Aug. 16, 1938. E. ROMANELLI 2,126,923

SWAGING MACHINE

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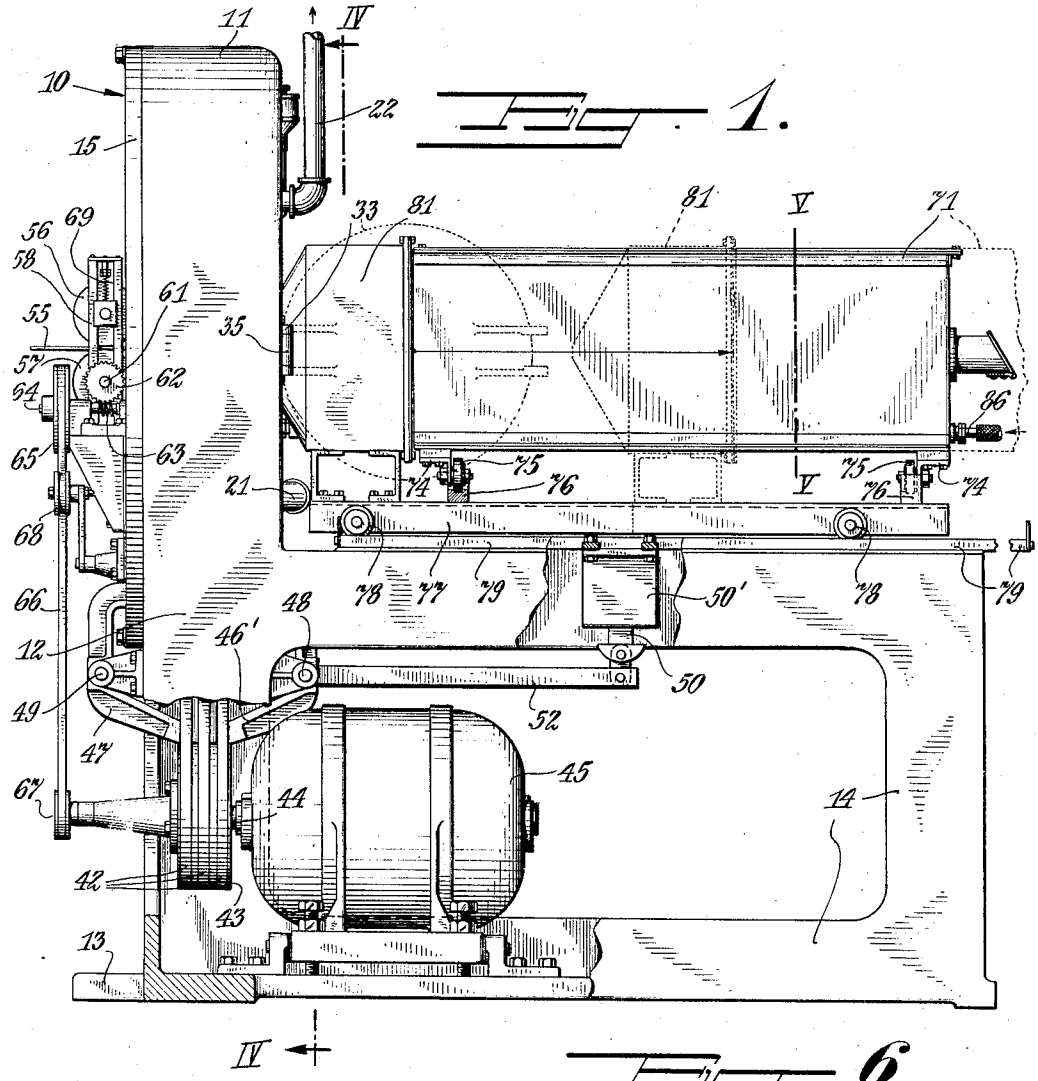


Fig. 1.

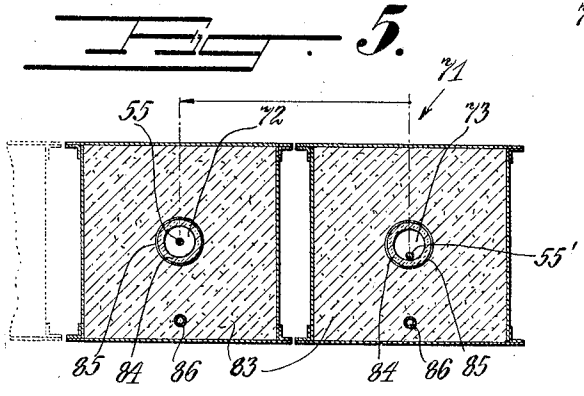


Fig. 5.

