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G. BAEHR.

TUBE DRAWING APPARATUS.

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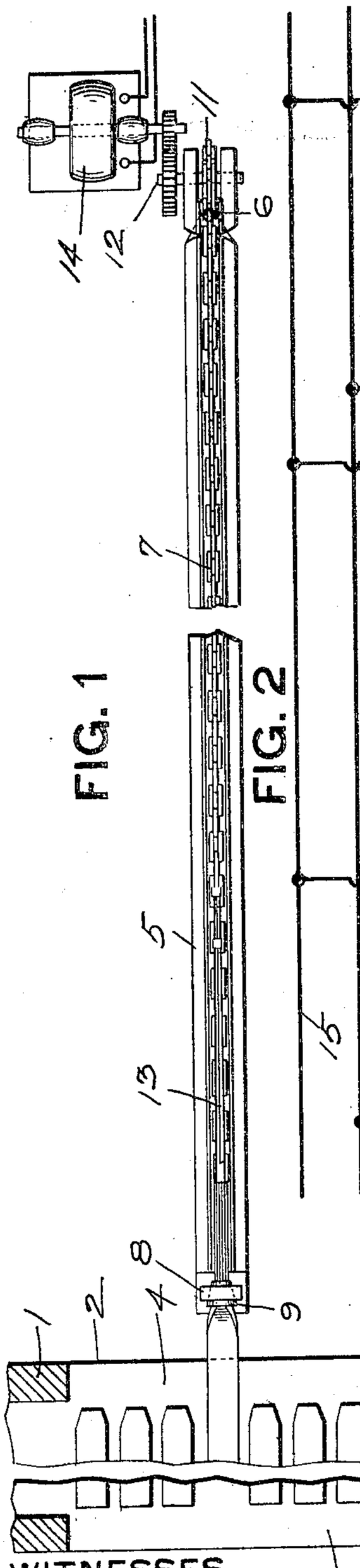

