April 3, 1928. 1,664,990

P. OEHMIG, JR., ET AL

MEANS FOR MAKING SEAMLESS TUBING

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Fig. 1.

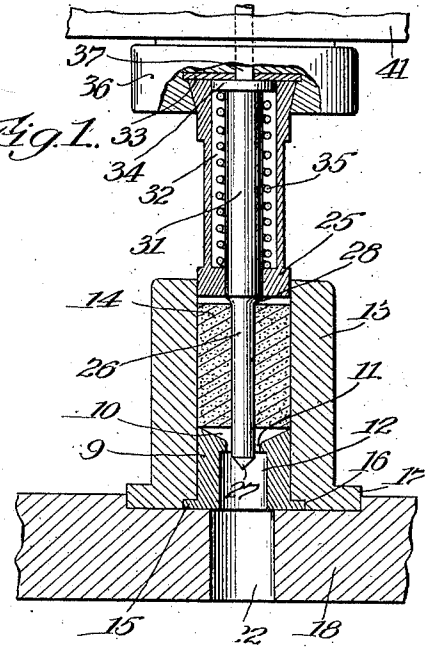


Fig. 2.

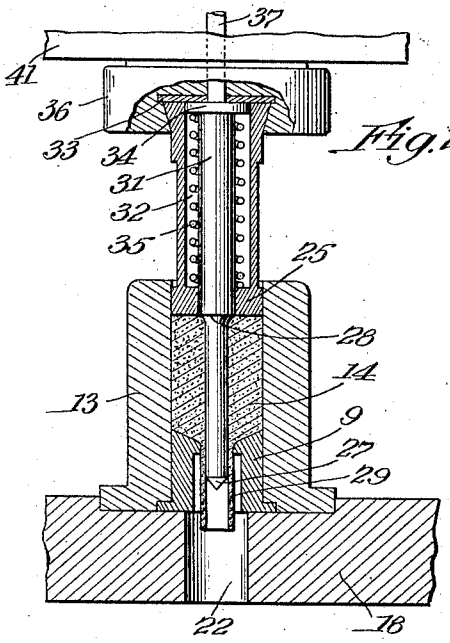


Fig. 3.

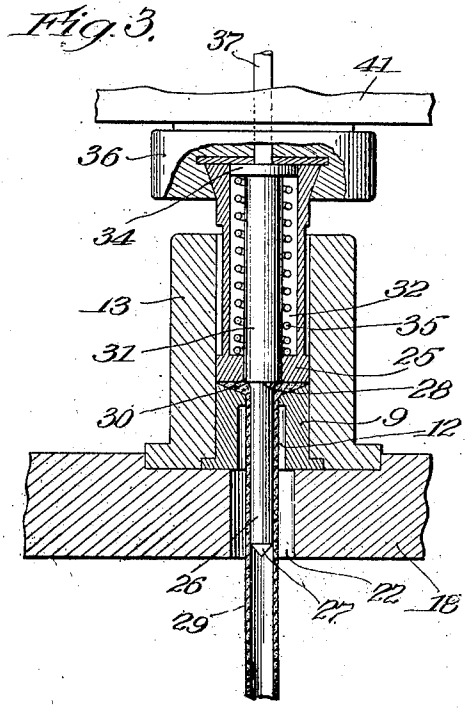
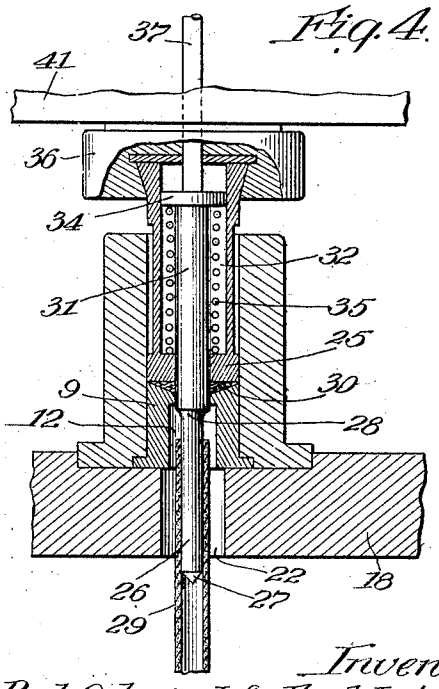


Fig. 4.