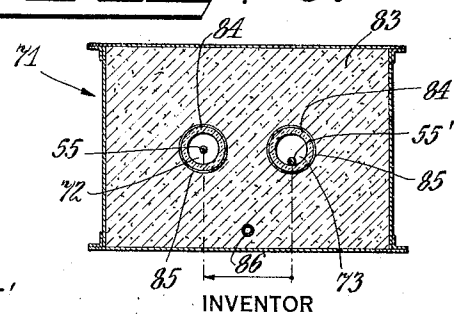


Fig. 6.

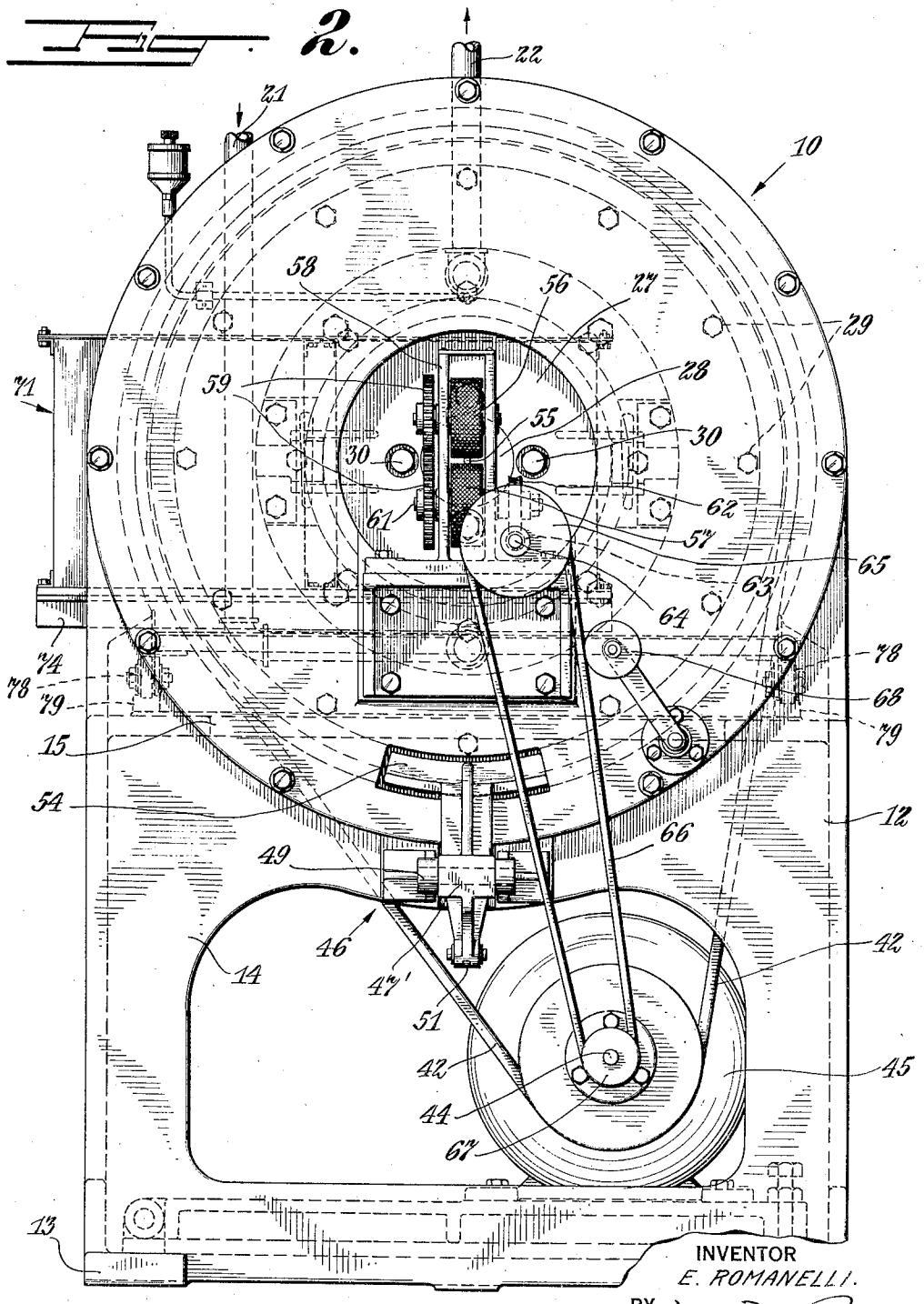
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SWAGING MACHINE

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Fig. 2.



