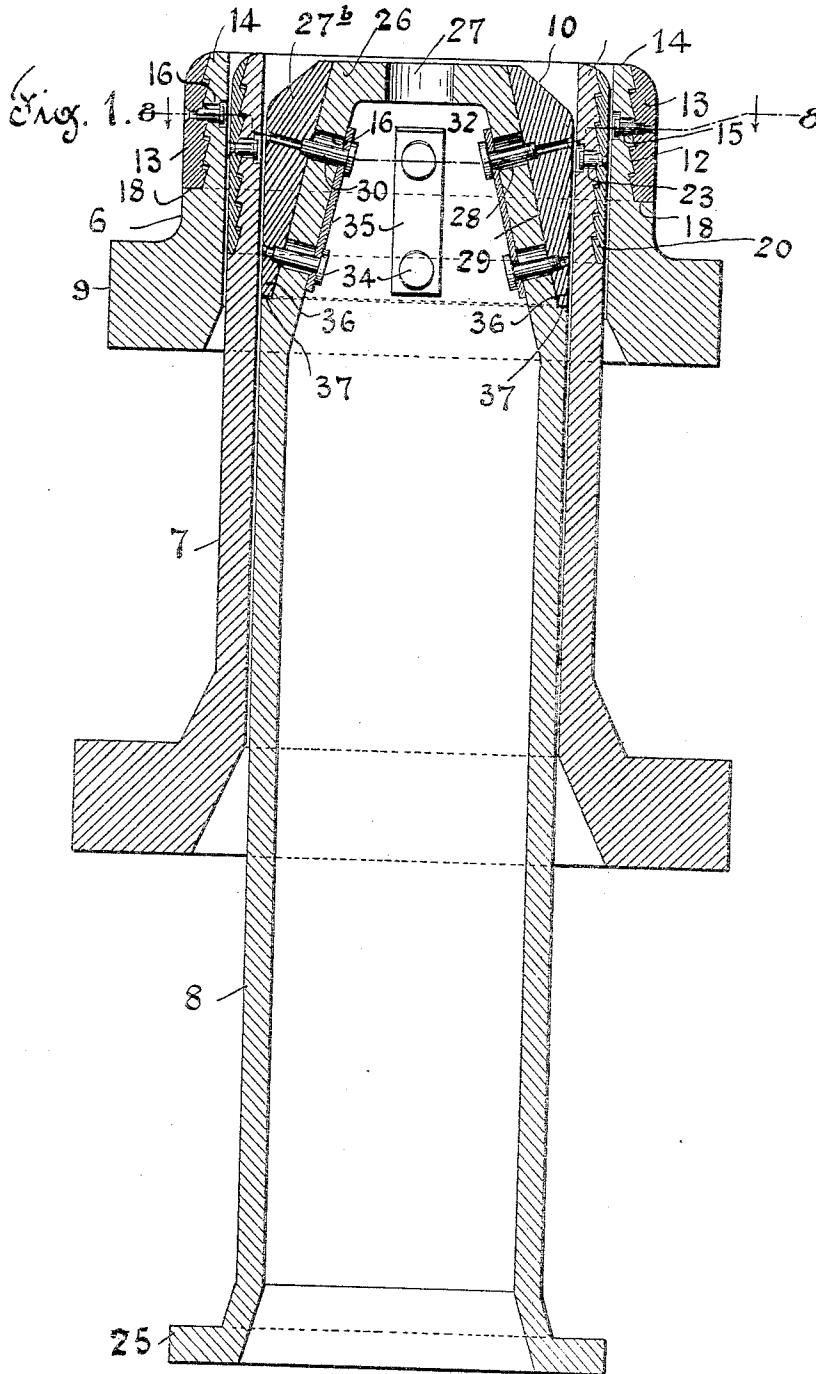


C. P. HIGGINS.
MACHINE FOR FORMING SEAMLESS TUBES.
APPLICATION FILED SEPT. 21, 1906.

961,129.

Patented June 14, 1910.

