Our invention relates to improvements in screw threading machines, and more particularly in machines of the type comprising a pair of externally screw threaded roller dies placed one beside the other and adapted to be rotated in the same direction for rolling a screw thread into a blank placed between the same. One of the objects of the improvements is to provide a machine of this type, in which means are provided, in addition to the said roller dies, for holding the blank being rolled in position. With this object in view our invention consists in providing a support between the said roller dies spaced from the plane passing through the axes of said roller dies so far that the blank is held in position with its axis in or near the said plane. In the preferred construction the said support is located so that the axis of the blank is located slightly below the said plane. We have found that this construction is preferable because thereby it is impossible that the blank being rolled be ejected from between the roller dies by the circumferential forces transmitted thereto by the roller dies.

Our invention also relates to the manner of mounting the roller dies on the frame supporting the same. For insuring exact rolling, the said roller dies must be exactly adjusted in their positions in order that the screw threads of both dies produce exactly corresponding screw threads on the blank and further the roller dies must be mounted so that they are adapted to be moved under pressure towards each other.

In view of these requirements another object of the improvements is to construct the roller dies and bearings so that they permit such displacements, and with this object in view another feature of our invention consists in having one of the bearings of the roller dies fixed in position on the frame of the machine while the blank is being rolled, while the other roller die is mounted, together with the shaft carrying the same and the driving gear, so as to be movable on the said frame in a direction transversely of the axis of the roller dies by hydraulic pressure.

To permit axial displacement of the roller dies the bearing of one of the said dies is mounted on the frame of the machine so as to be adjustable longitudinally of the axis of the die.

Another object of the improvements is to mount the bearings of the roller dies so that they may be exactly adjusted with their axes parallel to or angularly of each other, and with this object in view our invention consists in mounting one of the said bearings in the manner of a turn table on a vertical pivot bolt the axis of which passes between the said roller dies.

To permit the said movements of the roller dies, the driven shafts carrying the same are connected with driving shafts disposed perpendicularly to the said driven shafts and parallel to each other, and the said driving shafts are made in telescoping sections permitting the same to be extended or reduced in length, according to the position of the driven shaft and its roller die, and in addition the driving shaft connected with the roller die mounted on the said turn table is constructed for being yieldable transversely of its axis, in accordance with the position of the shaft driven thereby.

By connecting parallel driven shafts with parallel driving shafts the gears connecting the driving and driven shafts are displaced with relation to each other longitudinally of the driving and driven shafts instead of being located one beside the other, so that there is sufficient room to provide strong gearings such as are necessary for transmitting the power from the driving to the driven shafts.

Another object of the improvements is to provide a machine in which excessive axial strains on the driving mechanism of the roller dies are prevented, and with this object in view our invention consists in mounting the said roller dies in their bearings so as to be yieldable in axial direction, the said roller dies being preferably acted upon by springs.

Other objects of the improvements will appear from the following description.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings:

Fig. 1 is an elevation showing the top part of the machine,

Fig. 2 is a plan view of Fig. 1 partly in section,

Fig. 3 is a side elevation of the machine,

Fig. 4 is a sectional elevation taken on the line 4—4 of Fig. 2, and

Fig. 5 is an elevation showing a modification of the blank supporting device, the blank being shown in section.

In the example shown in the figures the machine comprises a frame 1 on which the operative parts are mounted. The said operative parts comprise a pair of roller dies 2 and 3 lo-
cated one beside the other and formed about their circumferences with similar screw threads, shafts 4 and 5 to which the said roller dies are secured, shafts 6 and 7 perpendicular to the shafts 4 and 5 and connected therewith respectively by worm gearing 8, 9 and 11, a pair of gear wheels, 12, 13 connecting the shafts 6 and 7, a belt gearing 14, and a motor such as an electric motor 15 for driving the mechanism.

The said electric motor is mounted on a bracket 16 attached to the end of the frame 1, and the gear wheels 12 and 13 are enclosed within a casing 17 fixed to the frame. The shafts 6 and 7 are constructed so as to be extensible in accordance with the adjustment of the bearings of the shafts 4 and 5 to be described hereafter. As shown the said shafts 6 and 7 consist of telescoping sections connected with each other by keys. Further, the shaft 7 is capable to yield in transverse direction, and for this purpose it includes two universal joints 18 and 19, Fig. 2 showing a Hardy joint 19 by which the shaft 7 comprises a coupling consisting of a pair of flanges 20 connected by screws 21 passed through circumferential slots made in one of the said flanges.