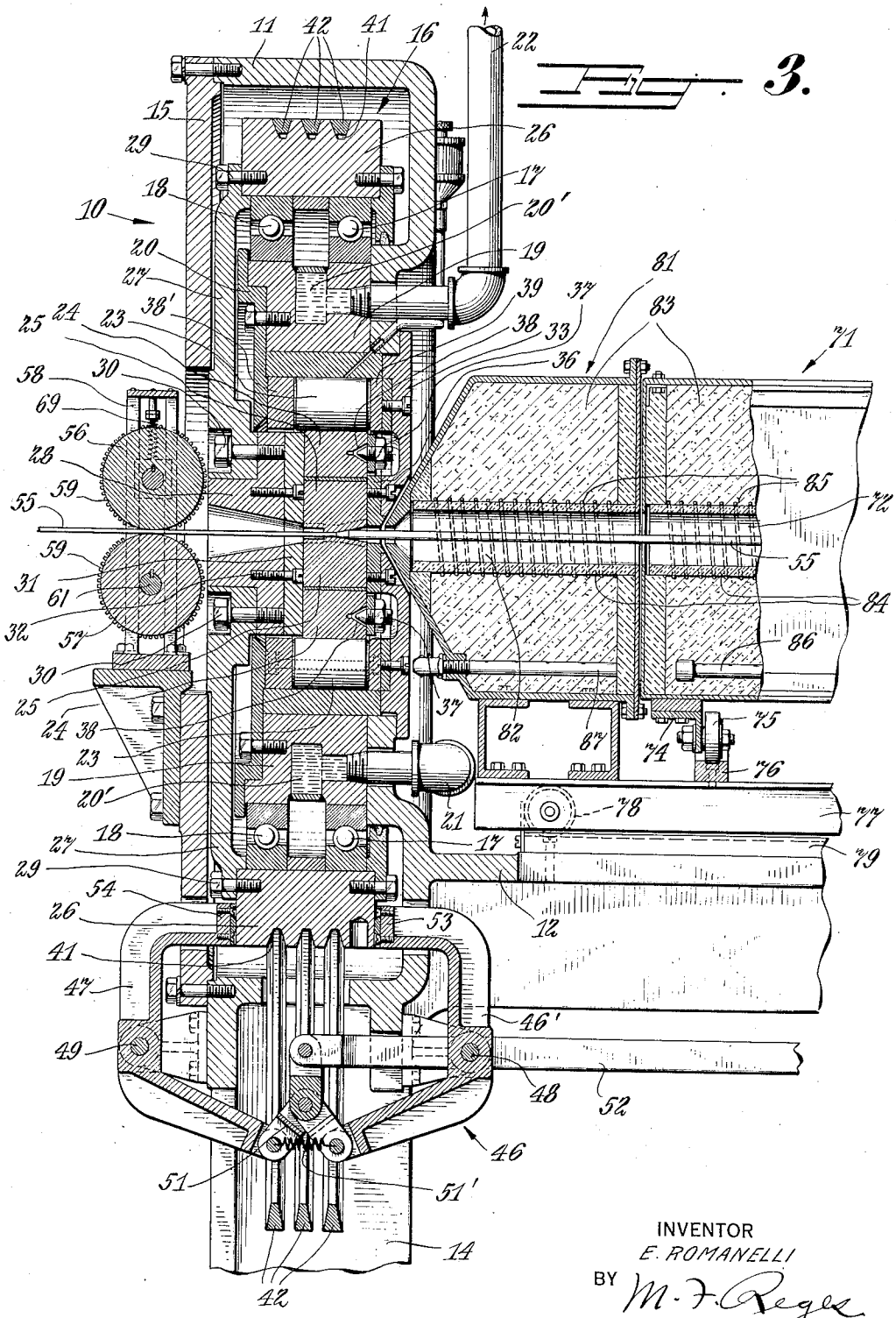
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Fig. 3.



