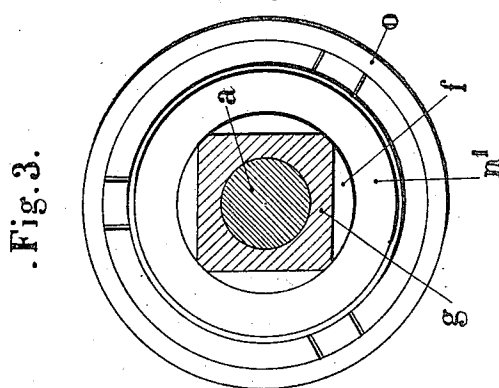
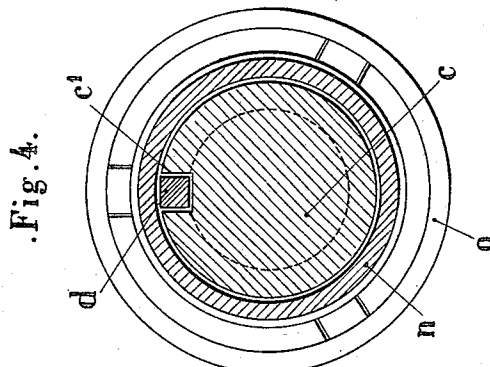
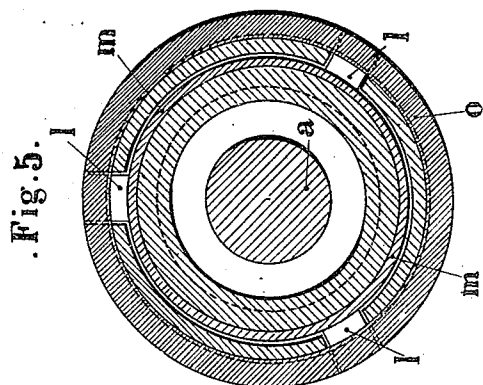
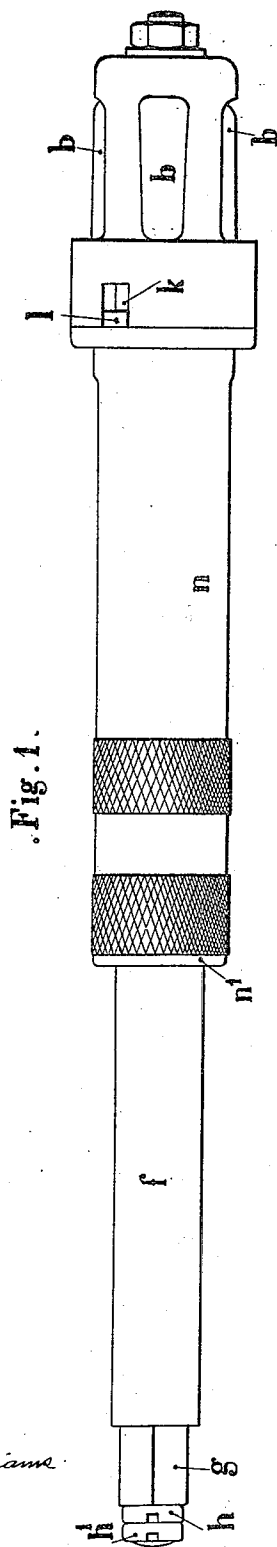


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APPLICATION FILED MAR. 30, 1921.