The shafts 4 and 5 are mounted in substantially cylindrical housings 28 and 29 by means of anti-friction bearings 23 and 27, and the gears 9 and 11 are mounted on the shafts 4 and 5 so as to permit axial displacement of the shafts. The construction will be described with reference to the shaft 4, and it will be understood that the mounting of the shaft 5 and the gear 11 is similar in construction. As shown, the gear 9 is supported on step bearings 28 and 29 and it is actuated upon by a coiled spring 30 supported on a disk 31 fixed to the rear end of the shaft 4. The step bearing 28 is supported on the race rings of the anti-friction bearing 23, and the step bearing 29 is normally supported on a shoulder 22 formed within the housing 25. The spring 30 permits the shaft 4 to yield in axial direction in case of excessive axial strain being exerted by the roller die 2. The gear 9 is connected to the shaft 4 by means of a key 32 permitting axial movement of the shaft relatively to the gear.

The housing 25 is secured to or made integral with a slide 35 which is guided on the frame 1 transversely to the axis of the shaft 4 by means of guide ways 36, and it is adapted to be shifted in transverse direction for exerting rolling pressure on the blank by means of a pair of hydraulic cylinders 37 fixed to an upright 38 rising from the frame 1 and containing piston 39 and piston rods 40 acting on an upright 41 rising from the slide 35. The said cylinders have a supply of oil under pressure, and they are adapted to be retracted, when the supply of oil is interrupted, by means of a spring 42 bearing on the upright 38 and passing through the head 44 of a screw bolt 43 passed through a hole made in the upright 38 and fixed to a block 33 made integral with the slide 35. The head 44 may be provided with a suitable arm projecting towards the upright 38 and adapted for engaging the same as the slide 35 advances, for limiting the movement of the said slide.

Oil under pressure is supplied to the cylinders 31 through pipes 43 by controlling devices which will be described hereafter. For ascertaining the pressure provided to the cylinders 31 a pressure gauge 45 is provided, and for automatically interrupting the supply of oil to the cylinders an electrical control device may be provided which comprises a cylinder 46 containing a spring pressed piston 47 operating an electrical contact 48 included in an electrical circuit controlling the supply of oil, as will be described hereafter. In lieu of the said cylinder 46 and piston 47 a contact may be provided in connection with the pressure gauge 45.

The housing 26 of the shaft 5 is mounted on a plate 55 made integral with uprights 56 to which the housing 26 is secured by means of screws 57, the said screws being passed through slots made in the uprights 56 and it may be the adjustment of the housing 26 in the direction of the axis of the shaft 5. The plate 55 is mounted on the frame 1 so that it may be turned about a vertical pivot bolt 58 fixed to the frame. For setting the bed plate in position screws 53 are provided which are passed through lugs 60 rising from the frame 1, and which engage the plate 55 at points located at opposite sides of the pivot bolt 58. After thus setting the plate 55 it is fixed in position by means of screws 54.

It appears to therefore that the housing 26 is capable of movements in two directions, first of a movement-longitudinal of the axis of the shaft 5 and second of rotary movement about the pivot bolt 58. The said axial adjustment permits the rollers 2 and 3 to be adjusted with respect to each other so that the screw threads formed thereon engage corresponding portions of the surface of the blank on which the screw threads are to be produced by rolling, and the rotary movement of the plate 55 permits the rollers to be placed either with their axes exactly parallel for producing screw threads on cylindrical blanks, or with their axes at different angles for producing screw threads on conical blanks.

The different adjustments of the shafts 4 and 5 require the adjustability of the shafts 4 and 5 referred to above, and it will be understood that the movement of the housing 25 and the shaft 4 requires only longitudinal adjustment of the shaft 5, while the two different adjustments of the housing 26 and the shaft 5 require in addition lateral displacement of the outer end of the shaft 7, for which purpose the said universal joints 18 and 19 are provided.

Below the roller dies 2 and 3 a supporting member 61 is provided which is located with its top face so far below the plane passing through the axes of the said roller dies that the blank being rolled is located with its axis below the plane. Thus in rolling the dies engage the blank somewhat above the horizontal plane passing through the axes of the blank, and thereby the blank cannot be ejected from between the dies by the circumferential forces acting thereon. Preferably the said support is rookingly mounted on a bracket 62 secured to the frame 1 so that it follows the transverse movement of the right and left hand roller die 2 as roll of the screw threads proceeds. The top face of the support 61 is concaved out in accordance with the diameter of the blank.

The support 61 shown in Fig. 4 is designed for supporting solid blanks. In Fig. 5 we have shown a modification showing a support used for threading tubular blanks. As shown in the said figure the support comprises an arm 63 disposed below the roller dies and parallel to the axes thereof, the said arm being adapted to be passed into the bore of the tubular blank for supporting the blank.