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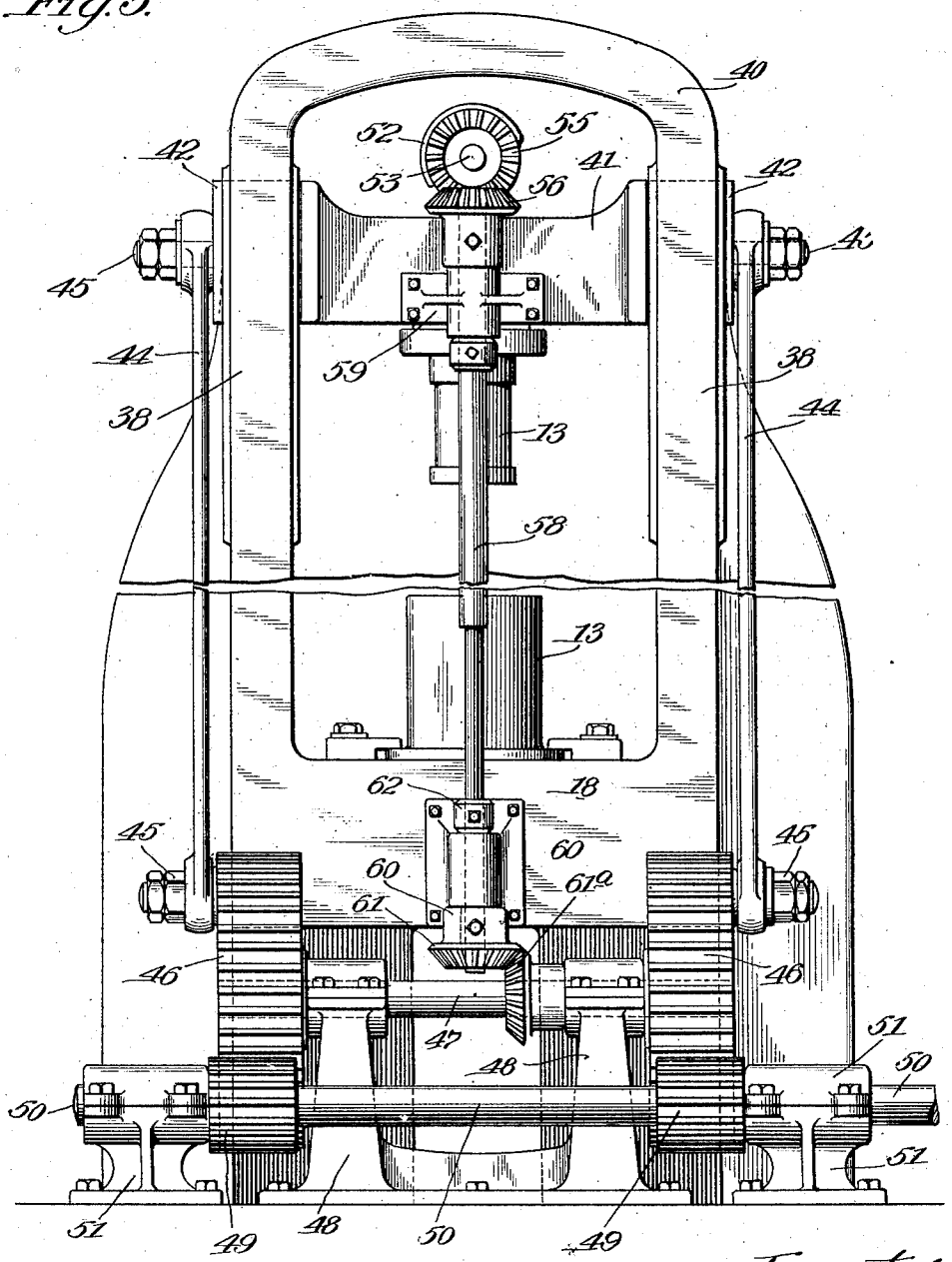
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Fig. 5.



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Fig. 6.

