No. 629,354. Patented July 25, 1899.

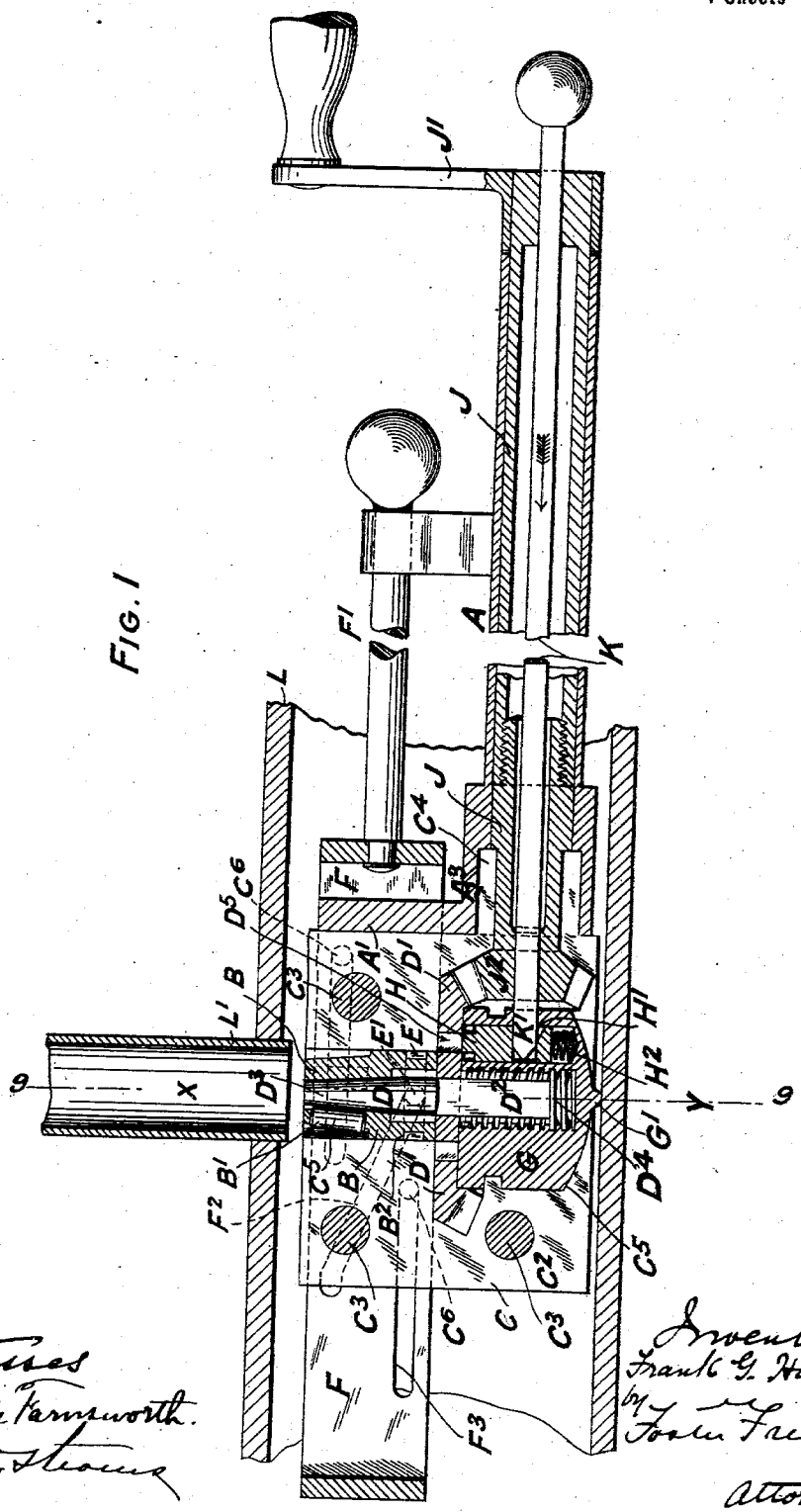
F. G. HAMPSON.

TUBE EXPANDING DEVICE.

(Application filed Jan. 5, 1899.)