FIG. 1

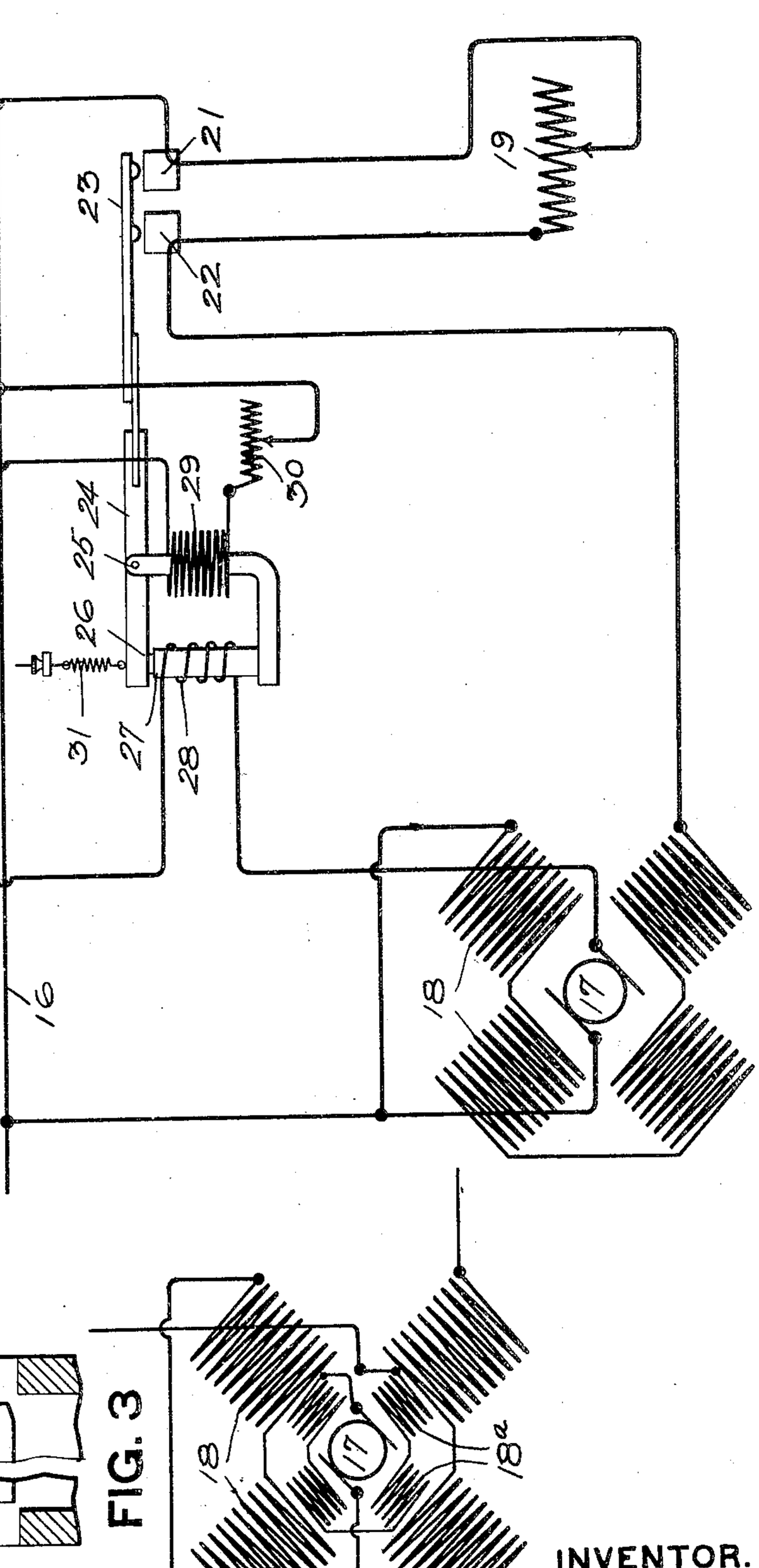

FIG. 2

FIG. 3

WITNESSES.

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TUBE-DRAWING APPARATUS.

No. 808,620. Specification of Letters Patent. Patented Jan. 2, 1906.

Application filed September 17, 1904. Serial No. 224,894.

To all whom it may concern:

Be it known that I, GEORGE BAEHR, a resident of McKeesport, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Tube-Drawing Apparatus; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for drawing tubing and the like, the more especially for the drawing of heated blanks through a bell and butt-welding the edges thereof.

The object of my invention is to provide apparatus for this purpose so arranged that it will run at a low speed while under an idle or friction load and at a higher speed when under a drawing or welding load, the change from the one speed to the other being made automatically and the higher speed being adjustable manually in order to adapt the same to the drawing of various sizes and kinds of blanks.

In the manufacture of butt-weld tubing the practice is to charge plates of the desired size into a welding-furnace and therein raise the same to a welding temperature. Then said plates are seized by tongs and the latter are connected to a traveling chain on a draw-bench in front of the furnace, by means of which the plate is drawn out of the furnace and through the welding-bell, being thereby bent into tubular form and the edges butt-welded together. The permissible speed of the draw-chain at the time the tongs are attached thereto is limited by several conditions. If the speed of the chain is too high when the tongs are attached thereto, there is danger of pulling the tongs off the blank or of pulling a piece out of the blank. When the tongs are connected to the draw-chain, they are compelled to overcome the static inertia of the blank lying in the furnace, and as a consequence there is a decided jerk at this time. Furthermore, when the forward end of the blank strikes the welding-bell the shock of impact, if the speed of drawing is very high, may result in the disengagement of the tongs from the blank. Furthermore, the drawing-chains on these benches run continuously, and the tongs are engaged with the chain manually. If the speed of the draw-chain is very high, difficulty is experienced in connecting the tongs therewith. In view of the several conditions just named the permissible speed of drawing butt-weld tubing in actual practice has been limited to a maximum of about four hundred feet per minute when butt-welding small-sized tubes and three hundred feet per minute when butt-welding larger-sized tubes. In order to increase the output of the furnace, and more especially when welding blanks of considerable length, it is desirable that the blanks be drawn through the bell at the highest permissible speed. It has therefore been proposed to impart a variable speed to the draw-chain, giving a low speed thereto when running idle, so that when the tongs are first engaged therewith the jerk in starting the blank in the furnace and impact when the front end of the blank strikes the bell will not be so severe as to jerk the tongs from the blank or tear out a piece of the forward end of the blank, this low speed continuing until the forward end of the blank has entered the welding-bell and the plate has begun to curl into tubular form and then increasing the speed of the draw-chain and drawing the remainder of the blank through the bell at the increased speed, thus reducing the time of the drawing operation and making it possible to draw a larger number of blanks within a given time.