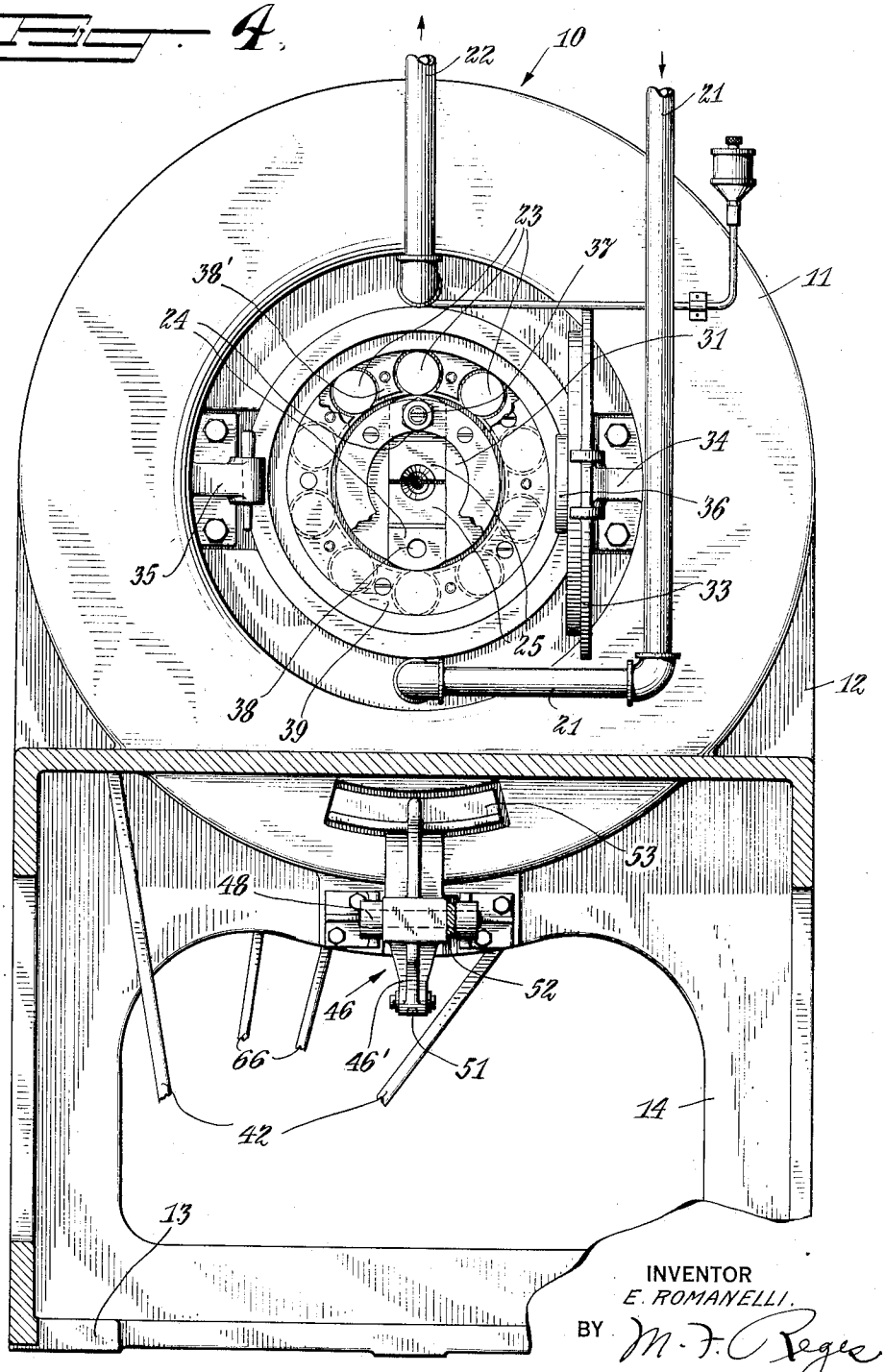
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Fig. 4.



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UNITED STATES PATENT OFFICE

2,126,923

SWAGING MACHINE

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Application February 21, 1935, Serial No. 7,483

7 Claims. (Cl. 78—18)

This invention relates to a swaging machine and, more particularly, to one for swaging tungsten slugs or bars to be drawn into wire form.