(No Model.) 4 Sheets—Sheet 1

FIG. 1



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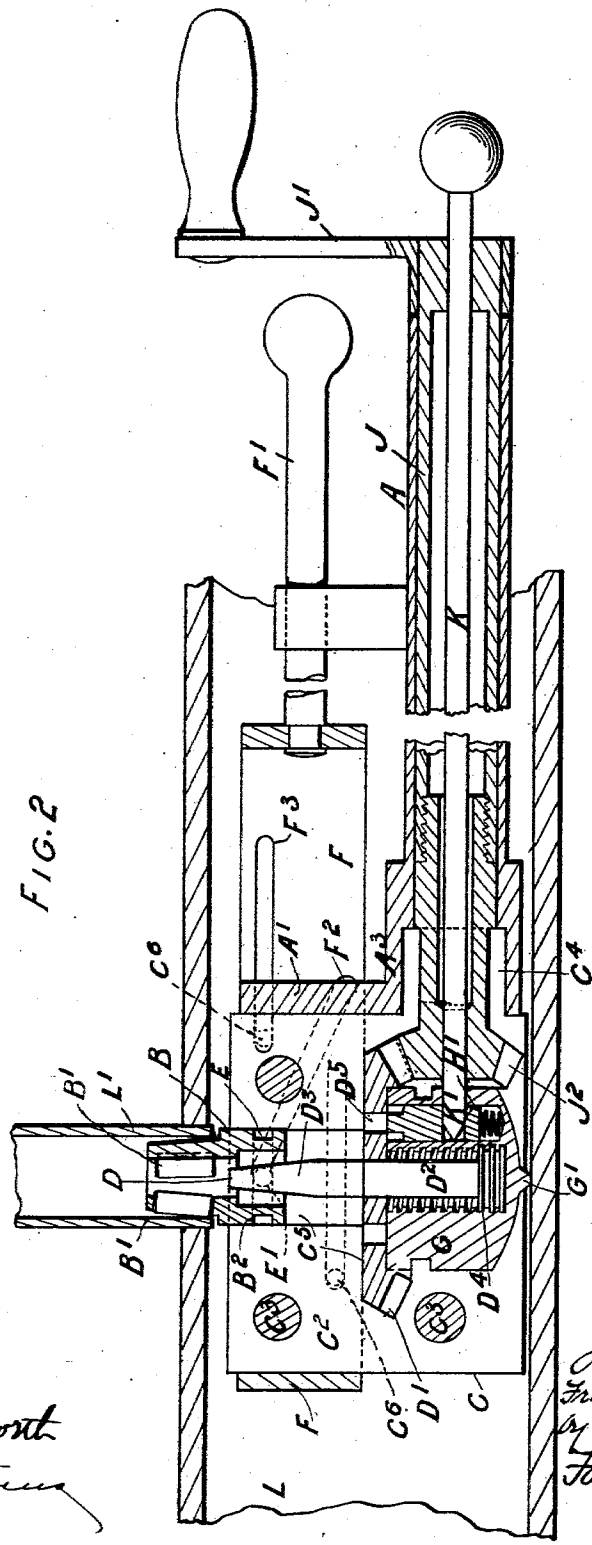
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(Application filed Jan. 5, 1899.)

(No Model.) 4 Sheets—Sheet 2.

FIG. 2



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(Application filed Jan. 5, 1899.)

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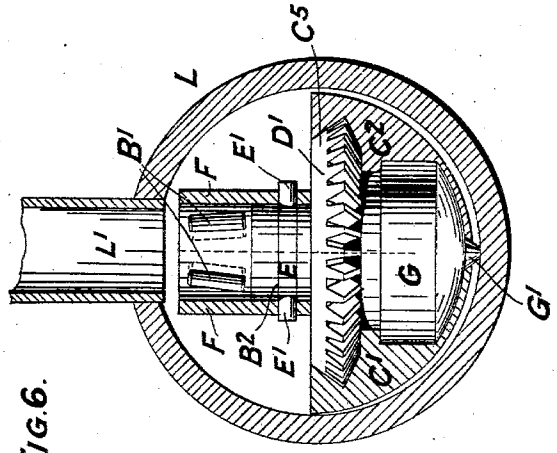


FIG. 6.