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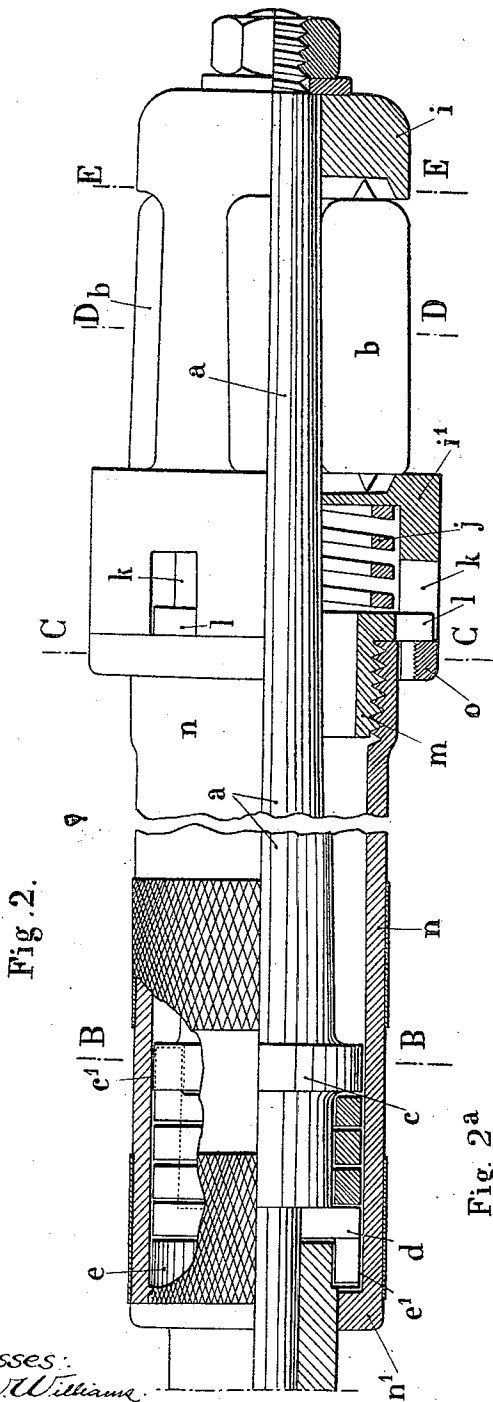
3 SHEETS—SHEET 1.



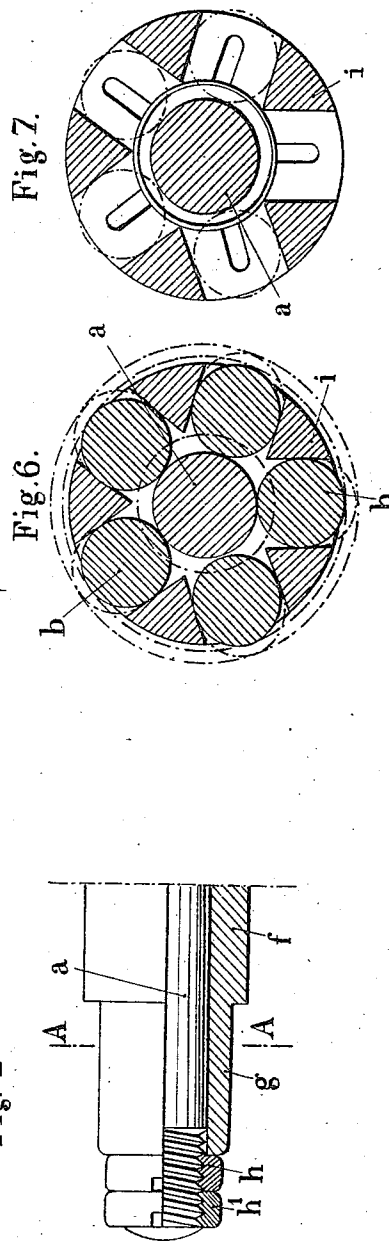
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Attys.



