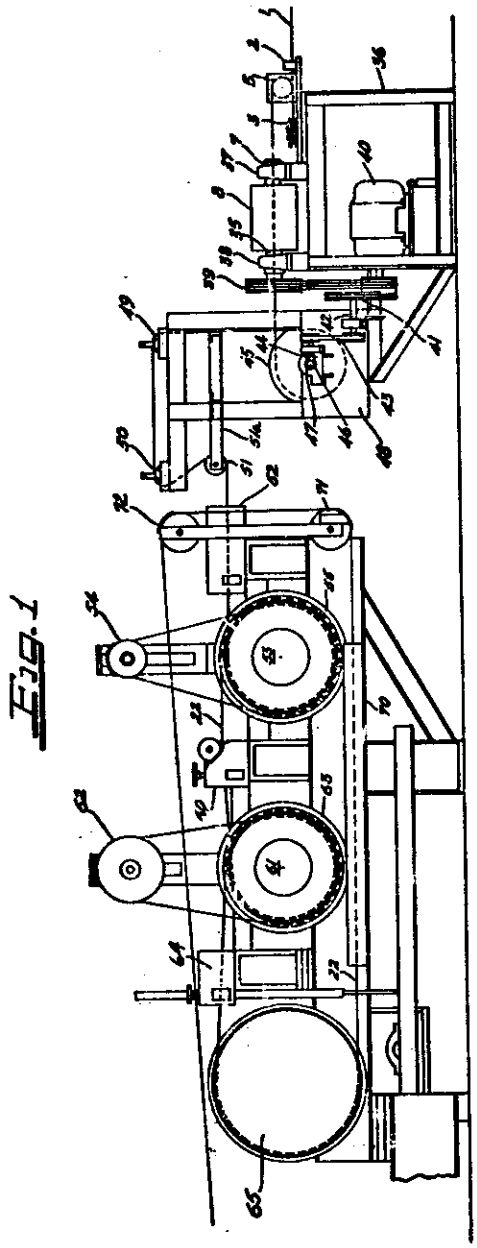

Fig. 1

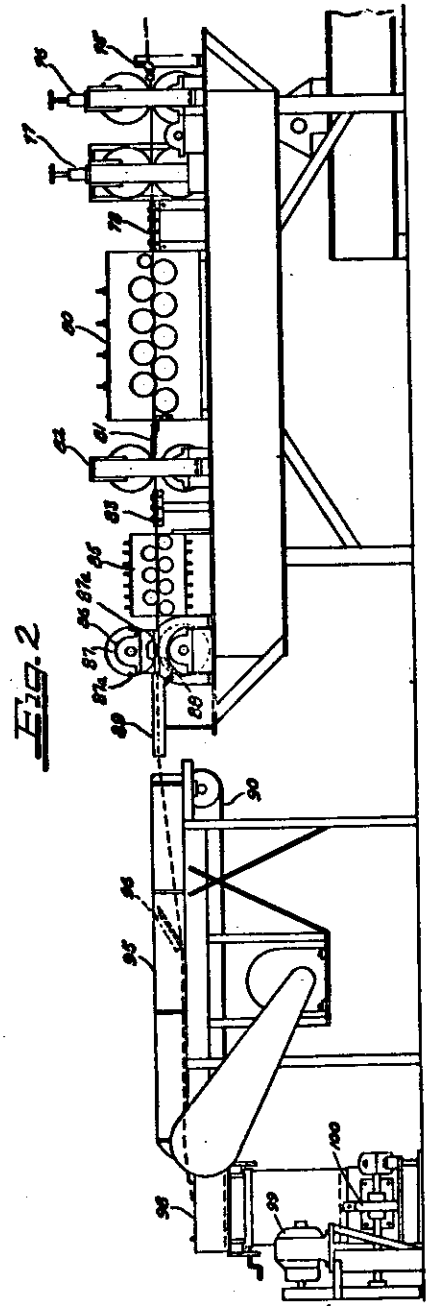

Fig. 2

Inventor
George W. Bell

Hill, Sherman, Meroni, Gross & Simpson
Attys.