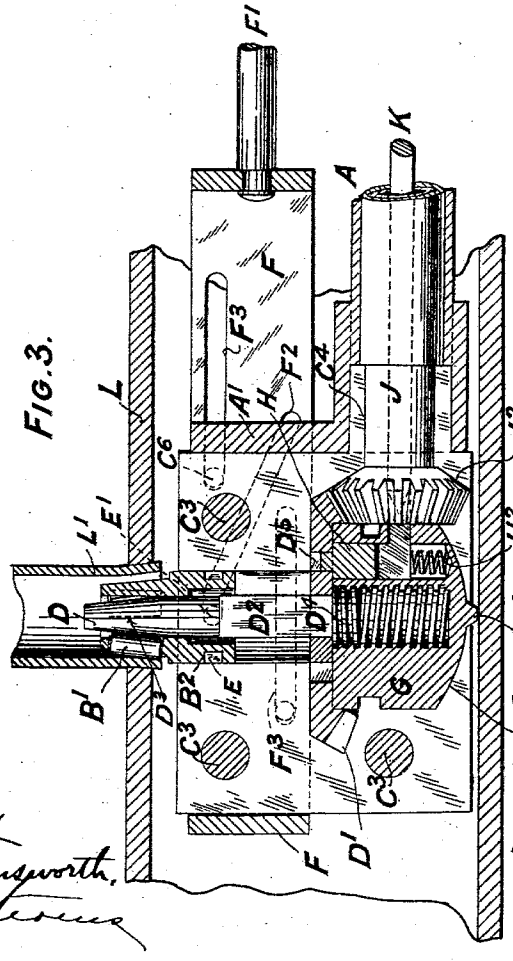


FIG. 3.

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TUBE EXPANDING DEVICE.

(Application filed Jan. 5, 1899.)

(No Model.) 4 Sheets—Sheet 4.