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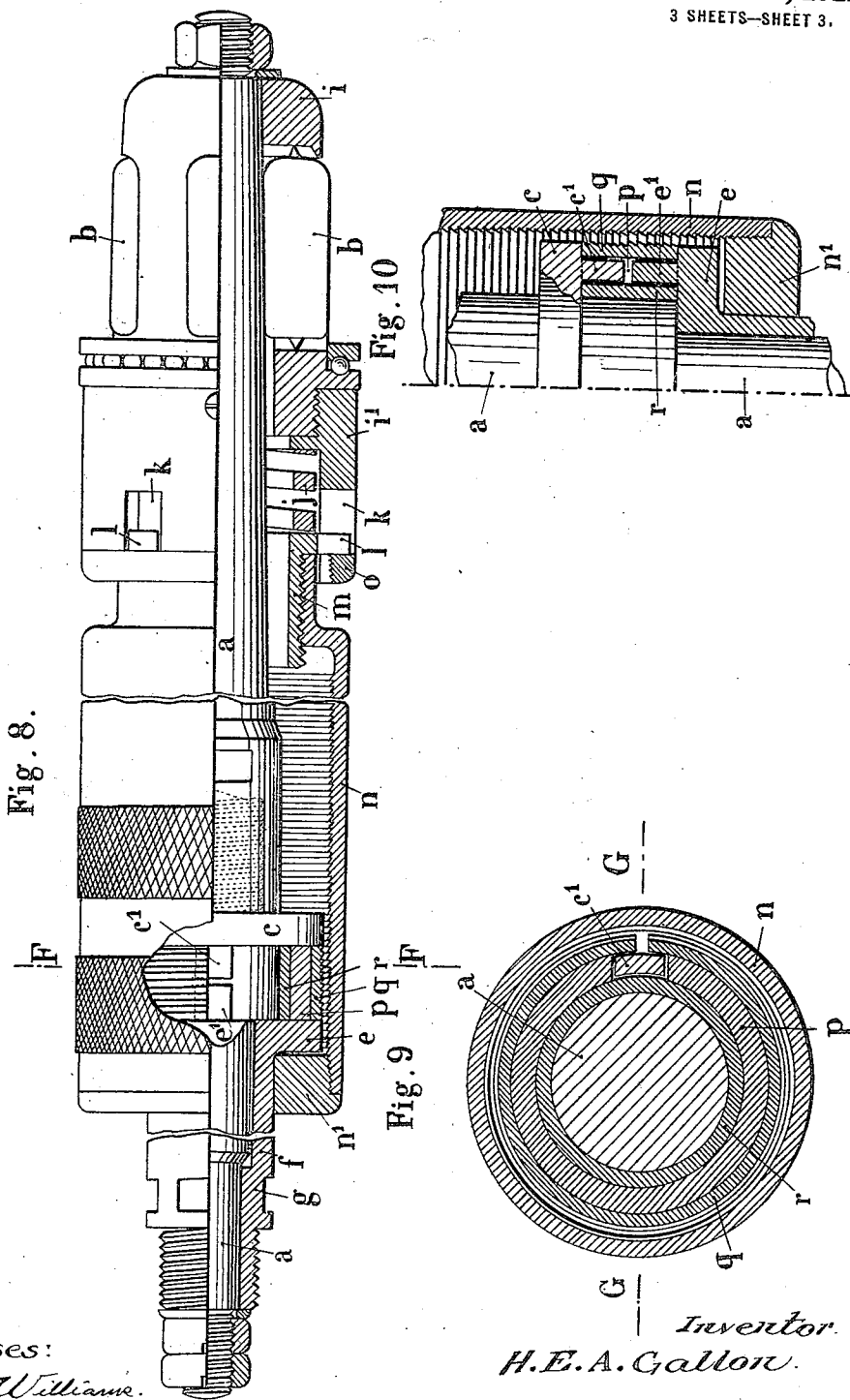
by *Mum. Lee* Attys.

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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

HENRY ERNEST ARISTIDE GALLON, OF HERBLAY, FRANCE.

EXPANDING APPARATUS WITH AUTOMATIC STOPPING AND ADJUSTABLE ACTION.

1,410,464.

Specification of Letters Patent. Patented Mar. 21, 1922.

Application filed March 30, 1921. Serial No. 457,118.

To all whom it may concern:

Be it known that I, HENRY ERNEST ARISTIDE GALLON, of 25 Rue de Pontoise, Herblay, Seine-et-Oise, France, have invented an Expanding Apparatus with Automatic Stopping and Adjustable Action, (for which I have filed an application in France, Dec. 20, 1919,) of which the following is a full, clear, and exact description.