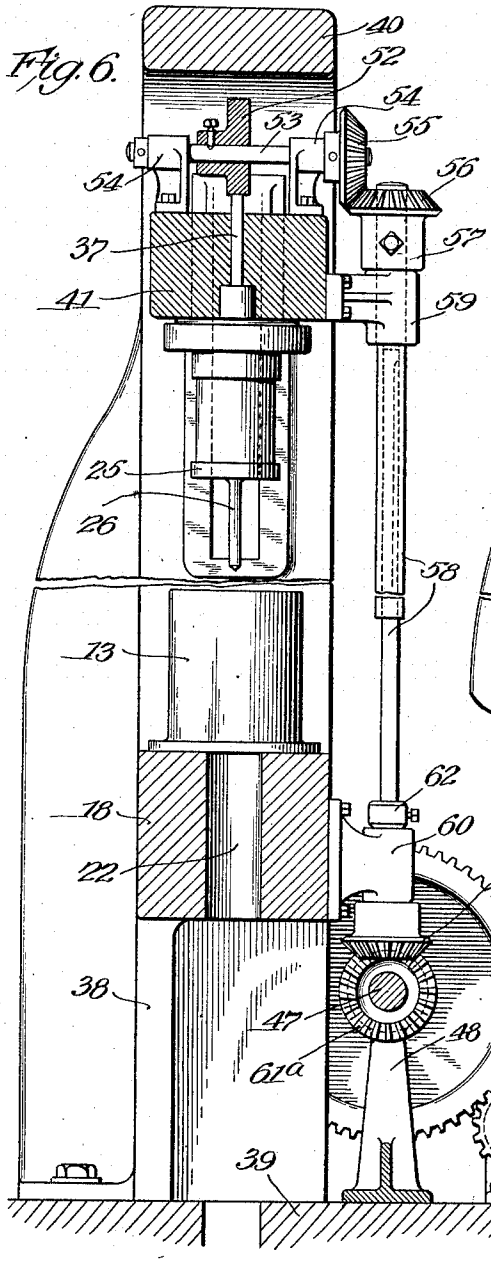


Fig. 7.

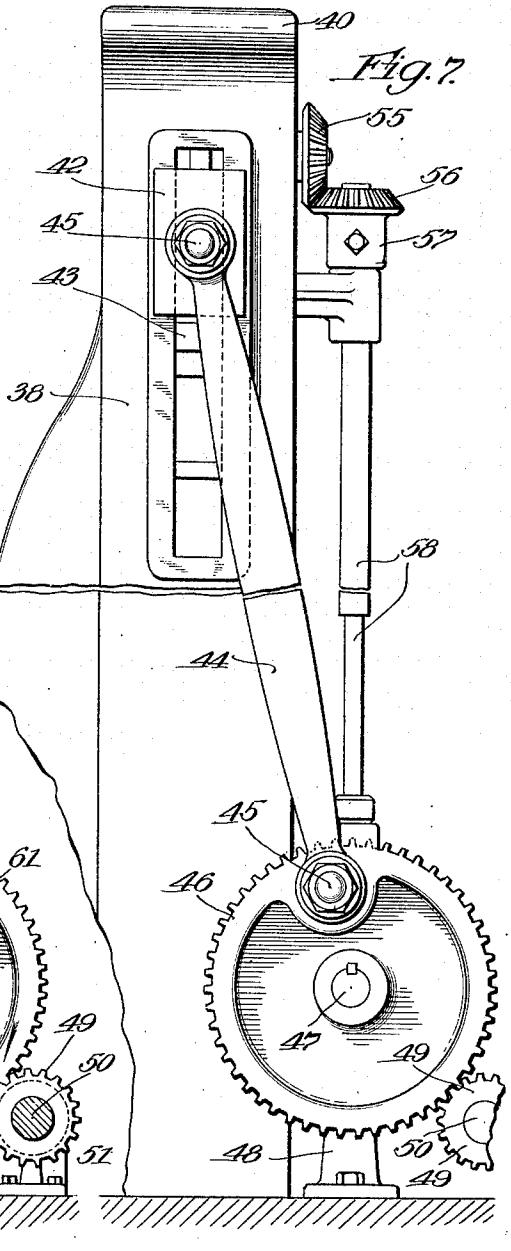


Fig. 9 Fig. 10. Fig. 11. Fig. 12. Fig. 13.