Swaging machines as commonly employed include a relatively long spindle having a fly-wheel mounted at one end. The other end of the spindle is usually enlarged and slotted to receive dies and hammers. The dies and hammers move freely and radially in the spindle slot. Around the enlarged end of the spindle is disposed a series of rolls backed up by a hardened head ring. The rolls are uniformly spaced in a cage and as the spindle is rotated the hammers and dies are thrown outwardly by centrifugal force. As the spindle rotates, however, the hammers contact with the rolls with the result that the dies are forced against the material which is thus compressed or swaged.

In machines as heretofore used in which it was the practice to mount the fly-wheel at one end of the spindle, the material to be swaged being fed in through the opposite end, relatively long bearings were required for the spindle and any play or lost motion would result in considerable vibration. Furthermore, machines of this character require a considerable amount of space and are on the whole cumbersome and, when using such machines to swage a tungsten body into a rod to be drawn into a wire, it becomes inconvenient to handle the swaged wire and also somewhat difficult to feed the body which is preferably delivered to the hammers directly from a furnace. The addition of a furnace to swaging machines as heretofore constructed would increase the length of the machine.

It is an object of the present invention to provide an effective and compact swaging machine.

Another object of the invention is to provide a swaging machine in which the swaging elements are mounted on the axis of rotation and are centrally located with respect to a fly-wheel.

A further object of the invention is to so arrange and correlate the operating elements as to prevent detrimental vibration.

A still further object of the invention is to provide a combined furnace and swaging machine so arranged as to facilitate the delivery of heated material to be swaged from the furnace to said machine.

Another object of the invention is to provide a multiple furnace adapted to simultaneously heat one article to be swaged and deliver another article to a swaging machine.

Other objects and advantages of the invention will be more clearly understood by reference to the following description together with the accompanying drawings in which:

Fig. 1 is a side elevational view of a machine constructed in acordance with the present invention;

Fig. 2 is an enlarged front elevational view of the machine shown in Fig. 1;

Fig. 3 is a vertical sectional view of the machine showing the swaging elements and heating ovens;

Fig. 4 is a view taken on line IV—IV in Fig. 1;

Fig. 5 shows a pair of movable ovens each in a separate furnace and

Fig. 6 is a single movable furnace having two ovens.

A machine constructed in accordance with the present invention may, as shown in Fig. 1, include swaging mechanism 10 comprising a casing 11 carried on a frame or support structure 12 of the machine. This structure may include a base plate 13 and a frame work 14 on which the various elements are mounted.

The casing 11 may have a removable cover plate 15 of circular form to enclose a weighted pulley or fly-wheel 16. The fly-wheel may be mounted to rotate on anti-friction means, such as ball-races 17 and 18, which races are mounted on an annulus 19 in which the swaging mechanism is supported. This annulus is rigidly mounted in the casing 11 and a flange piece 20 is bolted thereto and extends inwardly to retain certain of the swaging elements. Inasmuch as the fly-wheel rotates at relatively high speed, a large amount of work is done by the dies, and considerable heat is generated, the annulus 19 is, therefore, provided with a liquid passage 20' and an inlet pipe 21 may supply oil or other cooling fluid to the passage, which fluid is removed by outlet pipe 22. The fluid may be kept in circulation by suitable means to dissipate heat. The swaging elements, including rolls or rollers 23, hammers 24, and dies 25, are similar in construction to mechanism heretofore employed in swaging machines.

In accordance with the present invention, these elements are mounted at the wheel center of the fly-wheel 16 which, as shown, includes a rim 26, a disk 27 and a hub 28. The disk is secured to the rim by tap-bolts 29 and to the hub by tap-bolts 30. The hammers 24 and the dies 25 are disposed between a diametrically-grooved backer plate 31, secured by tap-bolts 32 to the hub 28, and a door or plate 33 mounted on a hinge 34 and provided with a latch 35. The door 33 has a conical aperture, the sides of which flare

outwardly at an obtuse angle to cooperate with the correspondingly shaped end of an associated furnace 81, for receiving swageable material therefrom without appreciable loss of heat.

The door is provided with a plate 36 which, in conjunction with plate 31, holds the dies in operative relation. The hammers, which with the dies 25 are movably mounted in a corresponding diametrical groove in the plate 31, shown vertical in Fig. 4, are held for radial movement by pins 37 which extend into enlarged apertures 38 to allow free and sufficient movement of the hammers under the action of the rolls 23. The rolls are held between cage rings 38' and head rings 39. The rollers 23 are, as shown, mounted about the annulus 19 and so arranged as to engage the hammers 24, which in turn engage the dies 25 as the dies and hammers rotate with the fly-wheel. The centrifugal force moves the dies and hammers outwardly and as the rollers strike the hammers the dies are forced inwardly, thus producing the swaging operation. This construction is well known in the swaging art.