10 The invention relates to an apparatus for expanding tubes and ferrules in tube plates and is more particularly adapted to be mechanically actuated; in this apparatus the stoppage of the advance and the
15 withdrawal of the spindle are automatically produced as soon as, the expansion being terminated, the unitary pressure produced by the tool on the metal reaches a limit value chosen beforehand according to
20 the work to be effected. The apparatus ceases therefore to advance as soon as the jumping up of the metal, in the recesses it must occupy, is terminated. Moreover, the spindle which exerts the pressure on the
25 beading rollers, is automatically and resiliently brought backward, so that the apparatus is ready for a new operation and can pass without stoppage from one tube to the following tube even without stopping the
30 machine actuating it, which latter may constantly rotate during all the work.

In the accompanying drawing given by way of example,

Fig. 1 is an elevation of the apparatus.

35 Fig. 2 is a broken view on an enlarged scale, partly in elevation and partly in section.

Figure 2^a is a view partly in elevation and partly in section of the left hand end
40 of the device shown in Figure 2.

Figs. 3, 4, 5, 6, 7 are sections made respectively according to lines A—A, B—B, C—C, D—D and E—E of Fig. 2.

Fig. 8 is a longitudinal section of a modification of the apparatus.

45 Fig. 9 is a section made according to line F—F of Fig. 8.

Fig. 10 is a section made according to line G—G of Fig. 9.

50 The apparatus comprises a spindle *a* the front end of which is fitted between the beading rollers *b* and is slightly conical. This spindle is provided with a shoulder *c* having a notch *c'* in which engages the

curved end of a torsion spring *d*. The other
55 end of this spring is engaged in a similar manner in a notch *e'* formed in a seat or shoulder *e* of a long sleeve *f* surrounding the rear end of the spindle. This long sleeve or tube *f* is externally provided with
60 a square part *g*, on which can be fitted a crank, or the driving shaft of any driving machine.

The screw-threaded end of the spindle receives a nut *h* and a locknut *h'*, by means
65 of which the compression of the spring *d* can be adjusted.

The axes of the rollers *b* are slightly inclined relatively to the generatrices of the barrel *i*, so as to produce the advance
70 of the spindle. This barrel is provided with a kind of casing *i'* in which is arranged a spring *j*.

In the walls of the casing *i'* are formed openings *k* in which can slide the blades
75 *l* of a screw-threaded ring *m*. This ring is screwed in the internally screw-threaded end of a socket *n*, the other end of which is provided with an annular ledge or rim
80 *n'* serving as a retaining or holding member for the seat *e*. This socket is externally knurled so as to permit of holding it with the hand during the work.

The ring *m* and the socket *n* are screwed
85 in each other on a left-handed thread.

The edge of the casing *i'* receives a screw-threaded ring *o* by means of which the ring *m* is held in the casing *i*.

For effecting an expanding operation, the barrel of the apparatus is introduced in
90 the end of the tube, or in the ferrule, until the edge of the casing *i'* bears against the tube plate.

The spindle is then pushed home towards the tube and a continuous rotary movement
95 is imparted to the sleeve *f*.

This rotary movement is transmitted by the spring *d* to the spindle *a*. The latter actuates the rollers *b* which roll within the expanded tube, driving along with
100 them the barrel *i* which rotates more slowly than the spindle *a*.

The spindle progressively moves forward, producing the necessary pressure.

This pressure increases and becomes very
105 high when the metal of the tube is perfectly fitted against the walls of the recess wherein it is beaded in. At this moment,

the strain for causing the spindle to rotate has increased to such an extent that the coils of the spring d open, bear against the walls of the socket n and are wedged therein.

The socket n is then integral with the spindle and rotates with the latter. The ring m follows the barrel i in its rotation, by means of the blades l ; it results therefrom that it does not rotate so quickly as the spindle a and the socket n .

Owing to this difference of speed, the ring m unscrews in the socket n and advances towards the barrel, thereby compressing the spring j and thus producing on the spindle a reaction towards the rear. In fact, this spring takes a bearing on the casing i^1 , which latter rests on the tube plate and the pressure it produces on the ring m is transmitted by the socket n to the spindle which at this moment is integral with the said socket. When the compression of the spring is sufficient, the spindle is brought backward by sliding between the rollers. The apparatus can then be withdrawn and inserted in the following tube.