4 SHEETS—SHEET 1.



Witnesses
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Katherine Solter

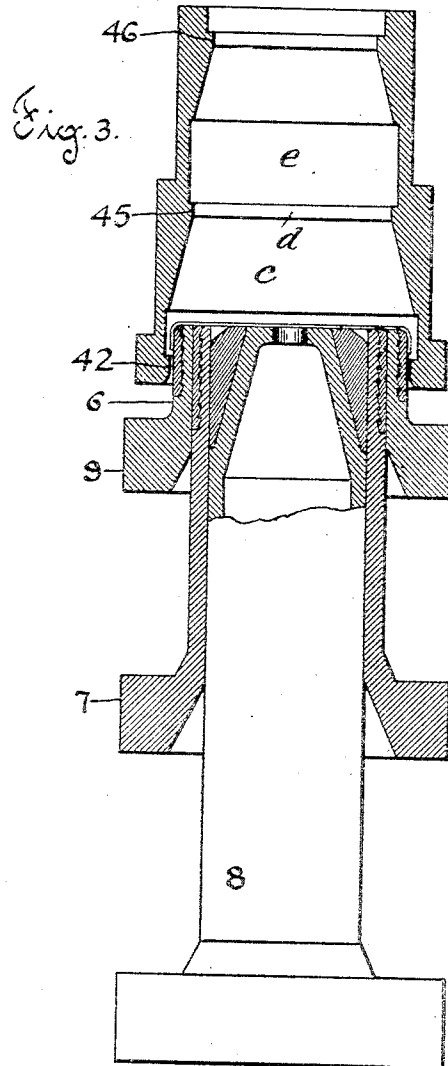
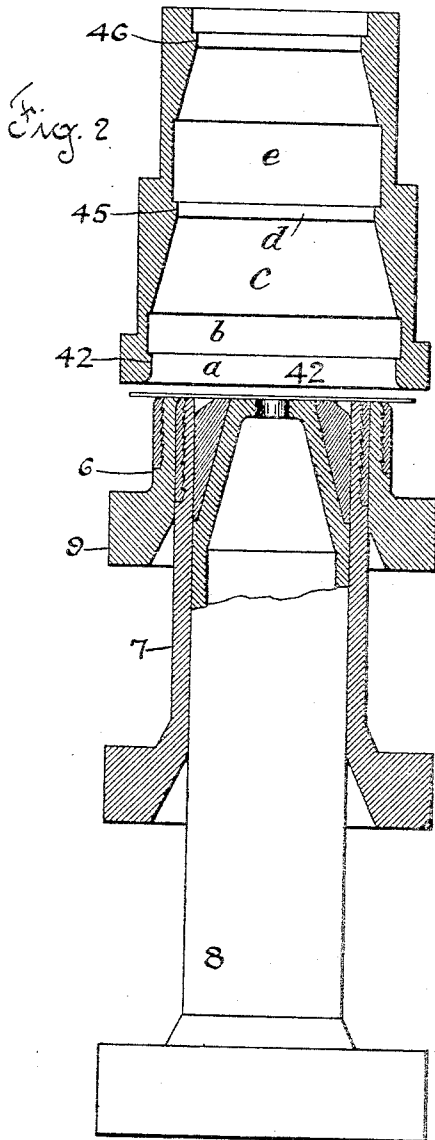
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4 SHEETS—SHEET 2.