The fly-wheel 16 is provided with belt grooves 41 to receive a belt 42 driven by a motor 45. A brake device 46 comprising lever arms 46' and 47 may be provided to stop the rotation of the fly-wheel upon a termination of the swaging operation. The arms 46' and 47 may be pivoted at 48 and 49 respectively and a toggle member 51 may be connected to the lower ends of the arms so that when the toggle is extended or straightened by an actuation of a lever 52 the upper ends 53 and 54 of the arms will frictionally engage opposite sides of the fly-wheel to terminate its movement. The arm 52 is pivoted at 48 and connected at one end to an armature 50 of a solenoid 50'.

The circuit including the solenoid may be so arranged with respect to the motor that when the motor operates to rotate the fly-wheel the armature moves to rock the arm 52 to permit a spring 51' to break the toggle 51 and release the brake. When the current is cut off and the motor is not operating, the solenoid causes the arm 52 to actuate the toggle to move ends 53 and 54 of arms 46' and 47 and terminate the rotation of the fly-wheel.

It has also been found practical to provide the solenoid with a separate circuit in which case the armature of the solenoid may be actuated by means of a push button to cause current to energize the coils of the solenoid and thus move the arm 52 causing the brake to act. The ends 53 and 54 of the arms may be provided with suitable friction pads to facilitate the braking operation.

Material or stock such as a rod 55 of tungsten is fed to the dies through the doorway and after being subjected to the swaging operation is removed by means of force rollers 56 and 57 between which the swaged material is fed.

The force rollers 56 and 57 may be mounted one above the other in bearing brackets 58 adjacent to the outlet side of the swaging dies. Each roller is provided with a gear wheel 59 in mesh. A shaft 61 of the lower roller is provided with a worm wheel 62 in mesh with a worm 63 (see Fig. 1) on a shaft 64. The shaft 64 is provided with a pulley 65 having a belt 66 leading over a pulley 67 at one end of the motor shaft 44. Thus when the motor 45 operates to drive the fly wheel the pulley 67 operates to transmit rotary motion to the rollers 56 and 57. An idler roller 68 is provided to take up any slack in the belt 66. The bearing boxes for the upper roller are slidable in the brackets 58 and a spring 69 holds the rollers in the desired gripping relation. The dimensions of the pulleys 65, 67 and the worm and worm wheel may be so proportioned with respect to the pulley 43 which drives the fly-wheel that the swaged material will be discharged in the proper time relation to the swaging operation.

Although the present swaging machine may be used for swaging articles of various forms such as tubes, rods, etc., it is especially adapted to swage tungsten rods taken directly from a furnace. In accordance with the present invention, therefore, the present apparatus includes a portable furnace 71 which cooperates with the swaging mechanism to facilitate the swaging of heated rods.

The furnace 71 includes a plurality of ovens preferably indicated by the reference numerals 72 and 73 and is mounted on transverse brackets 74 provided with wheels 75 movable on tracks 76. The tracks 76 are mounted on a carriage 77 having wheels 78 movable along tracks 79 secured to the stationary frame of the machine. The tracks 79 are arranged to permit a movement of the furnace to and from the swaging head and, by reason of the tracks 76, the furnace may be adjusted sidewise to position an oven in alignment with the swaging dies so that a rod of suitable material may be fed directly from the oven for a swaging operation. The ovens may, as shown in Fig. 5, be in separate insulated containers or, as shown in Fig. 6, a single unit may be provided with two or more ovens.

Although the furnace 71 may be used directly in cooperation with the swaging machine, it has been found more desirable to provide a supplemental furnace 81, the delivery end of which is obtusely conical to fit the conical aperture in the door 33, the apex of said end being on the axis of the delivery aperture therefrom, having an oven 82 held stationary with respect to the carriage 77.

The ovens 72 and 73 being movable as above described, may be adjusted to align a rod of material to be swaged. Oven 72 for example may be aligned with the oven 82, or a rod 55' in the oven 73 may be aligned with the oven 82. The oven 82 being in permanent operative alignment with the swaging dies serves not only as a means of keeping the stock at the required temperature up to the point of swaging, but also serves as a guideway for directing the stock to the swaging dies.