The present invention is designed especially for the purpose just named, the object being to provide apparatus, especially an electric-motor system, for driving such chain at a substantially constant low speed when running idle and at a substantially constant higher speed when the drawing strain is thrown thereupon, this change from the low to the higher speed being brought about automatically and by means which will quickly change from the lower to the higher speed.

Another object is to provide apparatus of the kind described so arranged that the higher speed can be varied manually, so as to adapt the same to drawing blanks of different sizes and characters and which should be drawn at different speeds in order to secure the best results.

In the accompanying drawings, Figure 1 is a diagrammatic plan view of the furnace and a draw-bench in front thereof. Fig. 2 is a diagram showing the motor system for driving the draw-chain, and Fig. 3 is a detail view showing a compound-wound motor.

The welding-furnace is shown at 1, this being of the usual or any preferred type and being provided with a hearth 2 for support-

ing the tube-blanks, a charging-opening 3, and a withdrawing-opening 4. In front of this furnace is located any suitable drawing apparatus, which preferably is arranged to move laterally in front of the furnace, so as to bring it into line with any one of the blanks in the furnace. The drawing apparatus illustrated is a drawing-bench 5, pivoted at 6 and mounted on suitable wheels, so that it can be swung into line with all of the blanks in the furnace. This bench will be provided with suitable drawing means, preferably a continuously-running draw-chain 7, and as my invention can as well be illustrated in connection with such a chain as with a reciprocating or other drawing mechanism I will describe the same in connection therewith. This draw-bench has at its forward end the bell-holder 8 for receiving the welding-bell 9, as is common in the art. The continuously-running draw-chain 7 passes over a sprocket-wheel (not shown) at the forward end of the bench and over a sprocket-wheel 11 upon a driving-shaft 12, located at the rear end of the bench. The tongs for connecting the blank to the bench are shown at 13, and these may be of any of the well-known forms of tongs now in use.

The driving-shaft 12 will be driven by an electric motor 14, which is controlled by the automatic speed-regulating system, which is shown diagrammatically in Fig. 2. In this figure the power-mains are shown at 15 and 16, respectively. The armature of the motor 14 is shown at 17 and the field-coils at 18. The motor illustrated is of the shunt-wound type, this being preferred as being the most efficient for my purpose. Arranged in series with the field-magnets of the motor is a resistance device 19, which may be of any suitable form and which preferably will be adjustable manually, so that it can be regulated at will. This resistance device is arranged to be cut into or out of circuit with the field-magnets of the motor automatically, according to the load on the motor, the arrangement being such that when the motor is running idle or under its friction load the resistance device will be short-circuited, whereas when the drawing strain comes on the motor the short circuit will be broken, thus placing the resistance device in series with the field and weakening the latter, and thereby increasing the speed of the motor in a manner well known to those skilled in the art. This result may be accomplished in various ways. In the drawings is shown an automatic magnetic circuit making and breaking device for controlling the short circuit of the resistance 19. This circuit-controlling device consists of two terminals 21 and 22, located in the circuit on opposite sides of the resistance device 19, together with a conducting member 23, arranged to bridge said terminals, and thus form the short circuit for such resistance device. The bridge-piece 23 is connected to a lever 24, pivoted at 25, and having thereon an armature 26, lying opposite the pole 27 of a suitable electromagnet. This magnet is provided with two coils, the coil 28 being in series with the armature 17 of the motor, while the coil 29 is bridged across the mains 15 and 16. These coils have the same number of windings or ampere-turns; but the coil 29 is wound oppositely from the coil 28 and is of finer wire, and therefore has a less current-carrying capacity than the coil 28. An adjustable resistance 30 is placed in series with the coil 29. An adjustable spring 31 acts on the armature 26 to normally hold the same away from the pole 27 of the magnet and to normally keep the bridge-piece 23 in contact with the terminals 21 and 22, so as to normally short-circuit the resistance device 19.