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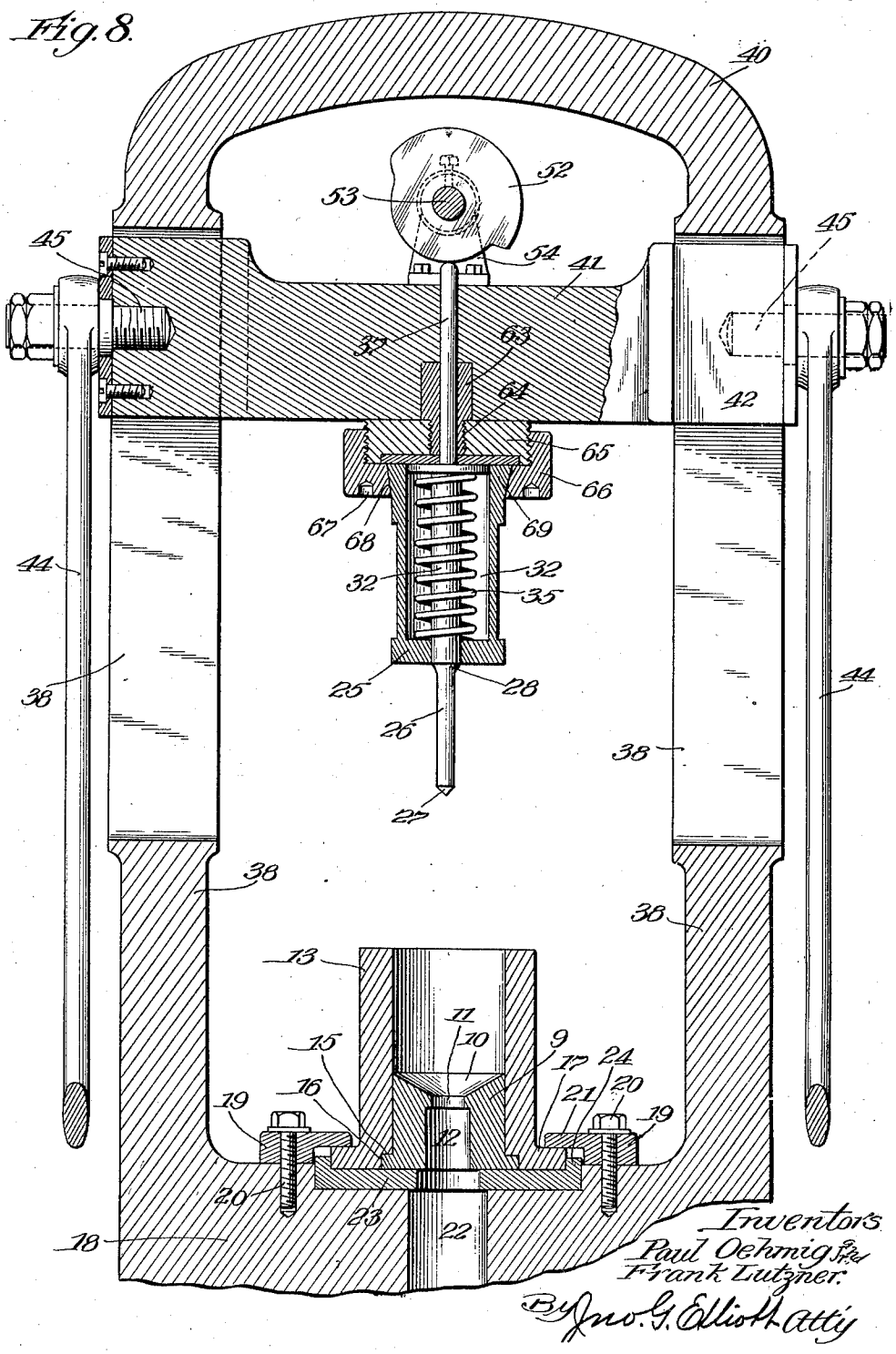
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Fig. 8.



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Patented Apr. 3, 1928. 1,664,990

UNITED STATES PATENT OFFICE.

PAUL OEHMIG, JR., AND FRANK LUTZNER, OF CHICAGO, ILLINOIS.

MEANS FOR MAKING SEAMLESS TUBING.

Application filed August 11, 1924. Serial No. 731,343.

This invention relates to a machine for producing seamless tubing of that type involving the extrusion of metal around a mandrel.

It is an object of this invention to provide a machine in which a tube can be extruded and severed from the waste material as it leaves the machine.