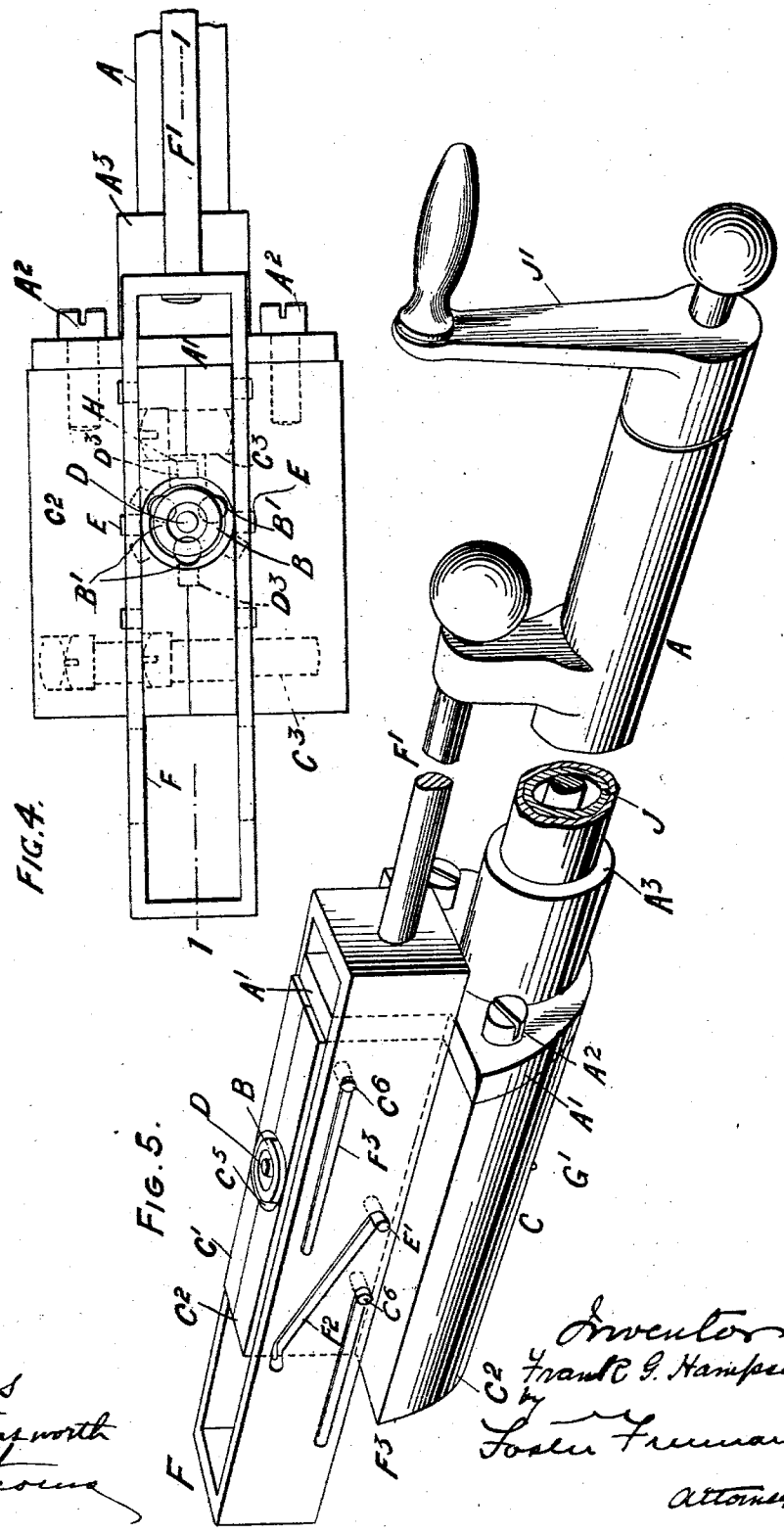


FIG. 4.

FIG. 5.

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UNITED STATES PATENT OFFICE.

FRANK GEORGE HAMPSON, OF SHOREHAM, ENGLAND.

TUBE-EXPANDING DEVICE.

SPECIFICATION forming part of Letters Patent No. 629,354, dated July 25, 1899.

Application filed January 5, 1899. Serial No. 701,247. (No model.)

To all whom it may concern:

Be it known that I, FRANK GEORGE HAMPSON, a subject of the Queen of England, residing at Shoreham, Sussex county, England, have invented certain new and useful Improvements in or Relating to Tube-Expanding, (for which I have made application for Letters Patent in Great Britain under No. 12,752, dated June 7, 1898,) of which the following is a specification.

This invention relates to the expanding of one tube into another or into a tube-plate or the like, and although it is applicable in accessible places and for large sizes of tubes as well as small it is particularly suitable for expanding very small tubes in inaccessible places, and I will now describe it in that application.

Hitherto in the case of boilers having many small tubes connected with drums or larger tubes great difficulty has been experienced in expanding the ends of the smaller tubes in the holes in the larger ones, and the choice of the sizes of tubes which could thus be used has been practically limited by reason of this difficulty.

A tube-expander constructed according to this invention will enable the ends of small tubes to be expanded into holes in the wall of a drum or larger tube or chamber whose dimensions are limited to such an extent that the use of the ordinary type of tube-expander within it would be impossible or impracticable. It is herein described with reference to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of the complete expander in position within a tube in readiness to expand a smaller tube into engagement therewith. Figs. 2 and 3 are views similar to Fig. 1 with the movable parts of the expander in the different positions assumed by them in the operation of the apparatus as hereinafter described. Fig. 4 is a plan of Fig. 1. Fig. 5 is a perspective view of the frame C, hereinafter referred to, with certain of its appurtenances; and Fig. 6 is a section on the line 6 6 of Fig. 1.

Like letters indicate like parts throughout the drawings.

The body of the apparatus comprises a shaft A of sufficient length to enable it to pass far enough into the large tube L, in which the work is being executed, to carry it down to the place where the smaller tube L′ is to be expanded. This shaft supports the apparatus by which the actual operation of expansion is effected, the axis X Y, about which the expansion-rollers travel, being arranged at an angle, which preferably, as in the present example, is a right angle, with the length of the shaft A and with the axial line of the control and operating mechanism. The end of the shaft opposite to that at which the expansion apparatus is carried supports the handles of the control mechanism by which the adjustment of the expansion apparatus is effected, so that it can be controlled and operated from the outer or accessible end of the larger tube L.

The expansion apparatus comprises a roller-carriage B, which may be tapered, as shown, or not, as preferred, carrying in recesses the expansion-rollers B′ and adjustable in the direction of the axis X Y in a frame secured to the shaft A, so that the carriage may be withdrawn into or protruded from the rest of the apparatus. The frame C in the example illustrated is made in twin parts C′ C^2, which abut against each other upon the central plane 1 1, Fig. 4, of the apparatus, being held together by countersunk screw-studs C^3 and by a plate A′, formed on one end of the shaft A and engaged with the parts C′ C^2 by screws A^2 and by the entry of extensions C^4 on the parts C′ C^2 into a socket A^3 on the shaft A. The lower portion of the frame thus constituted is approximately semicylindrical in transverse section, as may be seen from Fig. 6, so as to approximately fill one-half of the lower portion of the larger tube L, into which the apparatus is inserted, while the upper portion is narrower, (see Fig. 5,) inclosing the carriage B when the latter is retracted and serving to form a guide for the slides F, which bear against its outer faces, as will be presently explained.