The furnaces may be of any suitable construction and, in the selected embodiment shown, each furnace includes a casing filled with magnesium oxide powder 83, or other suitable insulating material, through which extends an oven comprised of a refractory tube, preferably an alundum tube 84, having a winding 85 of a resistance or high melting point material, such as molybdenum wire, as a heater. Means in the form of perforated pipes 86 and 87 are provided to admit hydrogen to protect the heater elements.

The present invention makes it possible to perform a substantially continuous swaging operation on material heated to a uniform temperature since, while one piece of material is being swaged, another is being heated. The portability of the ovens not only facilitates the delivery of the material to the dies, but, by reason of the construction shown, the entire furnace assembly may be moved on carriage 77, away from the swaging heat to permit access to the swaging elements.

It is important in the swaging of certain materials such as tungsten to be drawn into lamp

filament wire that the piece being swaged be kept at a constant temperature. This is made possible in the present machine and results in uniformity in the crystal arrangement of the swaged metal to the end that an improved product is attained.

It is also possible to provide uniformity in the degree of swaging since, by reason of the positive feed provided in the form of the force rollers **56** and **57**, a constant travel per unit of length per minute is possible and the quality and uniformity of the swaged article is improved.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed:

1. A swaging machine comprising a casing, an annular member mounted in and connected to one side of said casing, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, and a plate secured to said casing and holding said die means, hammers and rollers in place.

2. A swaging machine comprising a casing, a hollow annular member mounted in and connected to one side of said casing, means for circulating cooling fluid through said hollow member, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, and a plate secured to said casing holding said die means, hammers and rollers in place, said plate having a conical aperture, the sides of which flare outwardly at an obtuse angle, for cooperating with the correspondingly shaped adjacent end of a furnace and receiving material to be swaged by said die means.

3. A swaging machine comprising a casing, an annular member mounted in and connected to one side of said casing, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, a plate secured to said casing and holding said die means, hammers and rollers in place, and brake means comprising levers pivoted intermediate their ends, end portions of said levers passing through openings in said casing, a toggle device connecting the other end portions of said levers, and operating means for straightening said toggle device to cause said first mentioned end portions to frictionally engage said fly-wheel on opposite sides.

4. A swaging machine comprising a base, a casing extending upwardly from one portion of said base, an annular member mounted in and connected to one side of said casing, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, and a plate secured to said casing and holding said die means, hammers and rollers in place, said plate having a conical outwardly-flaring aperture for receiving material to be swaged by said die means.

5. A swaging machine comprising a base, a casing extending upwardly from one end portion of said base, a hollow annular member mounted in and connected to one side of said casing, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, a plate secured to said casing and holding said die means, hammers and rollers in place, said plate having a conical outwardly-flaring aperture for receiving material to be swaged by said die means, rollers disposed on the side of said die means opposite to that adjacent said furnace, and electrical power means for driving said fly-wheel and said rollers simultaneously, for swaging said material and drawing it through said die means.

6. A swaging machine comprising a base, a casing extending upwardly from one end portion of said base, a hollow annular member mounted in and connected to one side of said casing, means for circulating cooling fluid through said hollow member, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die

means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, and a plate secured to said casing and holding said die means, hammers and rollers in place.

7. A swaging machine comprising a base, a casing extending upwardly from one end portion of said base, a hollow annular member mounted in and connected to one side of said casing, means for circulating cooling fluid through said hollow member, a fly-wheel enclosed in said casing and comprising a hub portion encircled by said annular member, a disc portion extending therefrom and disposed between the other side of said casing and said annular member, and an outer peripheral portion secured to the outer edge of said disc portion, anti-friction means between said annular member and peripheral portion for rotatably mounting said fly-wheel, a diametrically grooved plate carried by said hub portion, die means movably mounted in said groove, hammers in said groove outwardly of said die means, hammer-actuating rollers disposed between said annular member and hammers, a plate secured to said casing and holding said die means, hammers and rollers in place, rollers disposed on the side of said die means opposite to that adjacent said furnace, electrical power means for driving said fly-wheel and said rollers simultaneously, for swaging said material and drawing it through said die means, brake means passing through an opening in said casing for frictionally engaging said fly-wheel, and circuits for said electrical power means and brake means, whereby said brake means is released when said power means is energized.

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