A still further object is to provide a machine, adapted for continuously producing seamless tubing from a blank or billet of ductile metal, which machine is provided with means for automatically discharging the tubing therefrom, free and clear of the die and the machine.

With these ends in view, our invention finds embodiment in certain features of novelty in the construction, combination and arrangement of parts by which the said objects and certain other objects are attained, all as hereinafter fully described with reference to the accompanying drawings and more fully pointed out in the claims.

In said drawings,—

Fig. 1 illustrates, in vertical section, a punch and die in which our invention finds embodiment, with a blank or billet of ductile metal therein in the position it occupies before being operated upon.

Fig. 2 is a similar view, showing the distortion of the metal of the billet or blank, following the extrusion of the tube initially therefrom.

Fig. 3 is a similar view, indicating the position of the waste metal therein before severing the finished tube therefrom.

Fig. 4 is a similar view, showing the position of the mandrel, following the severing of the tube from the waste metal and the discharge of the tube, free and clear of the die.

Fig. 5 is a rear elevation of the machine for operating the plunger and the mandrel.

Fig. 6 is a vertical side elevation of the machine partly in section.

Fig. 7 is a transverse vertical section.

Fig. 8 is a front elevation of the machine partly in section; and Figs. 9, 10, 11, 12 and 13 are detailed end elevations of tubing differing in cross-section, capable of being made by the machine of our invention.

Similar characters of reference indicate the same parts in the several figures of the drawing.

For carrying out our invention, (see Figs. 1–4, inclusive), 9 indicates a hollow die, the upper surface of which forms an inverted, quite shallow cone-shaped recess 10 in open communication with an extruding passage 11 for the die, in turn opening into an enlarged open-end chamber 12 in the die, which die is surrounded by and confined in a die holder 13, extending sufficiently above the die to provide a receptacle for a blank or billet of soft metal 14 from which to extrude an open-end tube.

The die 9 is preferably provided with an annular flange 15 recessed in an annular groove 16, formed in the die holder, which in turn is also provided with an annular flange 17 for securing it to a suitable base support 18, as may be, (see Figs. 5 and 8) by means of a ring 19 and screw-threaded bolts 20, which ring is provided with a flange 21, embracing the flange 17 of the die holder, the base 18, as shown in Fig. 8, being provided with an open-end passage 22 (see Fig. 1) in axial alinement with the passage 11 and chamber 12 of the die, through which to expel the tube extruded by the die, and in practice the die and die holder preferably directly seat upon a perforated steel plate 23, provided with a surrounding flange 24, embracing the flange 17 of the die holder.

Die holder 13 is provided with a plunger 25 from which projects a mandrel 26, which plunger is secured to a head block 36, operated by any suitable means, adapted, if need be, for forcing the mandrel through the soft metal blank or billet and for thereafter operating the plunger with a force sufficient for the compression of the blank or billet to extrude it around the mandrel through the passage 11 of the die.

The mandrel 26 is preferably pointed at its free end, as indicated at 27, to facilitate the perforation of the blank or billet, and also for centering it therein when previously perforated, as may be, for reducing the force of compression otherwise necessary for extruding the tube from the die, and the mandrel is also provided with a curved shoulder 28 adjacent the plunger, which shoulder is adapted to perform two functions, one of which is to expand the metal laterally in advance of the compressive force of the plunger, and the other for operating as a cutting edge for severing the extruded tube 29 from the waste metal, as hereinafter described.

In operation, the downward or inward

stroke of the plunger terminates just before or at the instant of its contact with the rim of the die, and its upward stroke when the mandrel is sufficiently above the die holder for the insertion in the die holder of a blank or billet of ductile metal, to a position of rest on the rim of the die, following which the plunger is operated with a force sufficient to project the mandrel through the metal blank or billet and to extrude a tube therefrom, with the exception of the small amount of metal 30 therefrom, filling the depression 10 in the die, and which, by its greater adherence to the plunger and the mandrel, will, on retracting the plunger, be detached from the die and be withdrawn from the die holder for removal therefrom before the insertion of a fresh blank or billet.

From the foregoing, it will now be apparent that, with the construction, arrangement and operation of the devices so far described, our invention provides a means for producing seamless tubing continuously from a blank or billet or ductile metal, the length of which tubing is limited only to the contents of the billet, and the size and thinness of the wall of the tubing so produced.