In each of the parts C′ C^2 a semicircular recess is formed, the two semicircular recesses when the parts C′ C^2 come together forming a complete circular recess C^5, in which B, D′, and G, hereinafter referred to, are rotatable.

The carriage B is moved endwise by devices which do not interfere with its rotation around the mandrel D when the rollers B′ are

in operation. On the carriage B is a ring E, carried in a circumferential groove B^2 upon the exterior thereof and provided with pins E'. These pins are controlled by slides F, adjustable upon the frame C in a direction transverse to that of the axis X Y by a rod F' and provided with cam-slots F^2, which are arranged at an angle with the direction of motion of the slides and receive the outer ends of the pins E. In addition to the cam-slots F^2 the plates F are provided with straight slots F^3, arranged parallel with the direction of motion of the plates and engaged by pins C^6, which project from the sides of the frame against which the plates bear, so as to keep the plates from riding up or down on the central projection, which they embrace.

F' is a rod by which the plates F can be adjusted. This extends into proximity to the handle J'.

The mandrel D, which extends into the carriage B, is encircled by a bevel-wheel D', retained in a recess C^5 in the frame C. The wheel is so engaged with the recessed frame as to be free to rotate, but not to have movement in the direction of its axis. That portion D^2 of the mandrel which passes through and in the drawings extends below the bevel-wheel D' is of angular form in cross-section and passes through an angular hole of corresponding shape in the boss or center of the bevel-wheel, with which it makes a sliding fit, so that while the mandrel D can move endwise easily through the boss of the bevel-wheel D' to follow up or to recede before the roller-carriage B yet the bevel-wheel D' cannot be rotated without turning the mandrel with it. The portion D^3 of the mandrel which bears upon the rollers B' is coned, and the opposite end D^4 of the mandrel is screw-threaded to engage with a screw-threaded nut G, encircling it. The nut G is journaled like the bevel-wheel D' to turn in the frame C. It occupies the lower portion of the recess C^5 and contains a sliding bolt H, which can enter recesses D^5 in the face of the bevel-wheel D'. Instead of the threaded end D^4 of the mandrel or the bolt H there may be other equivalent means by which the nut G can be engaged with or disengaged from the bevel-wheel D' on the mandrel, against both of which it bears.

J is a spindle journaled in the shaft A and frame C, with a handle J' at its outer end and at its inner end a pinion J^2 engaged with the bevel-wheel D', so that by rotating the handle J' the bevel-wheel D' and mandrel D can be turned.

K is a rod movable endwise in the frame C. This rod is employed to bolt the nut G to the frame C C' C^2, through which the rod passes, and also to operate by means of its coned or beveled inner end K' the sliding bolt H, with the beveled portion H' of which it engages.

H^2 is a spring by which the bolt H is normally kept in such a position that it locks the nut G and bevel-wheel D' together. By movement of the rod K in the direction of the arrow thereon from the position in which it is shown in Fig. 3 into that in which it is shown in Fig. 1 the beveled portions H' and K' of the sliding bolt and rod engage, so that the latter operates to retract the bolt H and free the nut G from the bevel-wheel D', the rod K simultaneously engaging the nut G and so locking it in the frame C C' C^2. A reverse movement of the rod K permits the bolt H to reëngage the nut G with the bevel-wheel D' under the influence of the spring H^2 and leaves the nut free to turn in the frame C.