As will be seen, no sudden stoppage and no rough shock take place. It is a spring that comes in action when the limit of chosen pressure is reached for causing the necessary movement for the disengagement of the spindle and it is another spring which acts on this spring for withdrawing it from between the rollers and bringing it backward.

It will also be understood that the apparatus works in an equal and uniform manner, even if the diameters of the recesses and of the tubes inserted therein are slightly different. It is the unitary pressure produced that limits the action of the apparatus and prevents it from crushing the metal. It suffices to choose the strength of the spring d and to adjust its initial compression.

The unloosening of the tool takes place automatically whatever may be the stroke effected by the spindle. The action of the apparatus is uniform in all cases for one and the same adjustment of the driving spring.

The machine actuating the tool may constantly rotate, it suffices to successively present the apparatus to the various tubes to be expanded.

When the same operation is begun on the following tube, the socket n is held stationary by means of the hand. As soon as the movement of the spindle has started, the barrel also rotates and actuates the ring m , thus screwing it again in the socket.

When the ring m is screwed completely home, the socket n is driven along and at this moment it is released by the hand.

In the arrangement shown in Figs. 8 to 10, the apparatus is constituted, as above, but the connection at the end of the operation between the sleeve f and the spindle a is

obtained by means of a driving segment p surrounded by an adherence segment q .

The segment p presents a gap in which are engaged two studs e^1 , e^1 respectively integral with the sleeve f and the spindle a .

The segment q is externally provided with circular threads capable of engaging with corresponding threads formed on the inner wall of the casing n ; these threads have a profile chosen in view of ensuring the transmission of the stresses in the direction in which they are exerted.

Inside the segment p is arranged a ring r adapted to compensate the differences of thickness which might be given to the smooth segment p , according to the stress it is desired to exert.

A ring i^2 mounted on a ball bearing terminates the casing i^1 .

Suppose it is desired to expand a tube and that:

1—the strain to be exerted on the sleeve f for expanding the tube until it comes in contact with the wall of the recess is of 40 kilograms; that the strain necessary for effecting the rolling of the metal is of 80 kilograms;

2—the strain for producing the opening of the inner segment is of 50 kilograms and for the outer segment 10 kilograms, so that the total strain for opening both segments simultaneously is of 60 kilograms.

During the first part of the work, that is to say the expansion of the tube the strain exerted on the spindle is less than the opening strain of the segments. The latter remain therefore closed; the spindle a remains independent from the socket n .

Then the rolling begins and the effort necessary for actuating the apparatus increases up to the value of 80 kilograms indicated above.

At the time the value of this effort is at 60 kilograms, the segments open; the threads of the outer segment engage with those of the socket n , thus rendering these two members integral with each other by a wedging action.

At this moment, the relative unscrewing of the socket n and of the ring m takes place, producing the compression of the spring j .

During the period between the passage of the effort at 60 kilograms,—point where the socket and the spindle are rendered integral with one another,—and the moment where the effort or strain reaches 80 kilograms, the spring j is compressed.

At the same time as the working strain reaches 80 kilograms, the compression of the spring reaches the point where it determines the rearward movement of the spindle.

As soon as the rearward movement of the spindle begins, the pressure of the rollers diminishes rapidly as well as the effort to be produced for actuating the apparatus.

When the strain comes back to 60 kilo-

grams, the segments tend to close. The inner segment is not prevented from closing, but the outer segment is held by the adherence between the corresponding faces of the threads, under the pressure of the spring.

The outer segment remains therefore integral with the socket and the latter continues to push back the spindle rearward, until it is completely released.

10 The recoil of the spindle thus takes place regularly, without jerks.

When the spindle has been pushed backward, both segments take again their position of rest.

15 With this arrangement, the unscrewing of the two members m and n is no longer indispensable for producing the withdrawal of the spindle; it has only the advantage of accelerating the same.