by

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Fig. 3

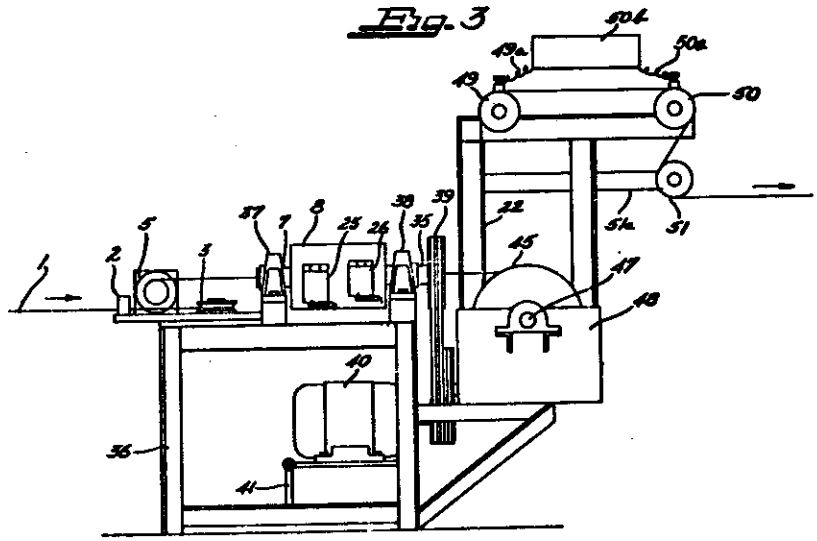
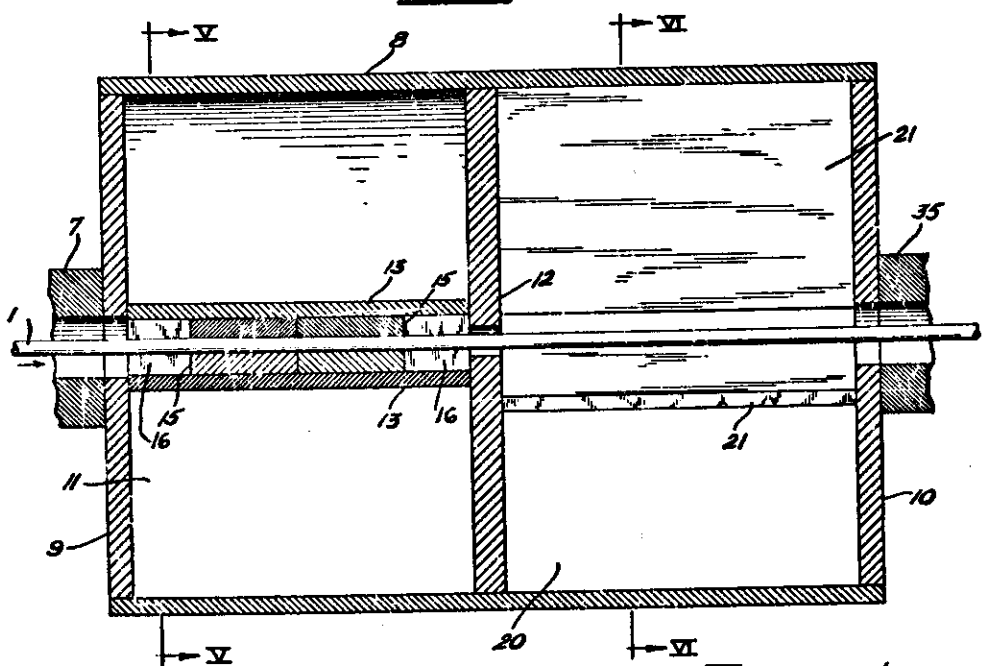


Fig. 4



Inventor
George W. Bell

Kill, Sherman, Meroni, Gross & Simpson
by Attys.

Nov. 17, 1959 G. W. BELL 2,913,354

CONTINUOUS METHOD FOR CONDITIONING WIRE

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Fig. 5

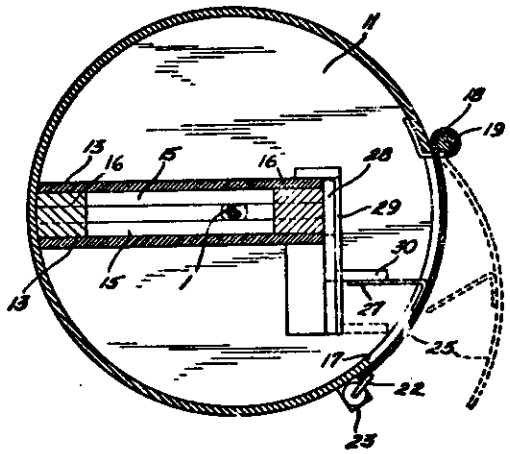


Fig. 6

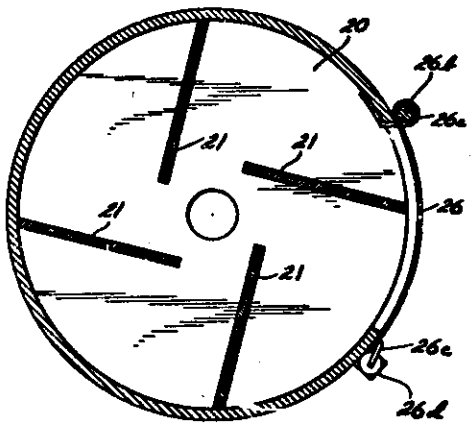


Fig. 7

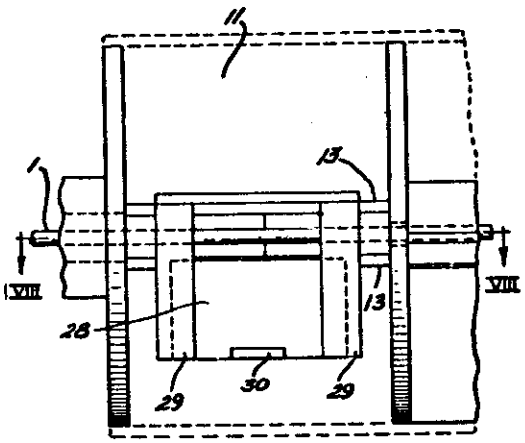
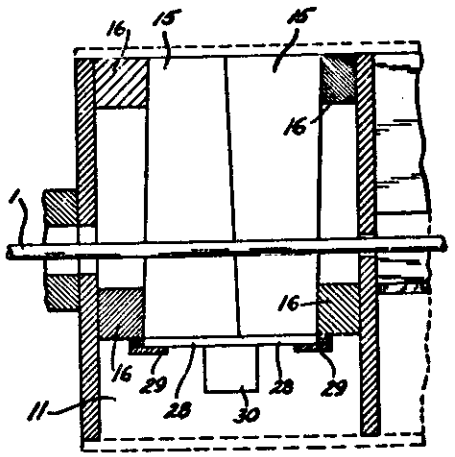


Fig. 8



Inventor
George W. Bell

Will, Sherman, Meroni, Gross & Simpson
by Attys.