In use the apparatus is passed, with its parts, in the position in which they are shown by Fig. 1 into the main tube L as far as the end of the small tube L', which is to be expanded, and the roller-carriage B is then protruded, as in Fig. 2, into the small tube L' by the slides F, which are moved endwise, so that the inclined slots F^2 therein acting upon the pins E', and so upon the ring E, move the carriage B out of the frame C from the position in which it is shown in Fig. 1 into that in which it is shown in Fig. 2. When this has been done, the rod K is moved so as to retract the bolt H and disengage the bevel-wheel D' from the nut G, which is simultaneously locked by the rod K to the frame C C' C^2. Then the spindle J is rotated to turn by means of the pinion J^2 the bevel-wheel D' without the nut in such a direction as to rotate the mandrel D and cause it to screw itself out of the nut G, following up the carriage B and forcing the rollers B' against the interior of the small tube L', as shown in Fig. 3. As soon as the mandrel has been moved out sufficiently far the rod K is moved so as to unlock the nut G from the frame C and allow the bolt H to reëngage the nut with the bevel-wheel D', these two parts G D' being subsequently rotated in company by the pinion J^2 to cause mandrel D to turn and force the rollers B to travel over the inner surface of the tube L' operated upon and expand it outward in a manner well understood. When the nut G, wheel D', and mandrel rotate in company in this manner, the mandrel of course receives no endwise movement. The nut G is preferably provided with a pointed portion G' to engage with the larger tube L to assist in holding or locking the apparatus in its proper position therein.

It will be appreciated that the actual details may be greatly varied without departing from the spirit of this invention, and would necessarily be varied according to the nature of the work and its accessibility or otherwise. The foregoing description will serve, however, to indicate how the invention may be carried into effect.

In the place of the shaft A a rod or other form of body may be adopted. Elastic or pneumatic apparatus or flexible shafting may be employed for driving the spindle J. The

mandrel D and nut G can be rotated by other than bevel-gear. The various spindles, such as J K, may be arranged one within the other.

A tube-expander such as is hereinbefore described can be inserted into the larger tube, operated therein, and withdrawn therefrom without detachment of any of its parts, and it can be used to expand smaller tubes than could be expanded under similar conditions with any other known expander.

I claim—

1. In a tube-expander, the combination of the supporting-frame, the roller-carriage free to rotate and move endwise therein, means for imparting endwise movement to the carriage, the expanding mandrel arranged centrally of the carriage, and means for rotating the mandrel and moving it endwise, substantially as described.

2. In a tube-expander, the combination of the supporting-frame, the roller-carriage free to rotate and move endwise therein, means for moving the carriage endwise, the expanding mandrel arranged centrally of the carriage, the nut on the frame engaged by the mandrel, the driving-gear to rotate the mandrel, and means for alternately locking the nut to the frame and gear, substantially as described.

3. In a tube-expander, the combination of the frame, the rotatable and endwise-movable roller-carriage, the expanding mandrel arranged centrally of the carriage and screw-threaded at its inner end, the nut engaging the mandrel, the gear-wheel having a sliding connection with the mandrel, the driving-shaft in mesh with said wheel and arranged at a right angle to the axis of the mandrel, and means for locking the nut to the frame, substantially as described.

4. In a tube-expander, the combination of the supporting-frame, the rotatable and endwise-movable roller-carriage thereon, the slide for reciprocating the carriage, the tapered expanding mandrel arranged centrally of the carriage and screw-threaded at its inner end, the nut engaging the mandrel, the gear having a sliding connection with the mandrel, the driving-shaft arranged at a right angle to the axis of the mandrel and engaging said gear, and means for alternately locking the nut, to the frame and gear, substantially as described.

5. In a tube-expander, the combination of the frame, the roller-carriage supported thereby, the expanding mandrel arranged centrally of the carriage, the nut engaging the mandrel, the gear-wheel connected thereto, and bolts for alternately locking the nut to the gear-wheel and frame, substantially as described.

6. In a tube-expander, the combination of the frame, the endwise-movable and rotatable roller-carriage, the ring loosely engaging the carriage and having lateral pins, the slide provided with inclined ways engaging the pins, the expanding mandrel, and operating means for the latter, substantially as described.

7. In a tube-expander comprising a roller-carriage and mandrel, each adjustable at an angle to the axis of a support C, A, driving and clutch mechanism to impart rotary and endwise motions to the mandrel for the purpose described.

8. In a tube-expander the combination with a support C A, of a roller-carriage adjustable at an angle with the axis thereof, a nut G, a mandrel engaged therewith, and clutch driving-gear which will cause the mandrel to screw into or out of the nut or the two to rotate in company.

In testimony whereof I have hereto set my hand in the presence of the two subscribing witnesses.

FRANK GEORGE HAMPSON.

Witnesses:
ALFRED J. BOULT,
HARRY B. BRIDGE.