WITNESSES
John A. Smith.
Katherine Folmer

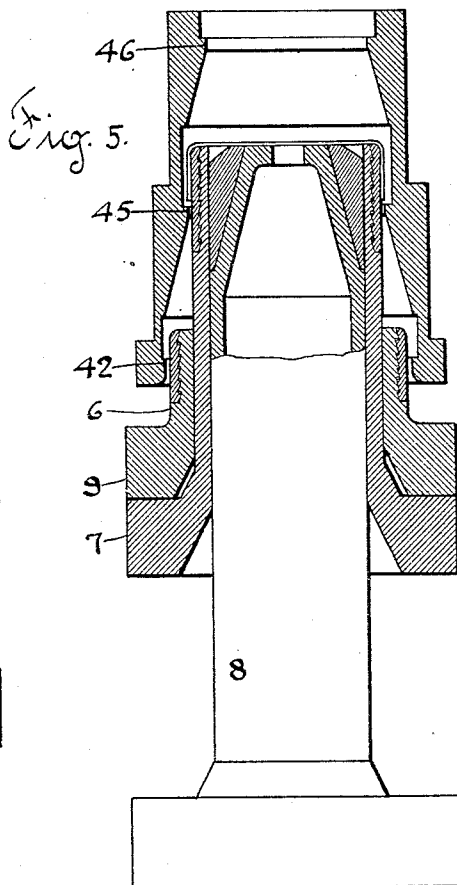
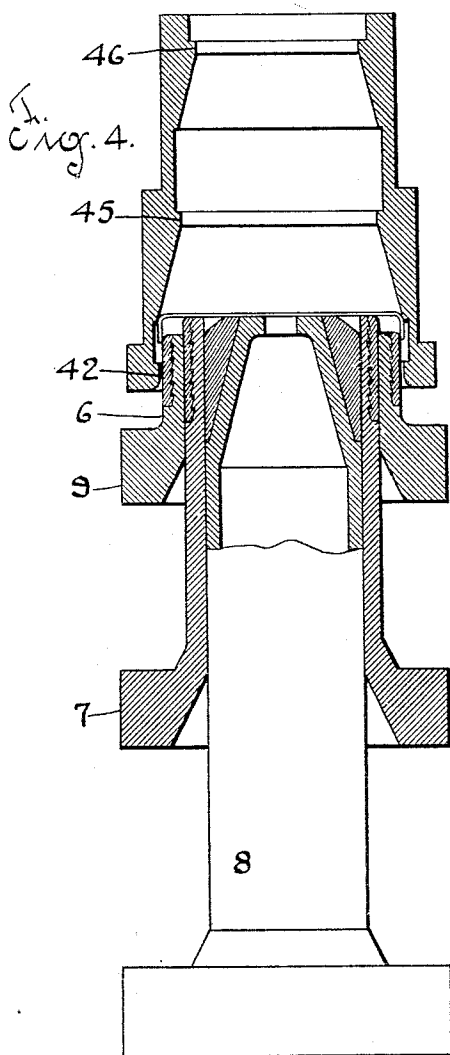
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4 SHEETS—SHEET 3.