In Fig. 1 we have shown a device for measuring the depth of the screw threads being rolled. The said measuring device comprises a measuring instrument 75 having a dial and a hand and
mounted at a suitable part of the machine, and a transmission gearing connected with the roller dies. As shown the said gearing consists of arms 16 and 17 rotatably mounted on disks 78 and 79 fixed coaxially to the ends of the roller dies, a link 80 connecting the said arms at their bottom ends, a link 81 connecting the arm 17 with a relatively fixed part 82 of the plate 55, an arm 83 jointed to the arm 17, a link 84 connecting the arm 83 with the arm 76, a spring 85 intermediate the said arms 83 and 76 and preventing lost motion in the joints of the arms 83 and 76, and a rod 86 connecting the arm 83 with the mechanism of the measuring instrument 75. At the top end of the arm 83 an insulated contact 87 is provided which cooperates with a contact screw 88 carried by the arm 71, the insulated contact 87 being connected by a lead 93 with the electromagnet 78.

When the roller die 2 is advanced by the slide 38 towards the roller die 3 for rolling the threads on the blank the arm 71 is held in position by the link 81, while the arm 76 is turned with its top end to the left, and this movement is transmitted through the link 84 and the rod 86 to the measuring instrument 75 which therefore indicates the advance of the rolling operation. When the insulated contact 87 makes contact with the screw 88 the electric circuit of the electromagnet 78 is closed through the lead 89 and through the body of the machine, so that the supply of oil to the cylinders 37 is interrupted. By means of the contact screw 88 the apparatus may be set in accordance with the inner diameter of the screw threads to be rolled on the blank.

The operation of the machine is as follows:

The blank to be threaded is placed between the roller dies 2 and 3, and the said roller dies are advanced towards each other so as to loosely engage the said blank. The housing 80 is adjusted on the bed plate 55 by loosening the screws 87, shifting the housing on the bed plate axially of the roller dies and again fixing the same in position by means of the screws 87. Exact adjustment of the screw threads relatively to each other is obtained by disconnecting the disks 78 of the shaft 7 and turning the same relatively to each other, the said rotary movement being transmitted through the shaft 7 to the roller die 2. The angular position of the roller dies is adjusted by loosening the screws 84 and turning the metal plate 56 about its pivot bolt 56, the bed plate being finally fixed in position by means of the screws 84.

After the operative parts of the machine have thus been adjusted oil under pressure is admitted to the cylinders 37 by opening the valve controlled by the lever 85, the pressure of the oil within the cylinders 37 being gradually increased. Simultaneously the electromotor 100 is switched in for imparting rotary movement to the roller dies 2 and 3. As the roller die 2 is advanced towards the die 3 the hand of the measuring instrument 75 advances, thus showing the advance of the rolling operation. Finally the insulated contact 87 engages the screw contact 88, thus energizing the electromagnet 78 and interrupting the transverse movement of the roller die 2.

The supply of pressure to the cylinders 37 is controlled by means of a valve chest 65 having a supply of oil under pressure through a pipe 43 connected with the aforesaid oil supply pipes 43 to the cylinders 37. Within the valve chest 75 a valve is located which is operated by means of a hand lever 88 and a rod 89. Further, the said valve may be closed independently of the rod 89 by means of an electromagnet 78 acting on a lever 71, the said electromagnet being energized through leads 72 including the aforesaid contact 88.

We claim:

1. In a screw threading machine, comprising a pair of roller dies placed one beside the other in position for receiving a blank between the same, shafts on which said roller dies are mounted, common driving means for said shafts, and driving connections between said driving means and each of said shafts, the improvement herein described which consists in a separable coupling arranged in the connection between the driving means and one of said shafts, said coupling when disengaged permitting the rotation in circumferential adjustment of one of the said roller dies relatively to the other.

2. In a screw threading machine, comprising a frame, a pair of roller dies mounted on said frame one beside the other in position for receiving a blank between the same, and bearings for said roller dies mounted on said frame, the bearings of one of said dies being moveable transversely of the axes of said roller dies, the improvement herein described which consists in hydraulic means for automatically moving the bearings of one of said dies toward the axial line of the companion die as the thread-cutting progresses, and for holding the die under pressure to the work throughout the thread-cutting operation, and means for controlling the hydraulic pressure actuated on said bearing.

3. In a screw threading machine, comprising a frame, a pair of roller dies placed one beside the other and adapted to receive a blank between the same, bearings for said roller dies, means for forcing the bearings of the dies severally towards each other, and driving means for said shafts, the improvement herein described which consists in a table mounted on said frame and supporting the bearings of one of said dies, said table having pivotal movement about an axis perpendicular to the common axial plane of the said dies and passing between the said roller dies, whereby the position of the table and of the bearings borne thereby may be adjusted, and means for securing said table in adjusted position on said frame.