20 In fact, from the moment the adherence segment renders the spindle integral with the socket n , the latter moves forward with the spindle and compresses the spring. There is a time when the reaction of the spring stops the advance of the spindle, then, after a few revolutions, determines the pulling off and withdrawal of the same.

25 Instead of the segment q covering the studs e^1, e^2 from which it is independent, as above described and illustrated, it could be more largely cut away, so that the said studs may be engaged between its ends.

30 The system forming the subject-matter of this invention is applicable to any existing mandrels, whatever may be the arrangement of the rollers, barrel, etc.

The above arrangements are given by way of example only, the forms, dimensions, detail arrangements and materials used may be varied according to circumstances without departing thereby from the principle of the invention.

Claims.

1. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, a conical spindle, beading rollers actuated by the spindle, elastic means receiving the driving motion and transmitting it to the spindle, and means actuated by the elastic means when the limit of unitary pressure is reached to stop the work and effect the withdrawal of the spindle.

2. In an apparatus for expanding the ends of tubes and ferrules in tube plates, a conical spindle, beading rollers actuated by the spindle, elastic means receiving the driving motion and transmitting it to the spindle, and means actuated by the elastic means when the limit of unitary pressure is reached, comprising a spring adapted to react on the spindle.

3. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, a driving shaft, a spindle actuated by the driving shaft, beading means

carried by the spindle, a resilient intermediate member between the driving shaft and the spindle, a member having a left hand screw thread, another member screwed in the previous one, a barrel, a spring between the second member and the barrel, adapted to react on the spindle.

4. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, beading rollers, a spindle acting on the beading rollers, a roller-carrying barrel, a driving shaft, a transmission spring capable of transmitting the normal strain without opening, and opening when this strain is exceeded, a socket with which this spring comes in engagement, a member in which the socket is screwed, and a pressure spring co-acting with the member.

5. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, beading rollers, a spindle acting on the beading rollers, a roller-carrying barrel, a driving shaft, a transmission spring, formed by a slotted segment, capable of transmitting the normal strain without opening, and opening when this strain is exceeded, a socket with which this spring comes in engagement, a member in which the socket is screwed, and a pressure spring in contact with said member.

6. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, beading rollers, a spindle acting on the beading rollers, a roller-carrying barrel, a driving shaft, a transmission spring formed by a slotted segment, capable of transmitting the normal strain without opening, and opening when this strain is exceeded, studs on this segment and engaged in a notch of the driving shaft and of the spindle.

7. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, beading rollers, a spindle acting on the beading rollers, a roller-carrying barrel, a driving shaft, a transmission spring formed by a slotted segment, capable of transmitting the normal strain without opening, and opening when this strain is exceeded, an adherence segment covering the previous segment, studs on this segment and engaged in a notch of the driving shaft and of the spindle.

8. In an apparatus for mechanically expanding the ends of tubes and ferrules in tube plates, beading rollers, a spindle acting on the beading rollers, a roller-carrying barrel, a driving shaft, a transmission spring formed by a slotted segment, capable of transmitting the normal strain without opening, and opening when this strain is exceeded, an adherence segment covering the previous segment, screw threads on the surface of the adherence segment, engaging with corresponding screw threads of the socket,

studs on this segment and engaged in a notch of the driving shaft and of the spindle.

9. In an apparatus for expanding tubes and ferrules, a rotary tool carrying spindle, means for rotating the spindle and causing it to progressively move forward, said means including a spring connected to the spindle and means for arresting and retracting the spindle when a predetermined pressure is reached.

10. In an apparatus for expanding tubes and ferrules, a rotary spindle, beading roll-

ers mounted upon the spindle, to be expanded and rotated therewith, means for rotating the spindle and causing it to progressively move forward, and means controlled by the spindle operating means for arresting and retracting the spindle when a predetermined pressure is reached.

The foregoing specification of my expanding apparatus with automatic stopping and adjustable action, signed by me this 14th day of March, 1921.

HENRY ERNEST ARISTIDE GALLON.