Our invention further provides a means by which the metal of the blank or billet is soft enough to utilize a compressive force for uniting with the waste metal in the die a fresh billet of metal, the tubing from which is overlapped by such waste metal, to form an elongated tight joint, providing for continuously producing seamless tubing twice the length otherwise capable of being extruded from a single blank or billet, and, by repetition, a seamless tubing unlimited in length, and for which purpose the plunger may have a roughened surface, if found necessary to such ends.

In practice, however, the metal billets are preferably provided at one end with a suitable projection and at the other end with a corresponding recess, adapted for fitting the projection of one billet in the recess of the other billet, whereby both the lateral expansion of the billets and their compression before described, are best utilized for uniting the extruded tubing from two or more billets.

As a means for operating the shoulder 28 for severing the tube 29 from the waste metal 30, a shank 31 for the mandrel projects through a chamber 32 closed by a cap-plate 33, one of the bearings of which shank is in the plunger and the other in a chamber, by means of a flange 34 secured to the plunger, between which flange and the inner surface of the plunger is a spring 35 coiled around the shank 31, the ends of which are respectively confined between the plunger and the flange 34.

The plunger and the cap-plate 33 therefor are securely fixed to a head block 36, which may be actuated by any means suitable for the operation of the mandrel and the plunger, as before described, which head block and the cap-plate 33 are perforated for the passage therethrough of a reciprocating rod or bar 37, which has an end bearing against the plunger and is adapted for forcing the plunger shank 31 outwardly through the plunger when the latter is at the limit of its inward stroke, and through the waste metal for thereby severing the tube therefrom, as indicated in Fig. 4.

The head block may be substituted for the cap-plate, against which the mandrel shank 31 is normally maintained until after the mandrel has passed through the blank or billet and the die, and until the blank or billet has been compressed to extrude a tube therefrom, except as to the waste metal 30, as shown in Fig. 3, whereupon the reciprocating bar or plunger is actuated to force the shoulder 28 through the waste metal against the resistance of the coiled spring 35.

Any suitable means adapted for operating the plunger and the mandrel, as above described, may be employed, as, for example, as shown in Figs. 5 to 7, inclusive, in which the base 18, shown in the preceding figures, is supported by uprights 38, projecting from a floor 39 and connected at their top by a cross-bar 40 for forming an open frame, provided towards its upper end with a sliding cross-head 41, guided between the uprights 38 by blocks 42, 42, at each end thereof, slidable in elongated slots 43 in the uprights 38.

Blocks 42 are actuated by crank arms 44, 44, pivoted thereto and to crank pins 45, 45, projecting from gear wheels 46, 46, at the opposite ends of a shaft 47, having its bearings in standards 48, 48, supported by the floor 39.

Gear wheels 46, 46, mesh with pinions 49, 49, secured to a driveshaft 50, journaled in bracket supports 51, 51, which driveshaft is actuated by any means adapted for applying to the plunger a compressive force sufficient to project the mandrel through the meal blank or billet, and to extrude a tube therefrom around the mandrel through the die.

For severing the tube from the waste metal 30 in the die, the end of the bar or rod 37 is opposed to a cam 52, mounted upon a shaft 53, journaled in bracket bearings 54, 54, mounted upon the cross-head 41.

Secured to one end of the shaft 53 is a beveled gear 55, meshing with a gear 56, provided with a hub 57, secured to a telescoping shaft 58, journaled at one end in a bracket bearing 59, secured to the cross-head 41 and providing an end support for the hub 57, the other end of the telescop-

ing shaft 58 being journaled in a bracket bearing 60, secured to the base support 18 for the die and die holder.

Telescoping shaft 58 has secured below its bracket bearing 60, a beveled gear 61 meshing with the gear 61ª on the shaft 47, the gear 61 being suspended by a collar 62 on the shaft 58, having an end bearing against the bracket 60.

It will now be seen, by reference to Fig. 8, that when the plunger and the mandrel are operated by means of a cross-head, the rod 37 passes therethrough and has its bearing in a post 63 recessed therein, having a projecting screw-threaded end 64, on which is a bushing 65, externally screw-threaded for securing thereto a ring 66, provided at intervals with recesses 67, for the application thereto of a wrench for tightening the ring on the bushing 65.