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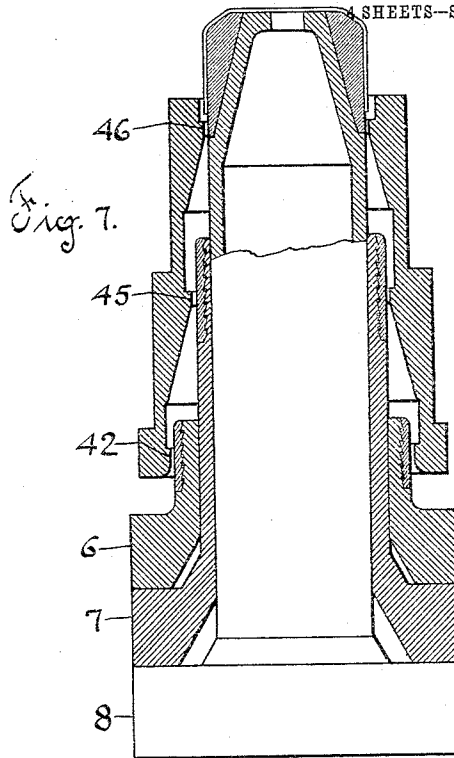
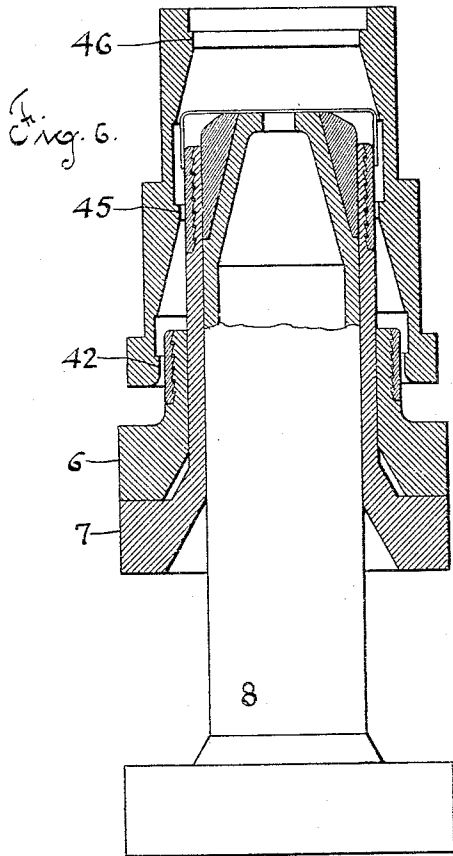
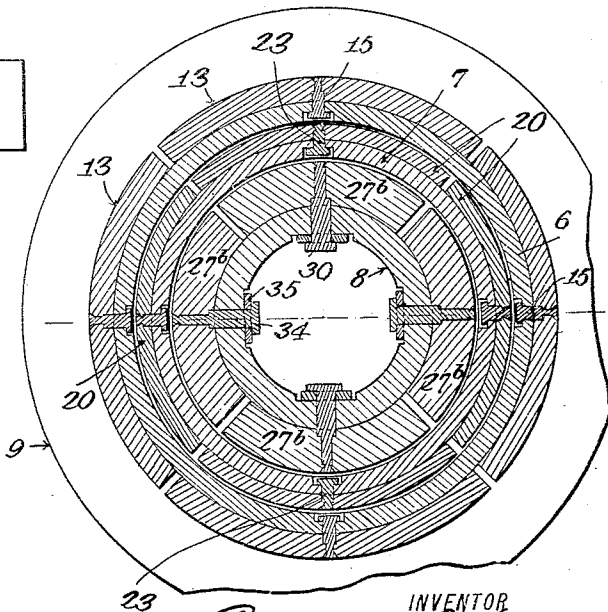


Fig. 8.



WITNESSES
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ATTORNEY.

UNITED STATES PATENT OFFICE.

CAMPBELL P. HIGGINS, OF ROSELLE, NEW JERSEY, ASSIGNOR TO THE BABCOCK & WILCOX COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MACHINE FOR FORMING SEAMLESS TUBES.

961,129.

Specification of Letters Patent. Patented June 14, 1910.

Application filed September 21, 1906. Serial No. 335,639.

To all whom it may concern:

Be it known that I, CAMPBELL P. HIGGINS, a citizen of the United States, residing at Roselle, in the county of Union and State

of New Jersey, have invented certain new and useful Improvements in Machines for Forming Seamless Tubes, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to male dies employed singly or in series in drawing seamless tubes from a disk or tubular blank of metal and is intended for use singly with one female die or in series with a series of co-

operating female dies and to be operated by a hydraulic press or other power device. The object of the invention is to provide a collapsible male die that will retain its size while under pressure in forming seamless tubes, and which will readily retract when the pressure is relieved or its movement reversed or when, in the case of multiple dies, the next size smaller comes into action, thereby permitting the flanged piece

to be readily removed. The dies forming the series are telescoped one within another and the pressure end of the outer dies have a series of serrations formed on their outer surface which are depressed below the surface of the die sufficient to allow the engaging inner serrated faces of the expandible sections to co-act therewith. These sections are moved longitudinally and expand the diameter of the die when under pressure, and retract when the pressure is relieved, which permits the tube to be easily drawn from the die.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of a set of collapsible dies embodying my improvements. Figs. 2, 3, 4, 5, 6, and 7 are diagrammatical views representing the relative position of the various dies in the successive operations in the formation of the tube. Fig. 8 is a transverse section on the plane of the line 8—8 of Fig. 1.

6, 7, and 8 are dies telescoped one within the other, the exterior die 6 having on one end a flange 9 which connects with power devices for raising or lowering the same when in operation.