In the operation of the motor system described the resistance device 30 will be so adjusted that the coil 29 will exactly balance the coil 28 when the motor is running under a friction load—that is, the load driving the draw-chain idly. Inasmuch as the two coils are wound in opposition, no magnetic forces will be manifest at the pole 27, and as a consequence the spring 31 will maintain the short circuit around the resistance device 19, so that the field of the motor will be at its maximum strength. This will give a relatively low speed to the motor, as will be readily understood. As a consequence the draw-chain will be driven at the lower speed, so that when the tongs and tube-blank are attached thereto the jerk incident to starting the blank in the furnace and the impact when the front end of the blank strikes the bell will not be so high as to disengage the tongs from the blank. As soon, however, as the forward end of the blank enters the bell the pulling strain very greatly increases, thus throwing a load on the motor. This, as is well understood, will slightly decrease the speed of, and counter electromotor force in, the motor-armature, thus causing an increased flow of current through said armature. This increased flow also passes through the coil 28 of the magnet, thus overbalancing said magnet and creating magnetic lines of force at the pole 27 thereof. This will attract the armature 26, which through the lever 24 will lift the bridge-piece 23, thus breaking the short circuit around the resistance device 19 and placing said resistance in series with the field of the magnet. As a result the motor-field will be weakened and said motor will speed up, as will be readily understood. As soon as the blank has been drawn entirely through the bell the strain on the drawing-chain and motor will suddenly and sharply decrease. This will cause the motor-armature to momentarily speed up, thus increasing the counter electromotor force thereof and at once cutting down the current flowing through said armature. As a result the current flowing through the coil 28 will be decreased to such

an extent that it will again be balanced by the current flowing through the balancing-coil 29, and the magnetic field at the pole of the magnet will be destroyed, or at least so far reduced that the spring 31 will be able to draw the armature 26 away from the magnet-pole and again establish the short circuit around the resistance device 19. The strength of the motor-field will therefore again be increased and said motor will run at the lower speed.

The motor by the system described is driven at only two speeds—a low speed when running under its friction load and a higher speed when drawing the blank through the bell. The higher speed can be varied by changing the variable-resistance device 29. This is effected manually, so that the apparatus may be set to secure various high speeds. This is desirable for the reason that light and small blanks can advantageously be drawn at a much higher speed than heavy and large blanks. The motor will automatically change from the low to the higher speed in the manner described, no matter at which higher speed the resistance 19 may be set.

The motor has been described as a shunt-wound motor; but a compound-wound motor is also suitable for my purpose. This is shown in Fig. 3, wherein in addition to the shunt-coils 18 the motor is provided with the series coils 18ª. In this case the shunt-coils 18 are connected to the resistance device 19 in the manner shown in Fig. 2, and the speed variation is effected in the same manner as in the preferred arrangement. The compound-wound motor has of course a "shunt-magnet," and under this term in the claims I intend to include both shunt-wound and series-wound motors.

By means of the automatic regulating system shown and described the speed of the motor will be automatically increased and decreased, this being effected entirely by the load on the motor. The system described is very simple, requiring only simple apparatus for carrying it into effect, and the operation is very rapid, the change from the lower to the higher speed taking place very rapidly, so that tube-blanks can be pulled in the minimum amount of time. In this manner the output is greatly increased. The system is also adapted to be set manually to secure various high speeds in order to adapt it to advantageously draw blanks of various sizes and weights.

What I claim is—

1. In apparatus for forming tubing, the combination of drawing mechanism, and means for actuating said mechanism, said actuating means being arranged to run at two substantially constant speeds and to automatically change from the one speed to the other by the drawing strain.

2. In apparatus for forming tubing, the combination of drawing mechanism, and means for actuating said mechanism, said actuating means being arranged to run at two substantially constant speeds and to automatically change from the one speed to the other by the drawing strain, and manually-operated means for varying the higher speed.

In testimony whereof I, the said GEORGE BAEHR, have hereunto set my hand.

GEORGE BAEHR.

Witnesses:
ROBERT C. TOTTEN,
G. KREMER.