4. In a screw threading machine comprising a pair of roller dies placed one beside the other and adapted to have a blank placed between them, means for rotating said roller dies, and means for forcing said roller dies toward each other for exerting rolling pressure on said blank, the improvement herein described which consists in indicating means connected with said roller dies and adapted to indicate the distance between the axes thereof, the said indicating means being in the form of links arranged substantially in the form of a parallelogram, two opposing links being rotatably mounted on the axis of said roller dies, an arm pivotally mounted on one of said links mounted on said roller dies and connected with the link mounted on the other one of said roller dies, and an indicating instrument connected with said arm.

5. A screw threading machine, comprising a pair of roller dies placed one beside the other and adapted to have a blank to be rolled placed between the same, means for rotating said dies,
hydraulic means for forcing said roller dies towards each other for exerting rolling pressure on said blank, a valve controlling the supply of pressure fluid to said hydraulic means, and electrical means controlled by said roller dies adapted to close said valve when the roller dies have been advanced towards each other to a predetermined distance.

6. In a screw-threading machine that includes a pair of roller dies formed with external screw threads and adapted to receive between them a blank to be threaded, and means for rotating the dies, the improvement herein described that consists in means for holding one of the rotating dies to engagement upon an introduced blank yieldingly and under thread cutting pressure, and means effective on the relief of such pressure for retracting said die.

7. In a screw-threading machine that includes a pair of roller dies formed with external screw threads, arranged in parallelism, and adapted to receive between them a blank to be threaded, means for rotating the dies, and means for advancing one of the dies toward the other as operation progresses, the improvement that consists in a support adapted to hold a blank to position to be operated upon by said dies, the support being movable in a direction transverse to the axes of the roller dies.

8. In a screw-threading machine that includes a pair of roller dies formed with external screw threads, arranged in parallelism, and adapted to receive between them a blank to be threaded, means for rotating the dies, and means for advancing one of the dies toward the other as operation progresses, the improvement that consists in a support adapted to hold a blank to position to be operated on by said dies, the support being pivotally mounted on an axis parallel to the axes of the roller dies.

9. In a screw-threading machine that includes a pair of roller dies formed with external screw threads, arranged in parallelism, and adapted to receive between them a blank to be threaded, means for rotating the dies, and means for advancing one of the dies toward the other as operation progresses, the improvement that consists in a support for a tubular blank to be threaded, such support including a rod arranged in parallelism with the axes of the dies and adapted to receive in encircling position upon it a blank to be threaded and to hold the blank to position to be operated on by the said dies.

10. In a screw-threading machine a horizontal base-plate, a slide mounted upon said base-plate, a housing borne by the slide, a threaded die rotatably mounted on a horizontal axis in the housing, a plate borne by said base-plate and rotatable upon a vertical axis, a housing mounted upon said rotatable plate and a threaded die rotatably mounted on a horizontal axis in the last-named housing, the two said dies in the assembly standing in side-by-side and relatively operative positions, the dies so carried standing on opposite sides of the vertical axis of rotation of said rotatable plate, the housing mounted upon said rotatable plate being adjustable in the direction of the axial extent of the die borne thereby, and means for advancing the said slide and holding the die borne thereby yieldingly and under pressure to engagement with a blank introduced between the said die and its companion die.

11. In a screw-threading machine including a pair of roller dies mounted in bearings and means for causing the dies together with their several bearings to advance one relatively to the other under pressure upon a blank introduced between them, as, in the course of operation they sink a thread in the blank, the improvement herein described which consists of two arms borne by the bearings severally of the two dies and radially extending from the bearings with reference to the axes of the rotation, link connection between the two arms, whereby relative movement of the bearings of the two dies effects variation in the angular positions of the arms relatively one to the other, and a measuring device responsive to variation in such angular positions of the two said arms.

12. In a screw-threading machine comprising a pair of roller dies placed one beside the other and adapted to receive a blank between the same, bearings for said roller dies, and driving means for said roller dies, and means for forcing said roller dies towards each other, the improvement herein described which consists in a pair of housings one for each die within which the dies are severally mounted for movement both rotationally and longitudinally in axial direction, and the driving means including a gear borne by the die and supported on a step bearing within the housing and restrained thereby from movement in the direction of the axis of the die, the die and the gear being relatively movable in the direction of the axis of the die.

WILHELM WEMHÖNER.
WERNER PLEGMANN.