As shown in the enlarged view, Fig. 1, the outer surface of the operating end of the die 6 is constructed with serrations 12 having inclined bearing surfaces that engage

with cooperating serrations upon the inner surface of the segmental sections 13, which are loosely mounted on the pressure end 14 and held in operative contact by means of cross-pins 15, extending through the wall of the die, and rigidly fixed in the segmental section 13. The die 6 is provided with guide-slots 16 to fit the cross-pins 15, and with recesses to accommodate the heads.

A shoulder 18 is formed at the end of the serrations on the die 6 and limits the longitudinal and expansion movement of the sections 13, the ends of said sections resting against the shoulder 18 when they have expanded to their full diameter. Die 7 is similarly constructed to die 6, except the segmental sections are made longer than sections 13 of the dies 6, to correspond to the increased length of the flanged plate formed by the die 7. The sections 20 on the die 7, are held in operative contact by means of cross-pins 23, extending through guide slots in the wall of the die 7, similar to the sections 13 on the die 6. Die 7 is operatively telescoped into die 6, after it has acted upon the blank. The serrations on the sections and the dies are made sufficiently large to allow for sufficient movement to expand and retract the sections, and strong enough to stand the strain of the flanging operation. Die 8 consists of a hollow cylindrical body having a flange 25 on one end. The pressure end 26 of the die 8 is integral and an aperture 27 in the center in said end is made for the convenience of assembling the attached parts during its construction. The end 26 of the die 8 is cone shaped, as shown, and the segmental sections 27^b are also coned to co-act with the conical surfaces 29 of the pressure end 26. These sections are held in operative contact with the conical surfaces of the pressure end 26, by means of cross-pins 30, extending through the guide-slots 28 in the walls of the die, and are rigidly secured in the sections.

The inner surface 32 of the wall of the die is inclined the same as the conical surfaces of the pressure end 26 to facilitate the longitudinal movement of the sections 27^b. The guide pins are provided with heads 34 which bear upon the straps 35 and hold the same in operative contact with the inner wall of the die 8. The lower end 36 of the sections when expanded to their full size,

receive the strain of pressure when the plate is being flanged on the die 8.

The operation of the dies is as follows:—
 5 The plate is placed on the end of the male dies 6, 7 and 8, as shown in Fig. 2, Sheet 2, and is flanged by means of a female die 42 drawn over the male die, as shown in Fig. 3. After the plate has been flanged on the die 6, the die is stopped and die 7 is moved forward. In this movement the serrated sections on die 6 retract or collapse against the body of the die, which facilitates the removal of the flanged blank from the die 6 by the forward movement of the die 7, as
 15 shown in Fig. 4. The flanging process is continued by the die 7 through female die 45, as shown in Fig. 5, and the flanged blank is in turn stripped therefrom by the die 8, Fig. 6, and the flanged plate is forced forward through the succeeding female die 46, which further extends the flange on the blank, as shown in Fig. 7. It is finally removed by the withdrawal of the collapsible die 8. During these operations, the flanged
 20 plate retains approximately its normal thickness, the diameter is diminished, and the length increased. This operation may be repeated with smaller dies until the desired size of the tube is obtained.

What I herein claim and desire to secure 30 by Letters-Patent is:—

1. In an apparatus of the class described, the combination of a series of female dies differing in diameter and provided with inclined faces, a series of hollow mandrel or 35 male dies each comprising a main body portion, segmental sections formed with a serrated face adapted to cooperate with the correspondingly serrated face on the body portion, and means for movably connecting 40 the serrated faces to the main body portion.

2. The combination with a series of female dies of decreasing diameter acting consecutively to form a seamless tube progressively from a blank of metal, of a series of 45 annular male dies of corresponding decreasing diameter, each provided with surrounding segmental sections adapted to move longitudinally and to expand and retract on the die, and capable of telescoping one with 50 in another.

In testimony whereof I affix my signature in presence of two witnesses.

CAMPBELL P. HIGGINS.

Witnesses:

AUGUSTE G. PRATT,
 H. S. CHINNOCK, JR.