For securing the plunger in the ring 66, the latter is provided internally with an outwardly inclined wall 68, corresponding with an outwardly inclined wall 69, adjacent the upper end of the plunger, by means of which walls the plunger is tightened in the ring with the screw-threading of the latter on the bushing 65.

The construction above described, for suspending the plunger from the cross-head 41, provides a simple and convenient means for connecting the plunger with and securing it to the cross-head, and for the assemblage of which the ring is first passed over the bottom end of the plunger to seat it in the ring, followed by tightening the latter upon the bushing 65.

In operation, with the plunger and the mandrel at the limit of their upward stroke, as shown in Figs. 5–8, inclusive, power applied to the driveshaft will be transmitted through the pinions 49, gears 46 and crank arms 44, to the cross-head 41, and actuate the cross-head for producing the perforating stroke of the mandrel and the compressive stroke of the plunger, and which, if continuous, will result in extruding a tube from a blank or billet of ductile metal in the die holder, and as continuously extrude a tube therefrom until nothing remains but the waste metal 30 in the depression in the die, and to which the tube will then be attached.

With the ending of the compression stroke of the plunger, the mandrel will then be projected into and operate as a straightening device for the extruded tube, as shown in Fig. 3, whereupon the rod 37 will be actuated by the cam 52 and thereby continue the downward movement of the mandrel until its shoulder 28 has been forced through the waste metal 30 and severed the tube therefrom, as shown in Fig. 4.

When the extruded tube has been severed from the waste metal, the rod 37 will be disengaged from the depressing surface of the cam, whereupon the expansion of the spring will lift the mandrel until its shank has reengaged the cap-plate of the plunger. In this connection, it is now to be observed that with the rising movement of the plunger, the waste metal will adhere thereto and be lifted out of the die holder and be discharged therefrom beyond the end of the mandrel.

In short, as will be seen by reference to Fig. 4, the combined surface of the plunger and the shank of the mandrel, following the severing of the tube, will be much greater for the adherence thereto of the waste metal than the surface of the depression in the die, and as a result of which the waste metal will stick to the plunger and the shank of the mandrel and be lifted by the plunger from the die holder, so that when the plunger is at the limit of its upward stroke, but little force is required to loosen it therefrom so that it will fall by gravity from the plunger to be caught by any suitable device as it passes the end of the mandrel.

The devices above described are well adapted for actuating the plunger with a force great enough for the penetration by the mandrel and for extruding a tube from a large body of ductile metal, and thereby accordingly continuously producing seamless tubing of a length corresponding thereto, and particularly radiator tubing, and still smaller tubing for other and new uses.

It is, however, to be understood that, for the purpose of continuously producing seamless tubing from a blank or billet of ductile metal, our invention includes the use of an ordinary die or other press, provided with a head block 41, described in connection with Figs. 1–4, inclusive, for causing the mandrel to penetrate and operate the plunger with a force sufficient to extrude a seamless tube continuously therefrom.

In short, while we have illustrated and described the preferred form and construction of devices for carrying our invention into effect, it is nevertheless capable of variations and modifications, without departing from the spirit thereof. We, therefore, do not wish to be limited to the precise details of the construction set forth, but desire to avail ourselves of such variations and modifications as come within the scope of the appended claims.

Having described our invention, what we claim and desire to secure by Letters Patent is:

1. In a tube extruding apparatus embodying a ductile metal container and a die associated with said container, a plunger reciprocable in said container, a mandrel having an annular shearing shoulder extending through said plunger, yielding means be-

tween said mandrel and plunger for normally maintaining the same against relative movement, means for operating said plunger and mandrel as a unit and means for advancing said mandrel relative to said plunger against the tension of said yielding means for shearing an extruded tube from the waste metal in said container.

2. In a tube extruding apparatus embodying a ductile metal container and a die, a hollow plunger in said container, a member extending coaxially through said plunger, said member embodying a mandrel portion and an annular shearing shoulder above said mandrel portion, said plunger and member having coacting abutments, a coil spring in said hollow plunger for normally maintaining said abutments in coacting relation, mechanism for operating said plunger and member with said abutments in coacting relation, and means for actuating said member independently of said plunger against the tension of said spring for the purpose set forth.

In witness whereof, we have hereunto set our hands this 31st day of July, 1924.

PAUL OEHMIG, JR.
FRANK LUTZNER.